A LATE MARITIME WOODLAND PESKOTOMUHKATI FISHERY
FROM THE MAINLAND QUODDY REGION, SOUTHWESTERN
NEW BRUNSWICK, CANADA

by

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ABSTRACT

The nature of precontact Indigenous fisheries and their significance to subsistence economies, seasonal mobility, and diachronic cultural change remain underdeveloped in the archaeology of the Maritime Peninsula, northeastern North America. This thesis presents an analysis of a precontact fishery from BgDs-15, a small shell-bearing site located on the northern mainland of Passamaquoddy Bay, southwestern New Brunswick, Canada. Several hundred bones recovered during the 2004 field excavations and over 3,000 fish remains from midden column and bulk feature samples were examined. Most of these fish bones are attributable to Atlantic tomcod (*Microgadus tomcod* Walbaum, 1792) and unidentified, tomcod-sized gadids, with some herring (Clupeidae) present. Multiple lines of complementary evidence, including taxonomic composition, relative abundances, skeletal element frequency, seasonality, and the ethnohistoric record were examined to produce a high-resolution analysis of the BgDs-15 fishery and provide insight into ancestral Peskotomuhkati settlement-subsistence strategies during the Late Maritime Woodland period (ca. 1350–550 BP).
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# TABLE OF CONTENTS

ABSTRACT .................................................................................................................................................. ii
ACKNOWLEDGMENTS ............................................................................................................................... iii
TABLE OF CONTENTS ............................................................................................................................... vii
LIST OF TABLES ......................................................................................................................................... ix
LIST OF FIGURES ........................................................................................................................................ x
LIST OF ABBREVIATIONS ......................................................................................................................... xii

CHAPTER 1: INTRODUCTION ..................................................................................................................... 1
Geographic Scope ...................................................................................................................................... 2
Significance of Research .............................................................................................................................. 4
  Indigenous Heritage ................................................................................................................................ 4
  Archaeology ............................................................................................................................................ 5
  Fisheries Research ................................................................................................................................. 6
Terminology ............................................................................................................................................... 7
  Culture History ....................................................................................................................................... 7
  Zooarchaeology ..................................................................................................................................... 8
Theoretical Considerations .......................................................................................................................... 10
Organizational Framework ......................................................................................................................... 13

CHAPTER 2: BACKGROUND ...................................................................................................................... 17
Cultural Context ......................................................................................................................................... 17
  Sea Fisheries ......................................................................................................................................... 17
  River Fisheries .................................................................................................................................... 19
  Indigenous Fisheries ............................................................................................................................ 20
Archaeological Context ............................................................................................................................... 24
  Early Research: The Late-Nineteenth to Mid-Twentieth Centuries .................................................... 24
  The Modern Period: The Late 1960s Onward ................................................................................... 27
Summary .................................................................................................................................................... 32

CHAPTER 3: THE ARCHAEOLOGY OF BIRCH COVE ................................................................................. 40
Archaeological Context ............................................................................................................................... 42
  BgDs-14 .................................................................................................................................................. 43
  BgDs-25 .................................................................................................................................................. 43
  BgDs-35 .................................................................................................................................................. 45
  BgDs-15 .................................................................................................................................................. 46
LIST OF TABLES

Table 1.1: Culture history model for the Quoddy Region, including the Maritime Woodland model (Black 2002; Hrynick and Black 2016) and Ceramic Period model (Petersen and Sanger 1991). Date ranges are in uncalibrated radiocarbon years BP. ............................................................................................................................................................................................. 15

Table 3.1: Number of identified specimens (NISP) and unidentified portion of BgDs-35 archaeofauna surface-collected during the 2004 field school.................................................. 52

Table 3.2: Number of identified specimens (NISP), %NISP, minimum number of individuals (MNI), and unidentified portions of the BgDs-15 zooarchaeological assemblage recovered during the 2004 field excavations...................................................... 53

Table 5.1: Volumetric data for the BgDs-15 column samples, including total volume processed, total NSP and NISP of fish per unit, and densities of fish remains (NSP/L and NISP/L). ........................................................................................................ 84

Table 5.2: Primary data summary for fish remains (NISP (%NISP)) recovered from column samples from each excavation unit in BgDs-15. .............................................................. 85

Table 5.3: MNI values for fish taxa recovered from column samples from each excavation unit in BgDs-15. ......................................................................................................................... 86

Table 5.4: Quantitative data for primary taphonomic signatures identified in BgDs-15 column samples, including relative abundance and density. ............................................................... 87

Table 5.5: Skeletal element analysis for EU N102 W114, organized by anatomical region. Note that, for the purposes of this analysis, the taxa Microgadus tomcod and Gadidae (cf. M. tomcod) have been aggregated (NISP 1146). .................................................. 88

Table 5.6: Skeletal element analysis for EU N104 W113, organized by anatomical region. Note that, for the purposes of this analysis, the taxa Microgadus tomcod and Gadidae (cf. M. tomcod) have been aggregated (NISP 425). .................................................. 89
LIST OF FIGURES

Figure 1.1: Map of the Quoddy Region, including selected place-names and locations described in the text: 1) St. Stephen, NB and Calais, ME; 2) Meddybemps, ME; 3) Pembroke, ME; and 4) Eel Brook, Grand Manan................................................................. 16

Figure 2.1: Map of the Mainland Quoddy Region, including archaeological sites described in the text: 1) Simpson’s Farm, 2) Devil’s Head, 3) Birch Cove sites, 4) Teacher’s Cove, 5) Phil’s Beach, 6) Holt’s Point, 7) Orr’s Point, 8) McAleenan, 9) Carson, 10) Minister’s Island, 11) Eidlitz, 12) Reversing Falls, and 13) Eastport... 36

Figure 2.2: Map of the Insular Quoddy Region and the Grand Manan Archipelago, including archaeological sites described in the text: 1) Pendleton Passage, 2) Partridge Island, 3) Bliss Islands Sites (see Figure 3), 4) Deer Island Point, 5) Gooseberry Point, and 6) Baird. ................................................................. 37

Figure 2.3: Map of the Bliss Islands, including archaeological sites described in the text: 1) Lighthouse Cove, 2) Pintlowes Cove, 3) Camp, 4) Weir, and 5) Northeast Point. ......................................................................................................................... 38

Figure 2.4: Horizontal stacked bar graph displaying relative abundances (%NSP) of the vertebrate archaeofaunas from precontact archaeological assemblages in the QR. Total sample sizes in parentheses. ......................................................................................................................... 39

Figure 3.1: Map of the Birch Cove area, including Sam Orr’s Pond and the Outer Pond, including the location of archaeological sites described in the text: 1) BgDs-35, 2) BgDs-15, and 3) BgDs-25. Stippling in the channel indicates the relative location of the rock sills which isolate the ponds at low tide................................................................. 54

Figure 3.2: The bipointed or contracting-stemmed projectile point surface-collected during inspection of the intertidal zone surrounding BgDs-15........................................... 55

Figure 3.3: Layout of BgDs-15 excavation units during the 2004 field school and relative extent of shell deposits visible on the surface of the site......................................................... 56

Figure 3.4: Photograph showing plan view and north soil profile of EU N100 W116 following the removal of Feature 1 sediments. Note the abundance of rocks in the feature interior and contrast between the dark soil of the feature and the lighter subsoil ......................................................................................................................... 57

Figure 3.5: EU N100 W116 1) Plan view following removal of Feature 1 sediments with dashed line indicating relative horizontal extent of feature; 2) North soil profile showing internal stratigraphy of Feature 1. Bold lines and arrows indicate soil layers confidently assigned to the feature. ......................................................................................................................... 58

x
Figure 3.6: The typical condition of the BgDs-15 field-collected zooarchaeological assemblage—block-lifts of highly fragmented bone, shell, and fine particles wrapped in foil. ................................................................. 59

Figure 5.1: Horizontal stacked bar graph displaying the relative percentages (mass) of the matrix constituents from the EU N102 W114 column samples, subdivided by natural layers and arbitrary excavation levels. ................................................................. 90

Figure 5.2: Horizontal stacked bar graph displaying the relative percentages (mass) of the matrix constituents from the EU N102 W114 column samples, subdivided by natural layers and arbitrary excavation levels. ................................................................. 91

Figure 5.3: EU N102 W114, surface of Layer 2, showing general composition of the shell-bearing deposits from BgDs-15. Note the marine shell exposed on the surface of the site. .............................................................................................. 92

Figure 6.1: The possible anthropogenic rock ring at the mouth of Sam Orr’s Pond in August 2017, facing southwest. The dashed line indicates the presumed outer perimeter of the alignment. .................................................................................. 105
LIST OF ABBREVIATIONS

ASNB – Archaeological Services New Brunswick
BP – Before Present
CP – Ceramic Period
CRM – Cultural Resource Management
eLMW – earlier Late Maritime Woodland
EU – Excavation unit
IQR – Insular Quoddy Region
LMW – Late Maritime Woodland
ILMW – later Late Maritime Woodland
MAU – Minimum animal units
MMW – Middle Maritime Woodland
MNE – Minimum number of elements
MNI – Minimum number of individuals
MQR – Mainland Quoddy Region
NSP – Number of specimens
NISP – Number of identified specimens
QR – Quoddy Region
SOP – Sam Orr’s Pond
SL – Standard length
STP – Standardized test-pit
TL – Total length
UofT – University of Toronto
UNB – University of New Brunswick
CHAPTER 1: INTRODUCTION

The primary objective of this thesis is to reconstruct a precontact Indigenous fishery by applying a fine-screening methodology to the bulk samples from BgDs-15, a small shell-bearing archaeological site along the northern mainland of Passamaquoddy Bay, southwestern New Brunswick, Canada. A “fishery” entails not only the acts of procuring fish and rendering their products, but also the location(s) where such activities take place (Simpson and Weiner 1989:967). Thus, this study aims to elucidate the taxa targeted by the fishery, how they were procured, the seasonality of the fishery, and the linkages between these activities and place. Ultimately, this research aims to establish detailed baseline data on archaeological fisheries which can then be applied to larger questions pertinent to regional ethnographic, archaeological, and fisheries research.

The objectives of this thesis also address several recommendations made by the original technical report on the 2004 archaeological field school at the Caughey-Taylor Nature Preserve (Dickinson et al. 2004:21). These aims include: 1) analyzing evidence for subsistence and seasonality at BgDs-15, 2) submitting samples for radiometric dating to establish the chronology of BgDs-15, 3) elucidating the linkages, if any, between the shell-bearing deposits at BgDs-15 and the shell-free Feature 1, 4) evaluating the potential of the rock ring identified in Sam Orr’s Pond as a potential fish trap, and 5) integrating ecological information for the Caughey-Taylor Nature Preserve with archaeological research to generate a nuanced understanding of landscape use in the past. Whereas a previous publication had examined BgDs-15 primarily from a geoarchaeological perspective (Dickinson and Broster 2007), this work focuses on
zooarchaeological analysis and attempts to more rigorously integrate the field school findings within the context of regional precontact archaeology.

**Geographic Scope**

The primary geographic focus of this thesis is the Quoddy Region (QR), a dynamic biogeographic and oceanographic zone which lies at the confluence of the outer Bay of Fundy and Gulf of Maine systems (Figure 1.1; Thomas 1983). Straddling the Canada–U.S.A. border, this region is encompassed by a line drawn from Point Lepreau to the northeast tip of Grand Manan Island in New Brunswick, extending to West Quoddy Head in Maine, and inland to the head-of-tide on the St. Croix River (Thomas 1983a:1). This expanse includes Passamaquoddy Bay, the Deer Island Archipelago, Campobello Island, the Wolves, Cobscook Bay, as well as the estuaries of the St. Croix, Digdeguash, Magaguadavic, and Letang Rivers. Archaeologists have tended to integrate the Grand Manan Archipelago into the QR as well (Black 1992; Blair 1999). One of the defining features of the QR is its high tidal amplitudes, with a maximum range of 8.3 m (Trites and Garrett 1983:9). These tides generate an intense mixing effect which prohibits thermal stratification, generates strong currents, and promotes high biological productivity. Together, the tides and physical geography of the QR have created a dynamic array of habitats, including fog-zone forests, coastal marshes, extensive intertidal zones, coves, and channels, which support a wide variety of resident and migratory animal life (Thomas 1983; Black 2002). The QR also comprises a significant portion of the traditional territory of the Eastern Algonquian-speaking
Peskotomuhkatiyik (Passamaquoddy), along with the drainages of the Magaguadavic, St. Croix, and Machias Rivers and adjoining coastlines (Erickson 1978).

The QR is nested within the Maritime Peninsula, a culture-geographic construct which includes the Canadian Maritime Provinces, Maine east of the Kennebec River, and portions of Quebec east of the Chaudière River, plus Bas-Saint-Laurent and Gaspésie (Burke 2000; Hoffman 1955). This region encompasses the traditional territories of several Eastern Algonquian-speaking peoples, including Mi’kmaq (Micmac), Wolastoqiyik (Maliseet), Peskotomuhkatiyik, and Eastern Abenaki (Kennebec and Penobscot). Together, these groups shared many cultural traits and formed the Wabanaki Confederacy during the colonial period (Bourque 2001:235–244). The Maritime Peninsula itself is a portion of the Northeast culture-geographic area (Trigger 1978), which comprises the territories of almost all the Eastern Algonquian- and Iroquoian-speaking peoples, being bounded geographically by the boreal forest to the north and the prairies to the west, whereas the southern boundary arbitrarily falls along the southern limits of the Ohio River watershed to the Atlantic coast. The Maritime Peninsula is characterized by a dearth of published archaeological literature relative to the greater Northeast, with the preponderance of research occurring as unpublished “grey literature” which is difficult to access (Wright 1999:606). In part, the present study is an effort to rectify this unfortunate knowledge gap.
Significance of Research

Indigenous Heritage

As a person of European descent studying and writing about precontact Indigenous history, I am cognizant of the fact that my research does not occur in a political vacuum and, in many ways, reflects the power differentials and privilege afforded by a legacy of colonial injustice. Canada is engaged in an ongoing process of grappling with its colonial past, particularly the historical mistreatment of First Nations, Inuit, and Métis children in the residential school system and the chronic failure to properly acknowledge their rights of self-governance, land tenure, and resource use. The complexities of First Nations fishing rights came to the fore in Atlantic Canada during the controversy surrounding the Supreme Court of Canada’s Marshall decisions\(^1\), which acknowledged the traditional fishing rights of the Mi’kmaq but have encountered significant difficulty in application (Davis and Jentoft 2001; Wiber and Kennedy 2001; Wiber and Milley 2007). The long-term implications of Marshall for the Peskotomuhkatiyik remain unclear (Wicken 2005). In the current political climate, archaeological data are sometimes brought to bear on the matter of First Nations traditional land tenure and resource use (e.g. Deal 2002; Lewis 2010). The Peskotomuhkati tribe is engaged in a decades-long struggle to assert their sovereignty in the State of Maine (Bangor Daily News [BDN], 5 March 2017), including their access to

a lucrative elver fishery on the St. Croix River (BDN, 2 April 2013, 6 May 2015; Los Angeles Times, 26 May 2017). The Canadian government has historically abdicated a fiduciary responsibility toward the Peskotomuhkati people; however, the Supreme Court of Canada’s landmark *Tsilhqot’in decision*\(^2\) and the evolving nature of nation-to-nation relations may make this stance untenable in the long term. Therefore, it is possible that the archaeological data presented in this thesis may be drawn upon to substantiate or refute future claims by the Peskotomuhkatiyik.

**Archaeology**

Despite the historical importance of fisheries to both the Indigenous and European peoples of the QR (see Chapter 2: Background), there are relatively few data available on the nature of precontact fisheries, a pattern which holds for the Maritime Provinces in general (Davis 1997). Within the QR, there is a disjuncture between mainland sites where fish remains are scarce and insular sites where fish sometimes comprise the majority of animal bones recovered. This disparity has contributed in part to two competing models of precontact subsistence and settlement for the region. Sanger (1987) has proposed the “Quoddy Tradition” to account for the Maritime Woodland period, characterized by a stable, broad-spectrum cold weather foraging strategy primarily directed toward terrestrial mammals and intertidal shellfish. In contrast, Black (1992, 1993, 2002) has suggested a more dynamic view of the Maritime Woodland

period considering insular zooarchaeological datasets and the structure of the archaeological record itself, suggesting that precontact economies in the QR were relatively specialized and varied considerably through time. This study represents the first detailed zooarchaeological analysis from the Passamaquoddy Bay mainland in over three decades; hence, it presents an important opportunity to re-evaluate the existing precontact subsistence-settlement model in light of new data.

*Fisheries Research*

Over the past several decades, scientists have become aware that marine ecosystems are not pristine and are, in a sense, artifacts of human behaviour following centuries of overexploitation, loss of biodiversity, habitat alteration, anthropogenic climate change, and chronic mismanagement (e.g. Jackson 2001; Jackson et al. 2001). One of the pervasive aspects of ongoing environmental decline is what Pauly (1995) has dubbed “shifting baseline syndrome”, whereby successive generations consider the amount of marine life at their time to be normal and, thus, fail to account for long-term degradation in management strategies. This has led to an increased call to employ archaeological data in establishing preindustrial baselines to supplement modern fisheries data, which rarely extend beyond a decadal scale. Accordingly, there has been a groundswell of archaeological research in the service of conservation biology or “applied zooarchaeology” (e.g. Lyman 1996; Lyman and Cannon 2004; Wolverton and Lyman 2012; Rick and Lockwood 2012), particularly toward fisheries research (e.g. Bourque et al. 2008; Carder and Crock 2012; Lotze et al. 2006; Steneck et al. 2002; McKechnie et al. 2014; Dunne et al. 2016; Maschner et al. 2008; Betts et al. 2011,
The QR ecosystem has not been spared the depredations of the modern era (Lotze and Milewski 2004); therefore, I see the present study as potentially contributing valuable data toward establishing preindustrial baselines for the area.

**Terminology**

*Culture History*

Archaeological researchers on the Maritime Peninsula are divided on cultural historical grounds between those who refer to the nearly three millennia prior to European contact as the Woodland (in the Maritime Provinces, or la *période sylvicole* in French Quebec) or Ceramic (primarily in Maine) period (Leonard 1995). This division resulted from debates during the early 1970s in which regional researchers attempted to standardize taxonomy (Bourque 1971; Sanger 1974). In part, the adoption of Ceramic period terminology was a rejection of the cultural trait implications associated with the use of Woodland period in the Midwestern Taxonomic System, particularly its relationship to the adoption of maize horticulture (Leonard 1995:19–22). The Ceramic period terminology has also been employed typologically to characterize successive stages of ceramic technology for New England and the Maritime Peninsula (Petersen and Sanger 1991), operationalized as a heuristic model which posits seven “Ceramic Period” stages (Table 1.1).

A critical reappraisal of the regional ethnohistoric record provides evidence that maize and tobacco were cultivated by Wabanaki peoples during the early contact period (Leonard 1995:22–26); moreover, paleoethnobotanical evidence from eastern New Brunswick suggests that incipient horticulture, perhaps even arboriculture, may have
been practiced during the Late Woodland period (Leonard 1996). Thus, much of the key cultural suppositions embedded in the Ceramic period terminology are likely unfounded. I ascribe to the “qualified” Woodland period terminology espoused by Black (1992:10) and refer to the Maritime Woodland period, both to denote the marine orientation of settlement-subsistence systems within the QR and to underscore cultural connections across the broader Northeast. The Maritime Woodland period (and subsequent Protohistoric and Historic periods) has been subdivided by Black (2002:314; Hrynick and Black 2016:24) into a modified tripartite scheme based on stratigraphic grounds and radiocarbon chronology (Table 1.1).

Zooarchaeology

Fundamentally, zooarchaeology is the analysis of animal remains recovered from archaeological contexts (Reitz and Wing 2008:1), augmented with ancillary datasets when necessary (Thomas 1996). Like the practitioners of any sub-discipline seeking to distinguish themselves, zooarchaeologists have developed a lexicon of terms, the meanings of which are not necessarily self-evident to the uninitiated. Below, I present general descriptive terminology that appears throughout the text, whereas specific quantitative measures are described as required in Chapter 3: Materials and Methods.

A specimen is simply a single bone, tooth, shell, or fragment thereof, whereas a skeletal element is a complete, discrete anatomical unit or organ, such as a bone, tooth, or shell (Lyman 2008:311). An assemblage is the entire set of animal remains from a specific archaeological context (Lyman 2008:309). Despite its common usage, the term fauna is commonly misapplied in zooarchaeological practice and often used
euphemistically in place of “animal bones” (Thomas 1996:2). The term, and its
derivatives such as “local fauna” and “faunule”, has a long and complicated history
within paleozoology in general (e.g. Williams 1903; Tedford 1970). The application of
fauna is often ambiguous, since it can refer to either extant or fossil faunas and is
sometimes conflated with the stratigraphic units from which faunas derive. A succinct
definition might be “an assemblage of animal taxa from a specific spatiotemporal
context” (see also Lyman 1994:508). I opt for the term archaeofauna to denote faunas
derived from archaeological deposits, wherein human behaviour (e.g. predation,
butchery, discard) is a key mediating factor in the accumulation of the assemblage.

Another crucial concept referred to in thus study is taphonomy, coined by
Efremov as “the study of the transition (in all its details) of animal remains from the
biosphere into the lithosphere” or, more concisely, “the science of the laws of
embedding” (1940:85, 93). In the milieu of archaeology, “the archaeological record”
may be substituted for “lithosphere”. A taphonomic signature is a detectable
modification on a specimen which may be attributable to a specific causal agent (Lyman
2008:264). In zooarchaeological practice, the taphonomic history is examined to control
for bias by discriminating human from nonhuman (both biotic and abiotic) agency in
generating bone accumulations and to evaluate the appropriateness of an assemblage or
sample for addressing a specific research question (Lyman 1994). In many respects,
taphonomic history resembles the modelling of the systemic context in behavioural
archaeology (Schiffer 1972).
Theoretical Considerations

This thesis is principally a study of archaeofaunas; therefore, it draws upon the explanatory methods employed within the sub-discipline of zooarchaeology. The explicit goal of this thesis is to explore human subsistence related to fish; that is, to extrapolate procurement (e.g. prey selection, capture methods, seasonality) and consumption (e.g. butchery, preservation, ingestion) behaviour from archaeological traces (see Betts 2008:10–12). Such an approach generally falls within the theoretical rubric of processual archaeology (Thomas 1996:1) with its focus on evolutionary ecology within a framework of logical positivism (e.g. Binford 1962; Binford and Binford 1968). However, I am critical of the ecological determinism inherent in processual archaeology and acknowledge that a physical-reductionist approach undervalues the complex social and ideational aspects of human-animal relationships (e.g. Marciniack 1999; Zimmerman-Holt 1996; Betts et al. 2012, 2015; Hill 2011, 2013; Zedeño 2013). Despite the functionalist stance I adopt in this research, I do not subscribe to the ahistorical, strictly adaptive tenets of processual archaeology. Instead, I view human-animal relationships as historically contingent and developed through “routine engagements with… animals in substantive spaces” (Betts et al. 2012:625). Toward this end, I see the methodologically rigorous approach employed herein as representing an initial step toward developing richly contextualized “genealogies of practice” which can illuminate the historical processes at play in the archaeological record (Pauketat 2001; Pauketat and Alt 2005; Sassaman and Holly 2011).
Throughout this thesis, I draw heavily on middle-range theory (see Trigger 2006:508–519) which, in zooarchaeological practice, is essentially synonymous with taphonomy (Betts 2008:20). Broadly, middle-range theory seeks to establish causal linkages among the signatures observed on archaeological specimens and the agents that produced them. Middle-range theory relies on the underpinnings of uniformitarianism and analogy (Gifford-Gonzalez 1991; Brewer 1992). Respectively, these two principles dictate that 1) the same natural laws that operate today also operated in the past and 2) unobservable processes or causal linkages can be inferred through contemporary, observable processes and causation. I regard these principles as essential to zooarchaeological interpretation and accept them implicitly.

I also engage in analogical reasoning to apply ethnohistoric accounts of the Peskotomuhkatiyik and other Wabanaki peoples to interpret the archaeological signatures encountered. Likewise, I rely on cross-cultural ethnoarchaeological studies of the behaviour and material culture of modern fishers to inform archaeological interpretations. These represent two forms of closely related analogical reasoning glossed under the direct historic approach: specific historical analogy and general comparative analogy, respectively (Willey 1953). The appropriateness of analogical reasoning has long been contested in archaeology generally (see review in Lyman and O’Brien 2001 and references therein) and in the archaeology of the Maritime Peninsula specifically (Bourque and Whitehead 1985; Leonard 1996). Yet, I see analogical reasoning as indispensable to archaeological research and concur with Wylie (2002:153) that appropriately employed analogical inferences can offer “strategies for eliminating
error and assessing likelihood, improving credibility and delimiting uncertainty” when coupled with empirical data.

The present study is also anchored in the particularistic trajectory of research in the Maritime Peninsula and the QR specifically, from which it cannot wholly be disentangled. The culture-history paradigm continues to exert a large influence on regional archaeology (see Robinson 1996; Blair 2004) despite having lost currency within the discipline (Lyman et al. 1997). This may be due in part to the fact that, while cultural chronologies had been well-established throughout much of North America by the 1950s (Trigger 2006:394), it was not until the 1980s that archaeologists in New Brunswick began to develop a regional culture history sequence (e.g. Allen 1981; Foulkes 1981; Tuck 1984; Sanger 1987; Turnbull and Allen 1988). Archaeological research in the QR has followed two broad theoretical threads: the site-level culture-historical approach adopted by Sanger (1971, 1985, 1986, 1987) and a stratigraphically-based human ecology approach utilized by Black (1991, 1992, 1993, 2000, 2002). In a sense, the differences between these two approaches reflect paradigmatic tensions within the discipline at large, including those of essentialist versus materialist ontologies and culture-historical versus processual explanatory strategies. I ascribe to the same materialist tenets as Black and agree that “[c]ultural remains… must be related to depositional sequences in order to be meaningful” (1992:158) rather than being insinuated into arbitrary, internally homogenous units of analysis which may obfuscate, rather than illuminate, the past. Therefore, I utilize the regional cultural chronology not as a literal history, but instead as a hypothetical model used to “trace real lineages of the
development of material culture in the archaeological record” (Trigger 2006:313) and against which new interpretations can be tested.

**Organizational Framework**

In Chapter 2, I provide pertinent background information that contextualizes the present study; specifically, I review the significance of fish and fisheries in the QR through time. The review is framed within three nested contexts which, taken together, structure what is known about archaeological fisheries in the study area. First, I briefly describe the fish fauna of the QR. Next, I provide cultural and historical context which describes the character and significance of both European and Indigenous fisheries in the region. I then discuss what is known archaeologically of Indigenous fisheries in region from an historical perspective. Finally, I critically evaluate the archaeological dataset, considering the environmental and cultural context, and describe how this provides the impetus for this research.

In Chapter 3, I introduce Birch Cove and Sam Orr’s Pond, located on the Caughey-Taylor Nature Preserve on the northern mainland of Passamaquoddy Bay, southwestern New Brunswick. I briefly discuss the physical geography and biota of the area and present the archaeological inventory of the preserve, including the history of research, zooarchaeological analysis, and chronology of the sites. The primary focus of both this chapter and the remainder of the thesis is BgDs-15, a small shell-bearing site located at the head of Birch Cove. I discuss the 2004 archaeological field school at BgDs-15, emphasizing the zooarchaeological data from the site, and discuss how this provided an opportunity for the present study.
In Chapter 4, I present the methodology and materials employed to analyze the column and bulk samples retained during the BgDs-15 excavations. These include the approaches to the screening methodology, identification (both taxonomic and taphonomic), quantitative measures, skeletal element analysis, and seasonality interpretations. The results of these analytical procedures are presented in Chapter 5, including the structural makeup of the shell-bearing deposits, taxonomic composition of the vertebrate fish assemblage, taphonomic signatures, and skeletal part representation.

In Chapter 6, I provide a detailed discussion of the archaeological fishery from BgDs-15 which subsumes interpretations of the procurement methods, seasonality, and carcass provisioning evinced by the assemblage. These interpretations attempt to integrate zooarchaeological interpretive frameworks with ichthyological research from the QR and greater Bay of Fundy-Gulf of Maine ecosystem. In Chapter 7, I integrate the findings from BgDs-15 within the regional diachronic culture history schema of the Maritime Woodland period. In particular, I discuss how these findings reinforce and challenge specific aspects of the orthodox view of precontact archaeology for the region.

In Chapter 8, I conclude the thesis by reiterating the contributions of this research endeavour to regional archaeology and offer suggestions for future avenues of inquiry based on my findings.
Table 1.1: Culture history model for the Quoddy Region, including the Maritime Woodland model (Black 2002; Hrynick and Black 2016) and Ceramic Period model (Petersen and Sanger 1991). Date ranges are in uncalibrated radiocarbon years BP.

<table>
<thead>
<tr>
<th>Maritime Woodland Model</th>
<th>Date Range</th>
<th>Ceramic Period Model</th>
<th>Date Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Historic</td>
<td>350 BP–Present</td>
<td>CP7 European Contact</td>
<td>400–200 BP</td>
</tr>
<tr>
<td>Protohistoric</td>
<td>550–350 BP</td>
<td>CP6 late Late Ceramic</td>
<td>650–400 BP</td>
</tr>
<tr>
<td>later Late Maritime Woodland</td>
<td>950–550 BP</td>
<td>CP5 early Late Ceramic</td>
<td>950–650 BP</td>
</tr>
<tr>
<td>earlier Late Maritime Woodland</td>
<td>1350–950 BP</td>
<td>CP4 late Middle Ceramic</td>
<td>1350–950 BP</td>
</tr>
<tr>
<td>Middle Maritime Woodland</td>
<td>2200–1350 BP</td>
<td>CP3 middle Middle Ceramic</td>
<td>1650–1350 BP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CP2 early Middle Ceramic</td>
<td>2150–1650 BP</td>
</tr>
<tr>
<td>Early Maritime Woodland</td>
<td>3150–2200 BP</td>
<td>CP1 Early Ceramic</td>
<td>3050–2150 BP</td>
</tr>
</tbody>
</table>
Figure 1.1: Map of the Quoddy Region, including selected place-names and locations described in the text: 1) St. Stephen, NB and Calais, ME; 2) Meddybemps, ME; 3) Pembroke, ME; and 4) Eel Brook, Grand Manan
CHAPTER 2: BACKGROUND

The waters of the QR exhibit a relatively low taxonomic diversity of fish, with approximately one hundred native marine and diadromous species recorded; however, the high primary productivity of the area has historically produced a prodigious overall fish biomass (Scott 1983). While it is difficult to estimate the original abundances of marine and diadromous fish in the QR after several centuries of intensive and, often unregulated fishing, pollution, and habitat alteration, the annual carrying capacity for anadromous fish in the St. Croix river alone is estimated to be 10,000 or more adult Atlantic salmon (*Salmo salar*) and potentially tens of millions of gaspereaux (*Alosa pseudoharengus*) (Lotze and Milewski 2002:24–26). The seasonal movements of fishes in the QR are complex and dependent on several factors including age, temperature, salinity, and habitat preference, but the overall pattern is of mobility between inshore habitats during summer and offshore sites in winter, with some notable exceptions (MacDonald et al. 1984).

Cultural Context

*Sea Fisheries*

Samuel de Champlain was the first European to make note of the abundance of fish in Passamaquoddy Bay, stating that in 1604 the waters “abound[ed] with fish in their season, such as cod, salmon, bass, herring, halibut, and others in great numbers” (Biggar 1922:270). While there is evidence for transatlantic fisheries targeting the coastal waters of the Northeast as early as the sixteenth century (Whitehead 1991; Betts et al. 2014), European fisheries were not well-documented in the QR until the late-
eighteenth century, with the first recorded herring weir constructed in 1797 (Doucet and Wilbur 2000:5). By the nineteenth century, intensive commercial fisheries occurred along the coastlines and islands of the QR and formed a cornerstone of the burgeoning colonial economy. From their inception, European sea fisheries in the QR utilized hook-and-line, nets, and weirs and were directed primarily toward groundfish such as cod, pollock, haddock, hake, and flatfish as well as herring and mackerel, with most of the catch being cured for export through pickling, salting, and smoking (Perley 1852:92–123).

Signs of stress or decline of fish populations were evident even by the mid-nineteenth century. From the late-nineteenth to the early-twentieth centuries, quantities of large herring in the QR had been greatly reduced while the fishery for juvenile herring, marketed as sardines, intensified and supported a cross-border canning industry (Cowie 1912:104–105; Huntsman 1953). Although an increased trawling effort produced higher landings mid-century, groundfish landings declined throughout the twentieth century and remain at historically low levels, in keeping with larger patterns in the Bay of Fundy (e.g. Simon and Comeau 1994; Clark and Paul 1999; Lotze and Milewski 2004:1434–1435). Salmon aquaculture in the QR began in 1979 and has since grown into an important local industry. However, the expansion of aquaculture has also led to environmental degradation, habitat loss, ecological imbalances, disease and parasite propagation, and displacement of traditional fisheries (Wiber et al. 2012).
River Fisheries

The rivers which drain into the QR, most notably the St. Croix, supported abundant runs of diadromous fish, particularly salmon, gaspereaux, and shad (*Alosa sapidissima*) but also rainbow smelt (*Osmerus mordax*), Atlantic tomcod (*Microgadus tomcod*), American eel (*Anguilla rostrata*), striped bass (*Morone saxatilis*), and sturgeon (*Acipenser* sp.). In the early nineteenth century, the St. Croix supported an estimated average catch of 18,000 Atlantic salmon and gaspereaux “in such quantities, that it was supposed they never could be destroyed” with thousands of barrels’ worth being taken, and the abundance of shad was “almost incredible” (Perley 1852:124–126). Dam construction began on the river drainages of the QR in 1780 (Hall et al. 2011:100), significantly reducing available spawning habitat. In 1825, the Union Dam was constructed on the St. Croix at Milltown (modern-day St. Stephen-Calais) without any provision for fish passage, decimating the once-prodigious fish stocks. Dams likewise devastated diadromous fish runs on the Dennys, Pennamaquan, and Orange Rivers in Maine (Atkins 1887:701). With the establishment of sawmills in the late-eighteenth century, water quality began to deteriorate (e.g. Soctomah 2009:86), a situation later exacerbated by the addition of discharge from municipal sewage and industry (Lotze and Milewski 2002). Two species of predatory sportfish, the chain pickerel (*Esox niger*) and smallmouth bass (*Micropterus dolomieu*), were introduced into the freshwater system in the late-nineteenth century (Anonymous 1988:23–26), followed in the twentieth century by brown trout (*Salmo trutta*), rainbow trout (*Oncorhynchus mykiss*), and largemouth bass (*Micropterus salmoides*) (Clarke et al. 2014:10–12), placing further pressure on native fish species. Today, salmon returns continue to decline (Jones et al. 2014) while
efforts are underway to restore gaspereaux runs through improved fish passage, habitat amelioration, and management (e.g. FB Environmental 2008:17–18).

**Indigenous Fisheries**

Despite having historically comprised “one of their chief industries” (Gatschet 1897:18), the ethnohistoric record of traditional Peskotomuhkati fisheries remains relatively sparse. Much of the consideration paid by Europeans toward the Peskotomuhkati economic practices since colonization has emphasized their pursuit of porpoise in the nineteenth century (e.g. Gesner 1839; Sabine 1852; Lorimer 1876; Ganong 1899); nevertheless, the available evidence emphasizes the importance of fishing. In Eastern Algonquian pictography, the tribal emblem for the Peskotomuhkatiyik was a pair of canoeists pursuing a pollock (Mallery 1893:378–379). Various accounts describe fishing using nets, spears, traps, as well as hook-and-line, both on open water during the summer and through the ice in winter. Night fishing with the aid of torchlight was also a common practice (e.g. Soctomah 2009:4, 125–126; Perley 1852:127; Pawling 2016:634). In 1808, Reverend Jonathan Fisher of Blue Hill, Maine, penned an account of Peskotomuhkati weir construction at “Penmaquon”, Maine (Pennamaquan, modern Pembroke):

> In the river I noticed their manner of catching eels. They had chosen a shoal place; the water about two feet deep, running over pebbles; obliquely across the stream they had driven down their laths, each about two inches wide, woven together at the top with strings of cedar bark, and so near together, that an eel of moderate size could not go between them. Near one side of the river the line of laths formed an obtuse angle, at the point of which was a small aperture, opening into an enclosure, made to receive the eels, as they descend the river, in this enclosure an Indian sits, and takes the eel with ease, as they enter it [Smith
1977:56].

Peskotomuhkati fishing practices were also adapted to the colonial economy in the nineteenth and twentieth centuries, when tribal fishers participated in commercial weir fishing, crafted sardine baskets, and served as guides on the lakes and rivers of the interior. A Peskotomuhkati weir constructed during the early twentieth century was elaborate and labour-intensive to construct and maintain:

The weirs are built on the beach when the tide is out... [A] donkey engine hired from the white men is used to drive the upright poles, which hold the nets in the circle and the brush in the long straight fence or driveway leading down the beach to the circle. This fence is fifty yards long. And the circular enclosure into the gate of which the fence forces the fish with the receding tide is 50 yards in circumference... The finny fish cannot escape the cunning and patience of the Native... [T]he Indian who stands guard at the door to observe from his elevated perch, or pier, when a sufficient number of sardines have entered the trap to warrant him to let down the door, which prevents their exit. Other Indians in dories will join this Indian and his companion, who paddles about in a canoe, shortly. And they will work long into the night putting the fish into barrels for the market [Soctomah 2002:129].

Several locations within the QR were associated with traditional Peskotomuhkati fisheries. In 1604, Champlain observed Indigenous fishers at the first falls of the St. Croix, at St. Stephen-Calais:

Two leagues up this river there is a waterfall where the Indians carry their canoes overland some five hundred paces... In May and June, so great is the catch here of herring and bass that vessels could be loaded with them... The Indians resort thither sometimes five or six weeks during the fishing season [Biggar 1922:273–274].

These falls (often referred to as “Salmon Falls” in historic literature) remained an important fishing station where salmon and gaspereaux were captured using spears and dip-nets from the eighteenth through twentieth centuries. By the mid-nineteenth century,
the fishery at this site had been impacted by the construction of the Union Dam. Upon visiting the location on September 4, 1851, Perley (1852:127) observed that:

Not far below the dam, a party of Passamaquoddy Indians were encamped for the purpose of spearing salmon by torch light; the fish not captured, were turned back by the nets, and then fell a prey to the Indians. At this late period of the year, the salmon were, of course, out of season, quite black, and almost worthless.

The fishing station was further undermined in 1830 when the town of Calais sold the rights to access a large boulder near the falls which was utilized during fishing (Soctomah 2009:84). However, an account published in 1948 romantically reminisces about Peskotomuhkati salmon fishing at the falls during the bygone times of plenty:

[H]ere was a lively scene. Naked men and women and children lined the banks of the St. Croix River, and if there was a chance to reach in and grab a fish it was quickly thrown on the bank. When the tide went down, the older ones would wade into the pools with their spears and clubs, then the real fishing began. It was a pleasant time for the Tribe. There would be plenty to eat for some time now… Some people fished from the birch bark canoes. Then came the eating… Around the fires were merry times as the women cooked the salmon; they had not cooking pans so they roasted the fish. The Passamaquoddy were not fastidious feeders. Very little of the fish was thrown away, very little [Soctomah 2003:137].

Another important fishing station was located at Eel Brook, on the northern tip of Grand Manan Island. Here, Lorimer (1876:61) described Peskotomuhkati eel fishing at the location, stating that “They set eel traps at its mouth, and catch sometimes in one night half a barrel or more of large fat eels as they make from the brook to the bay”. Gaschet (1897:21) gives the Peskotomuhkati name of this location as “Katekádik” (katuhkatik?), meaning “where eels are plentiful”. This location was also associated with the Wabanaki culture hero Koluskap (Glooscap) in Peskotomuhkati folklore. There, it
was said that *Koluskap* created the spectacular rock formations at the Seven Days Work Cliffs: “One time, Glooscap was fishing for giant eels and the fishing was plentiful. He laid the eels on top of each other and transformed them to stone for storage, upon his return his favorite food would be waiting for him” (Soctomah 2009:16).

Perhaps the most enlightening testimony to the importance of Peskotomuhkati fishing resides within the language and traditional knowledge of the people themselves. This is best exemplified by traditional place-nomenclature; the word “Passamaquoddy” itself derives from *Peskotomuhkat*, meaning “pollock spearers” or “those of the place where the pollock are plentiful” (Erickson 1978:135; Francis and Leavitt 2008:409), attesting to the importance of this fish. Other locations throughout Peskotomuhkati territory bear names associated with certain fish and fisheries, including Meddybemps, Maine (*Motopemsok*), meaning “lake of plenty of alewives” (Soctomah 2005:175).

Indeed, modern Peskotomuhkati community members maintain that their culture exhibits a deep reverence for fish, a fact aptly demonstrated by cultural perceptions toward haddock. The name for this fish, *cilonasit*, meaning “marked by fingers”, referring to the dark blotches near the pectoral girdle, is explained by one community member:

Implicit in the word, partly from the intonation when it is spoken, is that the markings show that the fish was picked up by the hand of the Creator, a reminder that the fish are given to us by the Creator. The reminder applies more broadly, but everyone agrees that the haddock is the sweetest fish [Soctomah 2003:14].

In addition to the symbolic importance accorded some fish, they formed an important subsistence basis in living memory: “Flounder was a staple food for us. Haddock and
pollock were the prize fish. Cod was the last choice, but it would be used for a stew, often cooked with heads and all” (Soctomah 2003:21). Preserving fish for delayed consumption during leaner months was also an important seasonal activity in recent memory:

In the fall of each year, we all knew that we needed to dry fish if we were going to survive the winter. Every household was drying fish. That was our survival for the winter. We dried flounder by just taking the heads off, gutting the fish out and nailing it to the side of a building, to dry in the sun. Pollock and cod were split whole and dried on clotheslines. Herring were salted down for winter in a barrel [Soctomah 2003:20].

The relative abundance of fish also ensured that they figured prominently at community gatherings: “Fish was always part of any ceremony, whatever fish they had, no special fish. All fish were special for a feast, because it fed us all” (Soctomah 2003:61). Fish were also distributed throughout the community during the times of economic hardship following settlement onto reservations:

There were some people, mostly older men, who would fish regularly for the whole community and distribute the fish, probably by sale or barter, but fish would always just be given to people who were poor, I mean “poor” in the sense of not having the same access to the resource… As kids, we would always go down to the shore to meet any fishermen coming in, a good meal [was] sure to follow [Soctomah 2003:137].

Archaeological Context

*Early Research: The Late-Nineteenth to Mid-Twentieth Centuries*

The first investigations into the precontact archaeology of the QR were conducted by natural historians during the late nineteenth century. In the summer of 1869, Baird (1881) sampled several shell-bearing deposits in Cobscook Bay, Oak Bay,
the Bliss Islands, Frye Island, Maces Bay, and the Grand Manan Archipelago, though the descriptions of his findings remain limited. He made note of the vertebrate animal remains he encountered, which were sometimes recovered “by the cart-load”, including those identified as sculpin (Cottidae) (Baird 1881:295). Matthew’s (1884) excavations at the Phil’s Beach site at the mouth of the Bocabec River in 1883 were more modern in character, representing one of the most thorough nineteenth century investigations into a Northeast shell midden (Trigger 1986:xv). Matthew’s report primarily concerns the domestic architecture from Phil’s Beach and adjacent shell deposits, including a detailed description of his “Hut Bottom A” (1884:11–15), a likely wigwam living floor surface. Quantities of animal bone were also encountered at Phil’s Beach, including those of Atlantic cod (Gadus morhua), herring (Clupeidae), sculpin, and great white shark (Carcharodon carcharias) (Matthew 1884:24; Betts et al. 2012:631). Rather than attributing the occupation of the Phil’s Beach site to a single season, Matthew inferred that the habitation was “more or less continuous” (1884:26). Later, in his *Monograph of Historic Sites in the Province of New Brunswick*, Ganong (1899) drew upon historic accounts, mapping, oral tradition, place nomenclature, and the visibility of eroding shell deposits to construct an inventory of Indigenous village and camp sites in the “Passamaquoddy District”—essentially, the QR and associated river drainages.

Following the work of these natural historians, there was a near-absence of fieldwork in the QR until the 1960s, which corresponded to a general hiatus in archaeological research in the Maritime Provinces (Connolly 1977; Murphy and Black 1996:4–5). Ultimately, this period of archaeological research in the QR consisted of sporadic explorations which generated some interesting new data. However, the
inconsistent reporting and lack of integration of the various projects inhibited synthesis of precontact archaeology in the region.

In the summers of 1948 and 1949, Kingsbury and Hadlock (1951) investigated the Eastport site on Moose Island, Maine. From 1950 to 1952, the R. S. Peabody Foundation sponsored a program of archaeological survey and excavation in the Northeast, including the QR (Stoddard et al. 1952). These investigations included extensive excavations at the Holt’s Point site, although the cultural material recovered would remain unanalyzed until the early 1980s (Hammon 1984; Salvaggio 1983). Less than two percent of the archaeofauna from Holt’s Point is fish, with only longhorn sculpin (*Myxocephalus octodecemspinosus*), burbot (*Lota lota*), and cod (*Gadus* sp.) identified (Salvaggio 1983:14).

In the early 1960s, Pearson (1970) excavated at three shell-bearing sites—Pagan Point (BgDs-1), Sandy Point (BgDs-6) and Minister’s Island (BgDs-10)—near St. Andrews, New Brunswick, under the aegis of the National Museums of Canada. This study was the first to employ radiometric dating techniques in the QR (Pearson 1970:184, 186–187; Black 2004:50). Pearson’s report, based on Churcher’s (1963) analysis, provides a cursory description of the vertebrate remains from these sites, consisting of an inventory of the identified taxa with estimates of the MNI for a select few mammal species. The only fish taxa noted were cod and sculpin from the Sandy Point site (Pearson 1970:186); unfortunately, no quantitative data were provided for these taxa.
The Modern Period: The Late 1960s Onward

In the late 1960s, David Sanger initiated a long-term field research program under the auspices of the National Museums of Canada and Historic Resources Administration of New Brunswick (Sanger 1971, 1985, 1986, 1987; Bonnichsen and Sanger 1977; Davis 1978), which included subsequent graduate research through various regional institutions (Lavoie 1972; McCormick 1980; Crotts 1984). This research incorporated survey of the St. Croix River watershed and shorelines of the mainland Quoddy Region (MQR; Figure 2.1) in addition to excavation at several shell-bearing sites around Passamaquoddy Bay, including those previously investigated by Pearson. In part, this research was motivated by the excellent bone preservation in shell middens and the presence of the Biological Station in St. Andrews, which would enable a detailed exploration of the precontact cultural ecology of the region (Sanger 1985, 1986:141).

However, the more explicit goal of these investigations was to reconstruct the cultural patterns of the Woodland period by comparing “the site locations, the artifact assemblages, and the associated fauna” (Sanger 1987:iv) from several coastal sites; in essence, to form a culture-history sequence for the QR. Analysis was typically conducted at the site level, although statistical comparisons were made between dwelling floors and shell middens at the Minister’s Island and Carson sites (Bonnichsen and Sanger 1977). These excavations relied on 6.4 mm (¼-inch) mesh to sort artifacts and animal bone from archaeological sediments.

Zooarchaeological analyses conducted by Savage (1970), Stewart (1974), Bonnichsen and Sanger (1977), Burns (1978), and McCormick (1980) indicate
vertebrate assemblages were dominated by members of the deer family, small furbearing mammals (especially beaver), migratory fowl, shorebirds, and seals; relatively few vertebrate fish remains were identified. At the Carson site, fish accounted for approximately three percent of the assemblage, with only a single haddock (*Melanogrammus aeglefinus*) otolith and seven flatfish vertebrae identified (Stewart 1974:6). At Teacher’s Cove, fish again comprised less than 3% of the assemblage, eleven of which were identified as sculpin (Burns 1978:37). Despite comprising 29% of the archaeofauna of the McAleenan site, none of the fish remains were identified beyond class (Savage 1970).

Seasonality interpretations based on mammal tooth eruption, migratory bird presence/absence and lack of vertebrate fish remains pointed toward late fall through spring occupations (Sanger 1987:68–71). Sanger (1986:150) also interpreted the volume of lithic and bone tool manufacturing debris in the dwelling features to be indicative of cold-season habitation. Together, these findings led Sanger (1987:84) to conclude that “[d]espite the littoral setting of the Carson site, the impression is one of terrestrial hunter-gatherers utilizing relatively few marine resources.”

In the late 1970s and early 1980s, the New Brunswick government Archaeology Branch and the Council of Maritime Premiers’ Maritime Committee on Archaeological Cooperation sponsored a coastal survey along select portions of Maritime Provinces coastline, including Passamaquoddy Bay, the West Isles, and Grand Manan Archipelago (Simonsen 1978, 1979; Davis and Christianson 1981; Davis 1982; Black 1984), resulting in the location of many previously unknown shell-bearing sites. In addition,
limited excavations were conducted during the construction of a seawall along the erosional face of the Minister’s Island site in 1979 (Ferguson and Turnbull 1980). This produced a small sample of fish bone (14.13% NSP), of which only four longhorn sculpin preopercula were identified (Stewart 1980:11, 16). Small fish remains were observed in the erosional faces of two precontact shell-bearing sites on Grand Manan Island (Black 1984:21).

Concurrently, excavations were undertaken at Partridge Island, in the West Isles to elucidate the precontact archaeology of the insular Quoddy Region (IQR; Figure 2.2) (Bishop and Black 1988; Black 1991, 1993; Bishop 1994). Fish bones comprise 33% of the Partridge Island archaeofauna and include remains of Atlantic cod, haddock, pollock (Pollachius virens), and Atlantic herring (Clupea harengus), with fish being especially prominent (≥80% NSP) in the Early Maritime Woodland stratigraphic component 1 and Middle Maritime Woodland stratigraphic component 2a (Black 1993:69–86). Column samples from the Partridge Island site were passed through 3.2 mm (⅛-inch) mesh, yielding numerous small fish remains (primarily herring) which were not represented in the field-collected sample (Black 1993:36, 73).

In 1983, limited test excavations were conducted at the Pendleton Passage site (BgDr-38) on Deer Island (Black 1984a). This excavation produced a small sample of vertebrate bone, including haddock, codfish (Gadidae), and unidentified small fish (Black 1984a:22). The Gooseberry Point site (BfDr-3), Campobello Island, was also tested during this period (Turnbull 1981). The size and age of Atlantic cod elements from Gooseberry Point were analyzed using the allometric regression formulae
developed by Rojo (1981, 1986). Column samples for Gooseberry Point were also processed, yielding remains of gadid fish (Black and Johnston 1986).

A more in-depth field program was conducted on the Bliss Islands under the direction of David Black, consisting of limited test-excavations in 1983 (Figure 2.3; Black 1985) and more extensive, full-scale excavations in 1986 (Black 1988, 1992, 2000, 2002). Additional excavations were carried out at the Weir site in 1993, although the results have yet to be formally published (Reading 1994; cf. Black and Blair 2000). This programme was undertaken with the explicit goal of refining the culture history of the QR and to explore human ecology on the Bliss Islands by investigating shell-bearing sites of varying sizes and structures (Black 1992:21, 28). These dimensions were explored through analysis of the archaeofaunas, niche width, stable isotopes, and seasonality analysis. The Bliss Islands site inventory indicates occupation throughout the Maritime Woodland, Protohistoric, and Historic periods, with the Early Maritime Woodland to earlier Late Maritime Woodland well-represented (Black 1992:90–94).

Of the seven precontact sites sampled on the Bliss Islands, only the Camp (BgDq-4) and Weir (BgDq-6) sites produced substantial samples of animal bone. At the Camp site, 39.3% of the 3,193 bones recovered were fish, including “herring-like” fish (probably Clupeidae), sculpin, Atlantic cod, hake (*Urophycis* sp.), haddock, and pollock (Black 1992:101–105). Fish are even more prevalent at the Weir site, comprising 75.6% of the 9,544 bone specimens recovered, including Atlantic cod, Atlantic sturgeon (*Acipenser oxyrinchus*), monkfish (*Lophius americanus*), longhorn sculpin, and pollock (Black 1992:95–100). Of the 3,191 animal bones recovered during the 1993 excavations
at the Weir site, 61.77% were fish, with only Atlantic cod and gadids identified beyond class (Reading 1994). In contrast to the findings from the MQR, niche breadth of the Bliss Islands sites indicated relatively specialized economies, with the Early Maritime Woodland stratigraphic component 1 at the Weir site being indicative of specialized shellfish and vertebrate fish exploitation (Black 1992:117). Stable isotope evidence from ceramic sherds on the Bliss Islands yielded signatures indicative of fish (Black 1992:113), providing further indirect evidence of fish exploitation. The presence of vertebrate fish in the Bliss Islands archaeofaunas is considered suggestive of warm-season occupation, and many of these sites are attributed to warm- or mixed-season occupations (Black 1992:145–147).

A second phase of archaeological research was conducted on Grand Manan Island from 1992 to 1995, consisting of collections analysis, reconnaissance, shovel testing, and limited excavation (Blair 1999). During excavation of the shell-bearing Baird site (BdDq-3), an assemblage of animal bone, including large fish vertebrae, was recovered (Blair 1999:63–70); however, the archaeofauna has not been formally analyzed. In 2005, additional fieldwork and collections analysis was undertaken at Deer Island Point (BfDr-5), a portage site located near Mocinikosk (the Old Sow Whirlpool) (Gilbert 2011). A small assemblage of calcined bone was recovered from Deer Island Point, but no fish remains were identified (Gilbert 2011:103–104). Simultaneously, a second phase of excavation was undertaken at the Gooseberry Point site that targeted a potential Late Archaic tool-stone quarry, where a small sample of bone was recovered from the overlying Late Woodland shell midden, including bones identified as Atlantic cod, haddock, Atlantic tomcod, and sucker (Catostomus sp.) (Stewart 2006).
Modern archaeological research in the Maine portion of the QR has also been sporadic, leading to the identification of several sites but little formal excavation (Spiess and Cranmer 2005:13–20). Test excavations were undertaken at the Reversing Falls site in Pembroke, Maine in 1989 by the Maine Historic Preservation Commission (MHPC; Spiess et al. 1990). Fish account for 22.5% of the vertebrate assemblage at Reversing Falls, with longhorn sculpin, Atlantic cod, and pollock identified (Spiess et al. 1990:18). The MHPC also tested extensively at Devil’s Head site, Calais, including several shell-bearing deposits (Spiess and Cranmer 2005). Fish comprise 86% of the 1,769 bones recovered and include Atlantic cod, flounder (Pleuronectiformes), sculpin, gaspereaux, and sturgeon (Spiess and Cranmer 2005:52). All contents from a single test-pit at Devil’s Head were bulk-sampled and processed in the laboratory using flotation and 1.0 mm mesh, resulting in the recovery of most of the fish bone from the site (Spiess and Cranmer 2005:25, 33). Subsequent excavations at Devil’s Head in 2014, which employed 3.2 mm aperture mesh for recovery, also produced flounder, gaspereaux, sculpin, and sturgeon (Hrynick et al. 2017).

**Summary**

The long and somewhat convoluted history of archaeological research in the QR has made it difficult to synthesize data on precontact fisheries. The variety of quantitative measures employed by various analysts, including species presence-absence, NISP, MNI, and size estimations, inhibit comparability among assemblages, an issue further compounded by the amount of data embedded within grey literature. Furthermore, there are ambiguities in the quality of taxonomic identifications among
analyses. For instance, the fish bone assemblage from the McAleenan site excavations included relatively diagnostic elements such as vertebral centra, yet none of these bones were identified beyond the class level. Some of the identifications that have been made, including freshwater fish such as burbot from the Holt’s Point site and sucker from Gooseberry Point, are difficult to reconcile with the biogeography of QR fish. These and other identifications may be spurious, possibly the result of inadequate comparative material, although this is difficult to independently evaluate. Thus, it is challenging to track long-term trajectories of Indigenous fishing practices prior to European contact in a systematic way.

In examining the archaeological data, there are apparent disparities in the abundances of fish recovered during excavations on the MQR, with the notable exception of Devil’s Head, and those from the IQR (Figure 2.4). In part, this has led to two somewhat inconsistent interpretations of Woodland period settlement-subsistence systems. In Sanger’s (1987:68–77, 117–120) formulation, the Woodland period is characterized by a diffuse or generalist pattern reliant primarily on terrestrial mammals and the absence of fish remains is explained by winter seasonality. However, such a pattern would seem to be in contradiction with the historical importance of fisheries to both Indigenous and European peoples in the QR. In contrast, the evidence from insular sites supports the interpretation that precontact subsistence practices were relatively specialized, seasonally variable, and dynamic throughout the Maritime Woodland, as well as incorporating a larger suite of aquatic resources, including fish (Black 1992:117–118, 1993:92–99). These competing interpretations are difficult to reconcile in the absence of new data from mainland sites.
While it is possible that the patterns in the archaeological record may reflect actual subsistence practices during the Maritime Woodland period, a more parsimonious explanation for the lack of fish may lie in field methodology. With few exceptions (e.g. Spiess and Cranmer 2005; Blair et al. 2017; Hrynick et al. 2017), excavation in the QR has relied on screening through 6.4 mm mesh to recover archaeological materials. Since the 1960s, it has been standard practice to sample archaeological sites with screens (Colley 1990:209), and 6.4 mm mesh has emerged as the “industry standard” (James 1997) for both academic and cultural resource management settings. However, since that time it has been debated whether this aperture size is appropriate for the adequate recovery of zooarchaeological data (Shaffer 1992; Thomas 1969; Stahl 1996; Cannon 1999), especially fish remains (Casteel 1972, 1976; Colley 1990; Gobalet 1989; Gordon 1993; Nagaoka 1994, 2005; Partlow 2006; Quitmyer 2004; Vale and Gargett 2002; Ross and Duffy 2000; Wheeler and Jones 1989). Although estimates of actual loss vary, it is widely acknowledged that the use of 6.4 mm inch mesh biases recovery and can cause fish to be vastly under-represented in zooarchaeological studies. This problem has been acknowledged by Sanger (1987:76), who speculated that finer screening at the Carson site may have resulted in the recovery of small fish such as Atlantic tomcod. When fine-screening (<6.4 mm aperture) procedures have been implemented in the QR, they have invariably resulted in increased recovery of small fish remains.

However, differential recovery cannot wholly account for the lack of fish from mainland sites. Bones from large fish such as Atlantic cod and flounder, particularly vertebral centra, are readily recovered even by 6.4 mm mesh. Both excavations in the IQR and elsewhere in the Maritime Peninsula, such as Port Joli Harbour, Nova Scotia
(Betts et al. 2017), and Indiantown Island, Maine (Spiess et al. 2006), yielded quantities of large fish despite relying on 6.4 mm mesh. One possible explanation is that smaller fish were more frequently targeted at mainland sites. Another is that the more ubiquitous and easily recovered mammal remains were prioritized during earlier excavation and fish bones were simply overlooked. Such an interpretation is supported by Sanger’s (1987:90) description of the McAleenan site excavations, where a “dense cluster of badly burned and highly fragmentary fish bone” was encountered. Unfortunately, none of these small fish remains were collected. The low identification rates (average 11%) of fish bones in zooarchaeological analyses of mainland sites may reflect this implicit bias. Taken together, the available data suggest that the systematic use of fine-screening on archaeological sites from the MQR could yield significant quantities of fish remains.
Figure 2.1: Map of the Mainland Quoddy Region, including archaeological sites described in the text: 1) Simpson’s Farm, 2) Devil’s Head, 3) Birch Cove sites, 4) Teacher’s Cove, 5) Phil’s Beach, 6) Holt’s Point, 7) Orr’s Point, 8) McAleenan, 9) Carson, 10) Minister’s Island, 11) Eidlitz, 12) Reversing Falls, and 13) Eastport.
Figure 2.2: Map of the Insular Quoddy Region and the Grand Manan Archipelago, including archaeological sites described in the text: 1) Pendleton Passage, 2) Partridge Island, 3) Bliss Islands Sites (see Figure 2.3), 4) Deer Island Point, 5) Gooseberry Point, and 6) Baird.
Figure 2.3: Map of the Bliss Islands, including archaeological sites described in the text: 1) Lighthouse Cove, 2) Pintlowes Cove, 3) Camp, 4) Weir, and 5) Northeast Point.
**Figure 2.4:** Horizontal stacked bar graph displaying relative abundances (%NSP) of the vertebrate archaeofaunas from precontact archaeological assemblages in the QR. Total sample sizes in parentheses.

- Holt's Point (824)
- Teacher's Cove (2370)
- Carson (1558)
- McAleenan (248)
- Minister's Island (269)
- Reversing Falls (679)
- Devil's Head (1769)
- Partridge Island (4260)
- Weir (9544)
- Camp (3193)

Key:
- □ Actinopterygii
- □ Aves
- ■ Mammalia
- □ Undetermined
CHAPTER 3: THE ARCHAEOLOGY OF BIRCH COVE

Birch Cove is situated along the western margin of Bocabec Bay, approximately 10 km northeast of St. Andrews, New Brunswick, and exhibits typically high tidal amplitudes with rocky intertidal zones and limited mudflats exposed at low tide. Sam Orr’s Pond (SOP) is a brackish water body located at the head of Birch Cove consisting of a relatively shallow basin and an outlet, the “narrows”, with a combined area which fluctuates seasonally and tidally between 8 and 12 hectares (Figure 3.1; Mortimer and Downer 1961:2). The substrate of SOP consists primarily of black mud overlying clay, with a rocky bottom present at the outlet of Taggart’s Brook and at the narrows (Mortimer and Downer 1961:3). A sill of basaltic rock lies at the outlet of the narrows, which separates SOP from the tidal “outer” pond; in turn, another sill separates the outer pond from Birch Cove. The two sills effectively dam SOP and the outer pond from Birch Cove except at high tides, when salt water vigorously flushes over the sills and outer pond, contributing significantly to the volume of SOP. Freshwater input originates from the watershed of Taggart’s Brook (including Stein Lake), precipitation, and surface drainage from the immediate vicinity.

These circumstances have resulted in a unique biogeographic setting within the QR and the Bay of Fundy system as a whole. Salinity levels in SOP vary significantly depending on tidal and freshwater inputs and range from 4‰ to 30‰ (Mortimer and Downer 1961:6). The shallow bathymetry of SOP (with a maximum depth of 4.3 m) also results in relatively warm water, with temperatures in summer frequently surpassing 20°C (Mortimer and Downer 1961:6). These conditions have made SOP amenable to
colonization by the hard-shell clam or quahog (*Mercenaria mercenaria*), representing the only such population known from the Bay of Fundy. Genetic studies of these quahogs suggest that they are distinct from populations in New England and Prince Edward Island (Dillon and Manzi 1992). Attempts were made during the late 1950s to develop aquaculture for the European oyster (*Ostrea edulis*) in SOP, though these fledgling efforts were frustrated by poor larval survival and high mortality rates (Hart 1958, 1959; Downer 1959; Mortimer 1960).

The flora and fauna of SOP have been summarized by Mortimer and Downer (1961:8–9). Other shellfish species include the eastern mudsnail (*Ilyanassa obsoleta*), the Baltic clam (*Macoma balthica*), and the introduced common periwinkle (*Littorina littorea*), with soft-shell clam (*Mya arenaria*) present in the narrows and blue mussel (*Mytilus edulis*) found on the rocky sills. Sam Orr’s Pond also supports a rich fish biota, including large numbers of mummichog (*Fundulus heteroclitus*), four-spine sticklebacks (*Apeltes quadracus*), three-spine sticklebacks (*Gasterosteus aculeatus*), and nine-spine sticklebacks (*Pungitius pungitius*). Elvers of the American eel are found in significant numbers in SOP, with adults also occasionally present. Atlantic silversides (*Menidia menidia*) and Atlantic tomcod have been recorded, although they are considered uncommon. The warm, brackish conditions in SOP have also produced a unique flora in the QR, permitting the growth of salt-tolerant widgeongrass (*Ruppia maritima*) and common eelgrass (*Zostera marina*). Since 1999, the vicinity of Birch Cove had been incorporated into the Nature Trust of New Brunswick’s Caughey-Taylor Preserve in recognition of its unique biogeography.
Archaeological Context

In addition to a unique suite of ecological conditions, the Caughey-Taylor Nature Preserve features a rich array of archaeological deposits. Several phases of exploration have resulted in the identification of four archaeological sites—designated BgDs-14, BgDs-15, BgDs-25, and BgDs-35—within the current boundaries of the Preserve. In 2004, these sites were the focus of a four-week archaeological field school held by the University of New Brunswick (UNB) under the direction of Susan Blair and Pamela Dickinson (Dickinson et al. 2005). This field school incorporated both educational and research components. The educational goals were achieved by introducing UNB undergraduate students to standard archaeological field methods and community-based approaches. The research aspect of the field school focused on the discovery of previously unrecorded archaeological resources, investigation of known archaeological components, and limited excavation of sites threatened by coastal erosion.

Archaeological Services New Brunswick (ASNB; Heritage Branch, Department of Tourism, Heritage, and Culture) subsequently conducted limited excavations at BgDs-35 in June 2014 (Jarratt 2015). In the summer of 2015, a joint field project was conducted by members of UNB and the University of Toronto (UofT) under direction of Susan Blair, Katherine Patton, and Margaret Horne (Blair et al. 2017). The 2015 excavations specifically targeted BgDs-25, with an interest in investigating the potential domestic architecture at the site. Descriptions of the individual archaeological sites and results of the various field investigations are summarized below.
*BgDs-14*

This site was initially recorded by David Sanger in 1970 but has not been relocated during any of the subsequent phases of fieldwork. BgDs-14 may have been lost to marine erosion during the intervening decades.

*BgDs-25*

This site was initially reported by David Sanger in 1970 and subsequently relocated during the 2004 field school. BgDs-25 consists of small pockets of shell-bearing deposits overlain by a thin layer of organic debris. The site is located near the mouth of Birch Cove in a small wooded area adjacent to a saltmarsh. This sheltered location has partially protected the site from marine erosion so, in 2004, extensive excavation at BgDs-25 was forgone in favour of the more immediately threatened BgDs-15. However, one exploratory 50 x 50 cm standardized test-pit (STP), N100 W100, was placed in the shell-bearing deposits of BgDs-25 and sediments were passed through 6.4 mm mesh. Shellfish remains exhibited low species diversity like BgDs-15 and were again dominated by soft-shell clam with some whelk present. Recovered cultural material included a small sample of lithic debitage and well-preserved mammal and bird bone. A dense layer of gravel and pebbles was encountered beneath the shell-bearing deposit which exhibited many of the characteristics of the gravel-lined dwelling floors encountered throughout the coastal archaeological record of the Maritime Peninsula (cf. Sanger 2010; Hrynick and Robinson 2012; Hrynick et al. 2012; Hrynick and Black 2016). A concentration of charcoal was encountered in the northwest corner of the STP N100 W100, potentially representing a hearth feature. This was designated Feature 1...
and further excavation was halted to preserve the integrity of this potentially significant cultural feature.

The joint UNB-UofT field program resulted in more extensive excavation across three non-contiguous loci at BgDs-25. The preliminary results of the 2015 excavations have recently been published (Blair et al. 2017) and form the basis of an ongoing Master of Arts thesis by Horne and are thus only summarized here. Two 1 x 1 m excavation units (EUs) were placed at Locus 1, revealing shallow but dense shell-bearing deposits consisting primarily of whole soft-shell clam valves, with some blue mussel and many northern whelk shells. Little additional cultural material was recovered in Locus 2, five 1 x 1 EUs were placed in a cross-shaped pattern near the 2004 test-pit. During the 2015 fieldwork, all sediments were passed through 3.2 mm mesh. Cultural deposits at Locus 2 were as thick as 30 cm in some places, tapering to only a few cm in others, consisting of more fragmented soft-shell clam, minor amounts of mussel, whelk, and mixed with greasy black soil and gravel. There was evidence for horizontal differentiation within the deposits, including rock concentrations, midden deposits, relatively shell-free areas, and concentrations of burnt material. Further evidence for spatial patterning is evinced by the relative abundance of lithic debitage among provenance units and the presence of a vertically oriented possible anvil stone in the central unit. While an architectural feature was suggested by the 2004 test-pit, the convoluted placement of the rocks and possible bioturbation obscured definitive patterning (cf. Hrynick et al. 2012). The animal remains and bulk samples from the 2015 fieldwork have not been formally analyzed, but numerous mammal, bird, and fish remains (including many burnt specimens) were observed during excavation. A radiometric assay conducted on a fragment of large
mammal bone returned a date of 270±30 BP (Beta-422062) with a 2σ calibration of cal. A.D. 1520 to 1575 and cal. A.D. 1630 to 1665 and cal. A.D. 1785 to 1795. The δ\(^{13}\)C value for this assay was depleted (-24.2‰), which may have skewed the date recently to an unknown degree. This date, taken in conjunction with a fragment of possible Saintonge buff-bodied earthenware, suggests a Protohistoric age for Locus 2. Situated approximately 30 m north of Locus 2, Locus 3 included linear stone features and a brick-lined hearth, indicating some sort of Historic period structure.

**BgDs-35**

Cultural deposits at BgDs-35 are suffering from active marine erosion. The site is situated on a narrow strip of land which, until recently, was held by a private landowner; thus, only surface inspection and collection of eroded cultural material were conducted during the 2004 field school. The surface collection resulted in the recovery of abundant lithic debitage and tools, including unifacial scrapers, projectile points, and biface portions. An assemblage of animal bone was also collected from the erosional face, consisting of 76 specimens, mostly of large and calcined mammal bone fragments (Table 3.1).

In 2014, ASNB conducted limited fieldwork at BgDs-35 at the behest of the then-landowner, who wished to construct a cottage at the location. Two STPs were placed within the footprint of a former cottage and two 1x1 m EUs, Units B and D, were excavated in the intact shell-bearing deposits of BgDs-35, with only the northeast quadrants of each unit taken to archaeological bottom (Jarratt 2015). The deposits were shallow and consisted of an admixture of marine shell and black soil, with angular rocks
throughout. Numerous lithic and bone specimens were recovered, including retouched flakes and scrapers, and a flaked stone axe fragment was collected from eroded deposits. No zooarchaeological data have been reported from this phase of excavations.

_BgDs-15_

Cultural deposits from BgDs-15 consist of an admixture of marine shell and black silty loam situated atop an undulating bedrock bench. The site is fringed to the south and west by a steep shingle beach. Little soil accumulation has occurred since the precontact occupation of the site, with pockets of shell exposed on the surface of the site and the remainder vegetated with a thin layer of salt-tolerant grass and sedges. Cultural deposits at the site are relatively shallow, with a maximum depth of approximately 30 cm or less below surface. The site is actively threatened by marine erosion and is being worn away along its southern and western margins. Therefore, BgDs-15 was targeted for limited excavation and constituted the focal point of the 2004 investigations.

Prior to excavation, the surface and erosional faces of the site were visually inspected and any cultural material encountered was surface-collected. This resulted in the recovery of a piece of quartz debitage and a bipointed or contracting-stemmed projectile point (Figure 3.2). A geophysical magnetometer survey of the site was conducted by Jason Jeandron of Archaeological Prospectors Inc. to identify subsurface areas of interest prior to ground disturbance. The geophysical survey detected several subsurface anomalies, one of which is attributable to a basalt dyke running north-to-south through the site and another representing a subsurface channel to the northeast of the shell deposits. Based on the observations made during this inspection, the southern
portion of the site was prioritized for testing and excavation due to the high amount of crushed shell visible on the beach, a lack of stabilizing vegetation, and its exposure to the mouth of Birch Cove. Following these preliminary steps, a 1 m grid was established across the surface of the site along a north-south baseline. Five 50 x 50 cm STPs were placed strategically and excavated with shovels and trowels to investigate magnetic anomalies identified during the magnetometer survey and to delimit the extent of cultural deposits.

Four non-contiguous 1 x 1 m EUs—N100 W116, N100 W118, N102 W114, and N104 W113 (Figure 3.3)—were placed near the southern periphery of the site. Each EU was excavated in 50 cm quadrants following natural soil layers. When a natural layer continued further than 10 cm, it was subdivided into arbitrary 10 cm levels. All sediments were passed through 6.4 mm hardware mesh and all lithic, ceramic, and zooarchaeological specimens were collected. Individual artifacts were piece-plotted with three dimensional coordinates when deemed appropriate. A 10 x 10 cm column sample was collected from every layer and level in each EU and retained for laboratory flotation and fine-screening. Charcoal samples were also retained for potential radiometric dating. All recovered cultural material was assigned an individual bag number according to provenience including EU, quadrant, natural layer, arbitrary level, and three-dimensional coordinates. When deemed appropriate, materials were block-lifted with associated soil matrix.

One cultural feature, designated Feature 1, was encountered during excavation of EU N100 W116 (Figures 3.4 and 3.5). This feature consists of a series of ash, charcoal,
and oxidized soil lenses with a dense cluster of rock at the base, probably representing some sort of complex hearth. Feature 1 was encountered in all but the southeast quadrant of EU N100 W116 and extended into unexcavated units to the north, east, northwest, and west. The feature was lenticular in cross-section with a maximum thickness of approximately 28 cm. Most of the lithic artifacts from BgDs-15 originate from the vicinity of Feature 1. All excavated portions of Feature 1 were bulk sampled in their entirety and retained for later laboratory analysis.

Few artifacts were recovered, consisting of a single amorphous biface, 17 pieces of lithic debitage, and 14 pieces of friable, grit-tempered, undecorated pottery fragments weighing 13.5 g. The marine shellfish from BgDs-15 have not been formally analyzed but a cursory examination suggests that the shell is overwhelmingly dominated by soft-shell clam with some marine gastropod and highly fragmented blue mussel also present.

Despite the small total excavation area, a substantial amount of vertebrate bone was recovered during the 2004 field school. The bones were generally encountered in fair to poor condition, being both highly fragmented and exhibiting a “flaky” appearance due to exfoliation of the bone cortex. The field-collected sample consisted of a mixture of material both collected from screens and block-lifted to preserve contextual data. This resulted in an uneven sample of bone larger than 6.4 mm in diameter and perhaps thousands of miniscule bone fragments retained incidentally along with soil matrix (Figure 3.6). To standardize analysis, only mammal and bird bone larger than 6.4 mm diameter was included in the analysis. These were separated from the smaller fragments by passing them through a handheld geological screen in the laboratory. This produced
an assemblage of 470 mammal and 44 bird bone specimens (Table 3.2). A total of 82 (17.45%) of the mammalian assemblage was identified to family, genus, or species.

Beaver skull and appendicular elements dominate (58.54%), with the remainder comprised of the dog family (Canidae; 40.24%) and a single dentary (1.22%) from an eastern chipmunk (possibly intrusive). The canid sub-assemblage includes several fractured cranial bones with unfused sutures, including an interparietal, left and right parietals, and a left frontal, which refit to form the dorsal portion of the braincase from a single individual. The interparietal is considerably more rugose than the coyote (*Canis latrans*) and grey wolf (*C. lupus*) skulls housed in the UNB Biology Department’s collections, suggesting that this may represent morphological variation in the domestic dog (*C. lupus familiaris*), although this attribution remains tentative. Two *Canis* sp. cervical vertebrae, including an axis (C2) vertebra, were found in close stratigraphic association with the skull fragments, perhaps originating from the same individual animal, and exhibit cut and hack marks consistent with butchery and decapitation. Taken together with the radiating fractures on the left parietal bone, which suggest severe trauma, it seems that a domestic dog may have been killed, butchered, and eaten during site occupation. Consumption of dog meat is known to have occurred among many Eastern Algonquian groups throughout the Northeast in various social contexts (Kerber 1997); therefore, it is not entirely surprising to see this behaviour represented in the BgDs-15 archaeofauna. Two of the mammal bone fragments, including the butchered axis vertebra, indicate gnawing by carnivores such as domestic dogs, further suggesting the presence of scavenging dogs during occupation.
In addition, many small fish remains were observed during the 2004 excavations and were considered abundant in field observations. Numerous vertebrae and otoliths were recovered during careful excavation and in the screen, even though all were small enough to pass through the 6.4 mm screens utilized. According to field notes, some vertebrae were found in apparent articulation, suggesting that whole vertebral columns and, therefore, whole skeletons were deposited in the midden. A sample of the field-collected fish bones were given a cursory examination by Frances Stewart in 2004, who tentatively identified them as gadids, possibly Atlantic cod and tomcod (Dickinson and Broster 2007:114). An age of four years was suggested for these elements, though it was not specified how this was determined. Given the apparent abundance of fish bones, the soil matrix collected with some mammal bones during the field school was examined to recover as many small fish remains as possible. This was done to evaluate whether an in-depth analysis of the column samples would be warranted. Rather than screening the matrix, the soil was examined with the aid of a low-power magnifying lens and all visible fish remains were recovered with the aid of featherweight forceps. This procedure resulted in the recovery of 977 fish bone specimens, 598 of which were attributed to family, genus, or species. Most the identified fish assemblage was Atlantic tomcod (80.27%), with the remainder comprised mainly of unidentified gadids (19.40%) and trace amounts of clupeids (0.33%). The gadid portion consisted of bones which lay within the size range of tomcod but which could not be speciated due to surficial weathering which obscured diagnostic features. It is likely that the gadid bones represent tomcod remains rendered less identifiable through taphonomic processes. The tomcod assemblage included many non-vertebral elements, including those of the mandibular,
hyoid, and branchial arches, palatoquadrate, and neurocranium. Such a variety of skeletal elements indicated that discernable patterning might exist among skeletal topographic regions. Taken together, these data were considered sufficient to undertake detailed examination of the BgDs-15 column samples to more fully elucidate the archaeological fishery.
Table 3.1: Number of identified specimens (NISP) and unidentified portion of BgDs-35 archaeofauna surface-collected during the 2004 field school.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Common Name</th>
<th>NISP</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTINOPTERYGII</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Microgadus tomcod</em></td>
<td>Atlantic tomcod</td>
<td>2</td>
</tr>
<tr>
<td>MAMMALIA</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Castor canadensis</em></td>
<td>beaver</td>
<td>11</td>
</tr>
<tr>
<td><em>Odocoileus virginianus</em></td>
<td>whitetail deer</td>
<td>2</td>
</tr>
<tr>
<td><em>Ursus americanus</em></td>
<td>black bear</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total NISP</strong></td>
<td></td>
<td><strong>16</strong></td>
</tr>
<tr>
<td><strong>Unidentified Mammal</strong></td>
<td></td>
<td><strong>50</strong></td>
</tr>
</tbody>
</table>
Table 2.2: Number of identified specimens (NISP), %NISP, minimum number of individuals (MNI), and unidentified portions of the BgDs-15 zooarchaeological assemblage recovered during the 2004 field excavations.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Common Name</th>
<th>NISP</th>
<th>%NISP</th>
<th>MNI</th>
</tr>
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<tr>
<td>ACTINOPTERYGII</td>
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<td></td>
<td></td>
<td></td>
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<td>herring family</td>
<td>2</td>
<td>0.29</td>
<td>1</td>
</tr>
<tr>
<td>Gadidae</td>
<td>cod family</td>
<td>116</td>
<td>17.06</td>
<td>—</td>
</tr>
<tr>
<td><em>Microgadus tomcod</em></td>
<td>Atlantic tomcod</td>
<td>480</td>
<td>70.59</td>
<td>13^a</td>
</tr>
<tr>
<td>MAMMALIA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Canis cf. familiaris</em></td>
<td>probable domestic dog</td>
<td>9</td>
<td>1.32</td>
<td>1</td>
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<tr>
<td><em>Canis sp.</em></td>
<td>dog or wolf</td>
<td>11</td>
<td>1.62</td>
<td>—</td>
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<tr>
<td>Canidae</td>
<td>dog family</td>
<td>13</td>
<td>1.91</td>
<td>—</td>
</tr>
<tr>
<td><em>Castor canadensis</em></td>
<td>beaver</td>
<td>48</td>
<td>7.06</td>
<td>3^b</td>
</tr>
<tr>
<td><em>Tamias striatus</em></td>
<td>eastern chipmunk</td>
<td>1</td>
<td>0.15</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total NISP</strong></td>
<td></td>
<td>680</td>
<td>100.00</td>
<td>19</td>
</tr>
<tr>
<td>Unidentified bird</td>
<td></td>
<td>44</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unidentified mammal</td>
<td></td>
<td>388</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unidentified fish</td>
<td></td>
<td>379</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

^a MNI calculation based on first or “atlas” vertebra
^b MNI calculation based on distal humerus
Figure 3.1: Map of the Birch Cove area, including Sam Orr’s Pond and the Outer Pond, including the location of archaeological sites described in the text: 1) BgDs-35, 2) BgDs-15, and 3) BgDs-25. Stippling in the narrows indicates the relative location of the rock sills which isolate the ponds at low tide.
Figure 3.2: The bipointed or contracting-stemmed projectile point surface-collected during inspection of the intertidal zone surrounding BgDs-15.
Figure 3.3: Layout of BgDs-15 excavation units during the 2004 field school and relative extent of shell deposits visible on the surface of the site.
Figure 3.4: Photograph showing plan view and north soil profile of EU N100 W116 following the removal of Feature 1 sediments. Note the abundance of rocks in the feature interior and contrast between the dark soil of the feature and the lighter subsoil.
Figure 3.5: EU N100 W116 1) Plan view following removal of Feature 1 sediments with dashed line indicating relative horizontal extent of feature; 2) North soil profile showing internal stratigraphy of Feature 1. Bold lines and arrows indicate soil layers confidently assigned to the feature.
Figure 3.6: The typical condition of the BgDs-15 field-collected zooarchaeological assemblage—block-lifts of highly fragmented bone, shell, and fine particles wrapped in foil.
CHAPTER 4: MATERIALS AND METHODS

All shell-bearing column samples from EUs N102 W114 and N104 W113 were examined in their entirety in the laboratory. In addition, bulk samples collected from Feature 1 in EU N100 W116 were processed to compare this shell-free activity area with nearby shell-bearing deposits. Rather than process the feature completely, a subsample measuring approximately 500 ml (dry volume) was taken from the centre of each of the six bags of sediment bulk-sampled from Feature 1. This resulted in comparable volumes of sediment being processed from Feature 1 and each of the shell-bearing units. At the time of analysis, the samples had been in storage for nearly a decade and were thoroughly dry.

Each sample was dry-screened through a nested series of 6.4, 4.0, and 2.0 mm geological screens. Approximately 500 ml dry volume was sorted at a time and was gently agitated for 30 seconds to ensure that all sediments were adequately sorted while minimizing damage to delicate bone and botanical remains. After processing, the sample from each screen (fraction) was spread onto a tray and examined under a desktop magnifying lens and all artifacts (lithic, ceramic), vertebrate bones, shells, and botanical materials (charcoal, seeds, plant roots) were carefully removed using featherweight forceps. Vertebrate remains were further subdivided by class (mammal/bird/fish) based on cortical bone thickness, the porosity of trabecular bone, surface texture, and gross morphology. All materials separated from the column sample matrix were counted, weighed, and bagged separately to facilitate future analysis. The remainder of the fraction was separated into its major structural components—marine shell, rock, and fine
sediment—and the mass and volume of each component was measured. Upon the realization that fish remains—including readily identifiable elements such as vertebrae—were passing through even the 2.0 mm screen, an additional screen was constructed with 1.0 mm aperture mesh (window screen) and all column samples were passed through this screen. After sorting and removal of the fish remains, all material which had passed through the 2.0 mm aperture screen (“fine fraction”) was retained for future analysis.

**Primary Data Collection**

Often referred to as the identification phase (Clason 1972), primary data collection is the most fundamental step in zooarchaeological analysis and provides the empirical basis from which all secondary data are derived (Reitz and Wing 2008; Wake 2004). Identification is the process whereby a bone, tooth, shell of unknown classification is transformed into useable data and occurs two principal stages: the determination of the skeletal element and the taxonomic attribution (sensu O’Connor 2000:39) of the specimen. To identify taphonomic characteristics, such as evidence of butchery or burning, it is important to consider actualistic studies which have examined the signatures of various taphonomic agents (e.g. Shipman et al. 1984; Nicholson 1995, 1996; Zohar and Cooke 1997; Butler and Schroeder 1998; Willis et al. 2008; Willis and Boehm 2014). Although it is central to every zooarchaeological analysis, the process of identification is rarely defined explicitly, and it is often simply assumed that the analyst followed due protocol and that the attribution is both accurate and precise (Gobalet 2001).
Identification is achieved using a “comparative method” (Lyman 2010:127), whereby an archaeological specimen is matched to reference material of known classification. Traditionally, natural history collections from museums have represented the most abundant comparative material available, and contain most taxa from a given zoogeographic area (Davis 1987; Lyman 2010). Unfortunately, few, if any, comprehensive skeletal reference collections for fish amenable to zooarchaeological analysis exist within the Maritime Provinces and the fish bone collections available at the UNB Anthropology department is limited to Atlantic cod, Atlantic herring, yellow perch, and monkfish. For the present study, the bony fish (Osteichthyes) portion of the Canadian Museum of History’s skeletal reference collection was acquired by loan. This collection represents 21 families, 42 genera, and 62 species from the seas and rivers of North America, including many which are present in the waters of the QR, or are closely related to those which are. A collection of marine fish otoliths representing codfish (Gadiformes), herring (Clupeidae), and smelt (Osmeridae) of various sizes was acquired by loan from the Atlantic Reference Centre at the Huntsman Marine Science Centre in St. Andrews, New Brunswick. Several published visual guides pertaining to the skeletal anatomy of North Atlantic fishes were consulted including Cannon’s (1987) Marine Fish Osteology: A Manual for Archaeologists, Wheeler and Jones’ (1989) Fishes, Watt et al.’s (1997) Guide to the Identification of North Sea Fish Using Premaxillae and Vertebrae, Rojo’s (2002) Morphological and Biometric Study of the Bones of the Buccal Apparatus of Some Nova Scotia Fishes of Archaeological Interest, and Campana’s (2008) Photographic Atlas of Fish Otoliths of the Northwest Atlantic Ocean. In addition, several online resources were utilized including the University of Nottingham’s

I also prepared skeletons from a selection of fish species native to the QR and available from local supermarkets and fishmongers, including Atlantic cod, pollock, haddock, Atlantic tomcod, gaspereaux, monkfish, striped bass, rainbow smelt, Atlantic salmon, American eel, winter flounder (*Pseudopleuronectes americanus*), and witch flounder (*Glyptocephalus cynoglossus*). The fish carcasses were prepared by heating them in a microwave oven long enough to soften muscle and connective tissues. The bony skeleton was then removed following the dissection procedure recommended by Wheeler and Jones (1989:178–183), defleshing the bones through maceration in water for approximately two weeks, cleaning any remaining soft tissue from the macerated elements, degreasing with household detergents, bleaching the bones with hydrogen peroxide, and drying them beneath an ultraviolet heat lamp.

Following the recommendations of other researchers (e.g. Banning 2000; Driver 2011; O’Connor 2000; Reitz and Wing 2008) identification of the skeletal element was attempted prior to taxonomic attribution to streamline analysis using a synoptically organized reference collection. Although some analysts limit fish skeletal part identifications to elements such as vertebrae, otoliths, and portions of the mandibular
arch (typically the premaxilla, maxilla, dentary, articular, and quadrate) (e.g. Nagaoka 2005), identification was attempted for all skeletal elements to better elucidate patterns of butchery and differential preservation. Paired elements were assigned to left or right side when possible. Taphonomic signatures, which could provide insight into the procurement and consumption of fish at the site, were also documented at this stage.

After the initial sorting by skeletal element, taxonomic identification was attempted (minimally to family, but preferably genus or species); however, no attempt was made to identify the numerous, highly fragmented spiny elements in the assemblage such as branchiostegals, fin rays, and pterygiophores, which are generally not diagnostic and prone to fragmentation. From an early stage in the identification process, it became apparent based on gross morphology that most of the fish remains from the BgDs-15 column samples derived from the cod family (Gadidae) and, more specifically, the Gadinae subfamily (sensu Roa-Varón and Ortí 2009). Four species from this subfamily are currently recognized in the QR: the Atlantic cod, haddock, pollock, and Atlantic tomcod (Scott 1983). Therefore, great care was taken when attempting to discern among these four species. Photographs and measurements for tomcod bones were also provided by Arthur Spiess, Maine Historic Preservation Commission. An element was only confidently attributed to a given taxon if it displayed sufficiently diagnostic anatomical landmarks to differentiate it from closely related genera or species. Size alone was not considered a sufficient criterion to discriminate between closely related taxa since fish exhibit indeterminate growth throughout their lifetimes, meaning that even fish which are large as adults are small at some point during ontogeny (Gobalet 1989:231). In such
cases where the taxon of a given element was ambiguous, it was assigned to a more inclusive grouping.

**Quantification**

To quantify relative abundances, two fundamental counting measures were utilized. First, the NSP, which includes all bone specimens in the assemblage regardless of identifiability, was tabulated. Second, the NISP or “the number of all skeletal elements… and fragments thereof – all specimens – identified as to the taxon they represent” (Lyman 2008:27) was tallied. A specimen was considered “identified” in this analysis if it had been classified minimally to family, genus, or species. While NISP is subject to a few shortcomings (Grayson 1984; Lyman 2008:27–38), particularly the problem of interdependence, it has the benefit of being a fundamental, additive counting unit and remains the standard of measurement in zooarchaeological analysis. NISP has the added advantage of making this study comparable to others that have come before, since all zooarchaeological analyses by their nature generate NISP values.

Relative taxonomic abundances in the assemblage were expressed as a percentage of NISP (%NISP), permitting an assessment of the relative contribution of each taxon to the archaeological fishery. By determining the NISP/NSP ratio, the rate of identification of the fish bone assemblage was calculated. The overall density of fish remains at BgDs-15 was calculated by determining the NSP and NISP per litre of sediment (NSP/L and NISP/L), facilitating comparison of fish density among archaeological contexts of varying volumes.
A derived measure, MNI, was also tabulated for the BgDs-15 fish bone assemblage. While numerous definitions exist for MNI (see Lyman 1994:43, 2008:40), a concise description would be the minimum number of individual animals necessary to account for all identified specimens in a given assemblage. The MNI was calculated based on the most commonly occurring (anatomically overlapping) skeletal element for a taxon within the assemblage. Like NISP, MNI measures suffer from several attendant complications, most notably the problem of aggregation (Lyman 2008:57–66); moreover, it has long been recognized that there is a significant statistical relationship between MNI and NISP (Grayson 1984:49–84), meaning that MNI is redundant as a measure of relative abundance. Nevertheless, MNI values were calculated to provide comparability between the current study and others from the QR which have relied extensively on MNI (e.g. Black 1992, 1993, 2002).

**Skeletal Part Frequency**

Information concerning butchery, discard, consumption and storage behaviour related to animal parts can be gleaned from the relative frequency of anatomical elements. In archaeological bone assemblages, processing and consumption behaviours affect bone survivorship independent of density-mediated destruction and differential recovery, as reflected in patterns of skeletal part frequency (Butler 1996:708; Morrison 2000:34). Numerous quantitative methods have been proposed to model skeletal part frequency such as the minimum number of elements (MNE), minimum animal units (MAU), as well as NISP- and MNI-based approaches (e.g. Lyman 1994, 2008; Reitz and Wing 2008; Grayson and Frey 2004). MAU, developed by Binford (1984:50–51),
provides a generally accepted index by which to measure element frequencies. The MAU is calculated by dividing the MNE value for an element by the number of times that element occurs in a complete skeleton. Each MAU is multiplied by 100 and divided by the largest value for the assemblage, resulting in a standardized measure (%MAU), allowing the relative frequencies of various skeletal parts to be compared. This procedure is modelled by the following formula (Lyman 1994:42):

$$\%\text{MAU} = \frac{100 \times (\text{MAU}_{\text{element}})}{\text{Maximum MAU calculated for the assemblage}}$$

The %MAU values can then be plotted according to anatomical regions in fish anatomy (e.g. cranial, pectoral, pelvic and vertebral bone groups). These patterns can be cross-referenced with ethnographically documented processing techniques (e.g. Belcher 1994, 1998, 2011; Stewart and Gifford Gonzalez 1994; Hoffman et al. 2000; Morrison 2000; Zohar et al. 2001) to infer which behaviours produced the patterning. These data could also help to elucidate the relationship between Feature 1 and the shell midden, and determine whether the hearth was somehow involved in the processing of fish.

**Seasonality**

Seasonality data for the fishery can provide important insights into settlement patterns and resource scheduling. Since fish exhibit indeterminate growth throughout their lifespan, histological examination of incremental growth structures such as vertebrae, otoliths, scales, and fin spines can be used to determine the season of capture. By examining these growth layers, it can be determined whether an animal was captured during a period of rapid growth (opaque layers) or growth arrest (hyaline or translucent
layers), which can then be correlated with the season the animal died. Unfortunately, this technique is fraught with difficulties (Van Neer et al. 2004), not the least of which is that the terminal growth bands which are essential for determining precise season-of-death can often become obscured during diagenesis (e.g. Campana 2008:6–7), reducing sample sizes and potentially undermining the fidelity of this approach.

A more straightforward but, nevertheless, potentially ambiguous method to determine seasonality is to infer the season of capture for species identified from the migratory behaviour of modern populations of the same species (Colley 1990:219–220). Many fish species undergo seasonal migrations, which can influence their availability to human predation. However, migratory behaviour can vary between different size/age cohorts within a species, so life history patterns must be taken into careful consideration before interpreting seasonality. Fortunately, the modern fish populations of Passamaquoddy Bay and the Bay of Fundy-Gulf of Maine system more generally have been subject to relatively intensive study (e.g. Leim and Scott 1966; Scott 1983; MacDonald et al. 1984; Scott and Scott 1988; Jury et al. 1994; Collette and Klein-MacPhee 2002), providing a robust foundation from which to infer seasonality. Seasonality interpretations are reserved for Chapter 6: Discussion.
CHAPTER 5: RESULTS

Matrix Constituents and Site Stratigraphy

Before proceeding further, it is instructive to consider the depositional history of the archaeological deposits. The relative frequency of three major matrix constituents—shell, gravel, and fine particles—measured from the column samples present an opportunity to quantitatively examine the stratigraphic units identified in the field. While BgDs-15 was determined to be a “single component” site based on observations of the depth and composition of the deposits, potentially significant differences were measured in the matrix constituents during laboratory processing. Precise determination of the depositional sequence and the interconnections among stratigraphic units across the site have important implications for interpreting chronology, evidence for behavioural patterns, the horizontal relationships among EU’s, and discerning appropriate units of analysis. This is especially true when provenience units are non-contiguous (cf. Black 1993), as was the case with the 2004 excavations at BgDs-15. This method also increases the likelihood of recognizing features and other special depositional contexts, such as domestic architecture (e.g. Hrynick and Robinson 2012; Hrynick et al. 2012), which are difficult to distinguish without extensive horizontal excavation. Here, I interpret the quantitative data from the column samples in each shell-bearing unit in conjunction with the observations recorded in the field notes and excavation records from the 2004 field school to examine the stratigraphy of BgDs-15.
In the field, four stratigraphic layers, including the surface, were identified during the excavation of EU N102 W114 (Figure 5.1). The surface of the unit consisted mostly of exposed, sun-bleached marine shell deposits with some grass/sedge vegetation cover. The higher frequency of fine particles in the surface stratum relative to deeper layers likely results from humic accumulation due to vegetative growth since site abandonment and possibly the effect of vertical soil movement by ants, which were observed in this unit during excavation. Layer 1 contained a mixture of marine shell and black, sandy loam with prominent plants roots and minor gravel inclusions. The transition from Layer 1 to Layer 2 was marked mainly by an observed increase in shell fragment size, with a greater number of whole valves. However, in terms of overall composition, Layer 1 and Layer 2/Level 2 are barely distinguishable, with nearly identical percentages of shell (74/72%), gravel (3/6%), and fine particles (23/22%). The compositional similarity between the two excavation strata would suggest that they in fact represent the same depositional event, with the Layer 1 shell more comminuted due to its proximity to the surface, postdepositional bioturbation, and/or trampling (Figure 5.2). In the field, Layer 2/Level 3 manifested as a continuation of shell deposits within an increasingly greasy black soil matrix. The column sample for this level indicates a marked increase in gravel and fine particles, consistent with increased observations of gravel and soil greasiness in the field. Layer 3 consisted of a thin (approximately 1 cm), noticeably greasy layer of black soil with charcoal. The bulk of the column sample from this level is composed of gravel with a near-absence of shell. While this layer was excavated, mottled patches of light grey and reddish- to orange-brown sandy soil with a
high gravel content were encountered. Layer 3 most likely represents a buried humic layer which predates the formation of the anthropogenic shell deposits and overlays a thin, leached Ae horizon, which is in turn underlain by a gravelly B horizon subsoil. The increased frequency of gravel in the Layer 3 column sample is probably the result of material incorporated from the Ae and B horizons due to the difficulty of isolating the thin greasy layer during excavation and soil formation processes.

While differences were observed in the structural composition of the soil strata identified during excavation, these variations do not detract from the assumption that the cultural deposits at BgDs-15 are generally contemporaneous on an archaeological timescale. Dissimilarities in the basal strata of the cultural deposits (Layer 2/Level 3 and Layer 3/Level 4) are parsimoniously explained by transition from anthropogenic shell-bearing deposits to underlying culturally sterile subsoil horizons and the integration of material, particularly gravel, through natural processes. Although they were differentiated in the field, Layers 1 and 2 are practically identical in terms of matrix constituents, suggesting they arise from the same depositional sequence and differ primarily due to weathering processes. Finally, differences in composition of the surface stratum most likely arise due to its comparative exposure at or near the surface in the centuries since site occupation.

*N104 W113*  

Four stratigraphic layers were likewise discerned during the excavation of EU N104 W113 (Figure 5.3). The surface level consisted of a more well-developed sod layer intermixed with some comminuted marine shell. The higher frequency of fine
particles in the surficial column sample is readily attributed to the thicker vegetative cover and animal bioturbation. Ants were likewise encountered burrowing throughout this unit from the surface to the upper level of Layer 2. Layer 1/Level 1 consisted of a mixture of fragmented shell, black sandy loam, and a dense root mass. An area of lighter brown, shell-free soil which contained numerous seeds was flagged as a potential rodent burrow. Vertical sediment movement due to bioturbation presents the simplest explanation for why a metal nail was recovered in the top level of Layer 2. The transition to Layer 2 was marked by an increase in shell fragment size and a higher observed abundance of whole valves, like the corresponding layer in EU N102 W114. Data from the column samples supports the homogeneity of the layer, which is predominantly composed of marine shell, albeit with a larger amount of fine particles than EU N102 W114. However, Layer 2/Level 4 has a higher quantity of gravel than the column samples from above or below. This discrepancy is probably related to sample size, since Level 4 was isolated to a ca. 2 cm patch restricted to the far southwest corner of the EU. The basal stratum, Layer 3/Level 5, consisted of a thin, dark black greasy layer which was thicker in the southern quadrants of the EU. An increase in gravel content was noted as Layer 3 was excavated, although the thickness of this layer or greater stratigraphic control during excavation may have led to less mixing of gravel and subsoil than occurred in the basal deposits of EU N102 W114. This layer was likewise underlain by a coarse, sandy orange-brown subsoil with abundant gravel and pebbles.

The overall stratigraphic composition is similar between EU N104 W113 and N102 W114. While the precise structural composition of the individual soil layers varies somewhat, the gradation from a comminuted shell- and fine particle-dominated surface...
layer to shell-dominated midden deposits, to greasy black basal layer remains essentially the same. The increased organic particles and fine sediments in the surface and Layer 1 levels is most likely the result of well-developed vegetative cover on the surface of the shell deposits and bioturbation by rodents and insects. Again, the greasy, organic rich Layer 3 probably represents a buried humic or vegetation layer obscured by subsequent shell midden deposition. Rather than discontinuities in the depositional history, the evidence suggests that subsequent bioturbation and pedogenetic processes are responsible for the variation seen in the matrix constituents of the EU N104 W113 column samples.

Summary

Analysis of the excavation notes and column sample matrix constituents supports the interpretation of the BgDs-15 shell-bearing deposits as representing a single archaeological component, wherein “component” is construed as a culturally homogenous unit spanning a relatively short timescale. In other words, the stratigraphic sequence appears to have occurred without significant discontinuity and there is no strong lithostratigraphic (sensu Stein 1992) basis upon which to vertically subdivide the deposits. Moreover, the same strata were encountered among EUs with some minor variation in structural composition, suggesting horizontal continuity of the deposits across the site. Thus, the greatest degree of behaviourally significant patterning would be expected to occur in the horizontal dimension and, for the remainder of this study, the individual EUs are utilized as the primary spatial unit of analysis, with the material in each unit is amalgamated for analytical purposes.
Radiocarbon Assays

Two radiocarbon assays were obtained from BgDs-15. The first was conducted on bone collagen from a beaver femur recovered from EU N104 W113. The sample returned a conventional radiocarbon age of 1270±30 BP (Beta-365483), with a 2σ calibration of cal. A.D. 660 to 780 (92.3%), cal. A.D. 790 to 805 (1.3%), cal. A.D. 815 to 825 (0.2%), and cal. A.D. 840 to 860 (1.6%) (Calibrated at 2σ with the program OxCal 4.3.2 [IntCal13; Bronk and Ramsey 2017; Reimer et al. 2013]). The δ¹³C value of this sample was slightly depleted (-21.7‰), possibly the result of diagenetic or taphonomic factors, and may bias the result to a more recent date by an unknown degree (Chris Patrick, personal communication 2013). However, this phenomenon has been observed in other bone samples from the Maritime Provinces and does not appear to produce a significant degree of error when compared with dates obtained from wood charcoal (Matthew Betts, personal communication 2013). This result appears consistent with the material culture recovered from the EU and falls within the earlier Late Maritime Woodland period in regional culture history.

A sample of wood charcoal from Feature 1 in N100 W116 was submitted for radiometric dating to discern the age of this feature and illuminate its temporal relationship to the adjacent shell-bearing deposits. A conventional radiocarbon age of 160±30 BP (Beta-376315; δ¹³C = -23.7‰), with a 2σ calibration of cal. A.D. 1660 to 1710 (16.7%), cal. A.D. 1715 to 1885 (60.0%), and cal. A.D. 1910 to post-1950 (18.6%) (Calibrated at 2σ with the program OxCal 4.3.2 [IntCal13; Bronk and Ramsey 2017; Reimer et al. 2013]). The date for this sample was essentially Historic to modern in
terms of cultural chronology and does not accord with the material culture encountered in Feature 1, which suggests a precontact date. Instead, it is likely that the charcoal sample was contaminated with exogenous carbon, perhaps by plant roots given the shallow stratigraphic relief.

**Quantitative Data**

A total of 9,522 grams of sediment measuring 7,325 ml in volume was processed from the BgDs-15 column and bulk samples, resulting in the recovery of 3,217 fish skeletal specimens (Table 5.1). The majority of these remains, totalling 2,186 specimens, originated from EU N102 W114, with an additional 730 specimens from EU N104 W113, and 301 from the subsamples of Feature 1 in EU N100 W116. Relative density of fish was highly variable among provenience units, peaking in EU 102 W114 with an average of 1055 NSP/L, followed by 254 NSP/L for EU N104 W113 and 126 NSP/L for the Feature 1 subsamples from EU N100 W116.

A further 1,723 of the fish remains could be confidently assigned to family, genus, or species (Table 5.2), for an identification rate of 54%. Of these, 1,366 (79%) were attributed to Atlantic tomcod, 337 (20%) to the family Gadidae, and 21 (1%) to the family Clupeidae (herrings). Given that all the gadid remains fall within the general morphological range of tomcod elements, taken together with the preponderance of tomcod remains identified in the assemblage and the fact that elements attributed to this family could not be identified more specifically due primarily to surficial weathering, it seems likely that the vast majority of these remains originate from tomcod. Thus, the qualifier “(cf. *M. tomcod*)” was added to the gadid attributions. Overall, the relative
abundances of the three identified taxa are remarkably similar between the three EUs examined. Much of the unidentifiable portion of the sample consisted of fragmentary fin rays, branchiostegals, badly weathered vertebral portions, and flaky pieces of bone attributable to cranial elements.

Minimum numbers of individuals (MNIs) were determined for Atlantic tomcod and Clupeidae for each provenience unit (Table 5.3). These calculations were based on the abundance of first or “atlas” vertebrae, the most common anatomically overlapping element within the assemblage, or the total number of vertebrae within an individual fish. Since the vertebral column of tomcod can contain 53–57 individual vertebrae (Scott and Scott 1988:283), a median value of 55 vertebrae was utilized for the purposes of MNI calculation. No attempt was made to calculate MNI separately for Gadidae (cf. *M. tomcod*), since these identifications are likely redundant on those of tomcod. Consequently, skeletal elements for tomcod and unidentified gadids were aggregated for the purposes of MNI calculation.

**Taphonomic Signatures**

Several taphonomic signatures were identified within the BgDs-15 fish bone assemblage which could be assigned to a variety of agents (Table 5.4). Weathering—that is, evidence for the gradual destruction of bone through mechanical and chemical agents (Behrensmeyer 1978)—was ubiquitous throughout the assemblage, as manifested by exfoliation of the outer bone layers, general fragmentation, and obscuration of surface features. This weathering was one of the primary impediments to precise identification since it obliterated many of the diagnostic characters utilized to discern
one taxon from another. Any number of agents including trampling, cooking, digestion, and geochemical processes could have produced this signature, raising the problem of equifinality in its interpretation. Moreover, the criteria in determining this variable were somewhat subjective and difficult to precisely quantify. Therefore, weathering was not tallied beyond qualitative observation.

The predominant attribute in the bulk sample fish assemblage is thermal alteration or burning, as evinced by carbonized and calcined bones. Burning is a continuous process which occurs when bone is exposed to excessive heat, resulting in colour changes, warping, and shrinkage caused by the incineration of the organic component and mineral recrystallization (Shipman et al. 1984; Nicholson 1993, 1995; Stiner et al. 1995). As temperature and/or exposure time to heat increase, bone undergoes sequential changes from unburnt to carbonized (blackened) to calcined (completely white), with various intermediate colour stages. Depending on its position within a fire, a bone may exhibit multiple burning stages due to temperature differentials.

Virtually all stages of burning were identified in the BgDs-15 bulk samples, including charred (superficially carbonized), fully carbonized, partially calcined (black turning to blue-grey), and fully calcined. It proved difficult to distinguish the surficial blackening on charred specimens from mineral staining, such as that caused by manganese oxides (cf. Shahack-Gross et al. 1997). Therefore, only bones which exhibited both black colouration on their surface and evidence of physical alteration due to heat exposure were tallied. Such vagaries of identification mean that the burnt bone
counts should at best be considered minimum numbers. In total, 95 (4% NSP) burnt bones were identified from EU N102 W114 and 308 (42% NSP) from EU N104 W113. As might be expected from a shell-free hearth context, all but one of the bones recovered from the Feature 1 subsamples in EU N100 W116 showed evidence burning. The high abundance of burnt fish bone from EU N104 W113 is noteworthy for a shell midden context, being nearly identical in terms of both absolute abundance and relative density to Feature 1.

Another prevalent attribute in the assemblage was the crushing or distortion of bones, primarily vertebral centra, but also a quadrate and a basioccipital. A total of 87 bones from EU N102 W114 were modified in this manner, with a further 9 identified in the N104 W113 samples. This signature is consistent with experimentally derived assemblages produced by mastication of fresh fish bone by mammals (Wheeler and Jones 1989:69–76; Butler and Schroeder 1998:960). Unfortunately, it is impossible to distinguish reliably between human, carnivore, and rodent ingestion of bone, since all produce similar traces. However, this does provide direct evidence of consumption of fish on-site, either by the human inhabitants, their companion dogs, or subsequent scavengers. Given that these remains were incorporated throughout the matrix of the midden units, it seems reasonable to presume they were consumed, and probably excreted, by humans or dogs during episodes of active shell, bone, and other refuse accretion.

The evidence for mastication and digestion of fish carcasses has important consequences for the representativeness of the BgDs-15 fish bone assemblage.
Experiments including human, dog, pig, and rat consumption demonstrate that anywhere from 87 to 100 percent of skeletal remains can be destroyed by mastication and subsequent passage through the mammalian gut (Wheeler and Jones 1989:74–76). In another study of tui chub (*Gila bicolor*) remains consumed by modern humans and coyotes, measured rates of bone destruction were slightly lower at 74% (Butler and Schroeder 1998:962). If these rates of destruction are applied to the BgDs-15 assemblage, the implication is the loss of several hundred or even thousands of bones in the column samples alone. It is also likely that mastication and digestion have reduced the identifiability of the assemblage, as many of the crushed specimens were unidentifiable vertebrae portions.

No direct evidence of butchery in the form of cut or hack marks was identified on the specimens. This lack of such evidence is not surprising since butchery marks on fish bones most frequently occur on the spines and transverse processes of vertebrae, ribs, and pterygiophores (Willis et al. 2008), all of which are often fragmented postdepositionally and infrequently identified. Cut marks on fish bone are also readily masked by other taphonomic agents and become obscure relatively quickly following diagenesis (Willis and Boehm 2014). This reinforces the importance of skeletal part frequency for inferring butchery and meat provisioning practices related to fish.

**Skeletal Part Frequency**

Since all the remains attributed to gadids fall within the size and morphological range of Atlantic tomcod elements, with fragmented, weathered, or less diagnostic elements being grouped within the more inclusive family taxon, these were aggregated
with tomcod elements for the purpose of skeletal part analysis. Skeletal part frequencies were determined across eight anatomical regions representing virtually the entire fish skeleton (Tables 5.5 and 5.6). Sampling and retrieval bias is unlikely to be a factor in the patterning since all bone was collected using 1 mm mesh, likely resulting in near-total recovery. Thus, any variation in the frequencies is expected to reflect behavioural or taphonomic factors which select for and against certain elements.

In the fish bone assemblage from EU N102 W114, the first or “atlas” vertebra is the most commonly occurring element, with an MAU of 31.00 (%MAU 100.00), considerably higher than the next most abundant elements in terms of %MAU. The vomer (45.16), one of the anteriormost elements of the braincase, and the abdominal/caudal vertebrae (49.35), comprising the bulk of the vertebral column, exhibit the next highest %MAU values, suggesting fairly even skeletal part frequency. Other abundant elements include the basioccipital (32.26), premaxilla (37.10), maxilla (27.42), hyomandibula (25.81), and posttemporal (25.81), representing various regions of the cranial, postcranial, and appendicular skeletons. Given that the atlas vertebra is situated at the juncture of the cranial and postcranial axial skeletons, and is in close proximity to several other anatomical regions, this strongly supports a relatively even representation of elements from across the skeleton.

A comparable pattern holds with the EU N104 W113 fish bone assemblage where the basioccipital, a cranial axial element which articulates directly with the vertebral column, ranks as the most commonly occurring element with an MAU of 6.00 (%MAU 100.00). The next highest %MAU values are held by the abdominal/caudal
vertebrae (97.17), atlas vertebra (83.33), and otoliths (83.33), suggesting a fairly even representation of both the cranial and postcrani al axial skeleton. Additional frequently occurring elements include the maxilla (58.33), hyomandibula (50.00), and premaxilla (41.67), representing lateral skull bones of the mandibular and hyoid arches.

Unsurprisingly, the most abundant elements are relatively dense and compact bones associated with locomotion and feeding whereas the more poorly represented elements are either small or comparatively delicate, particularly elements of the neurocranium. However, there are certain patterns within the skeletal part frequencies that warrant further consideration.

The abundance of the atlas vertebrae in the EU N102 W114 sample seems anomalously high given that bone density values for the atlas vertebra measured in another gadid, the Pacific cod (*Gadus macrocephalus* (Smith 2008:58)), show this bone is not especially dense in comparison to other elements from the neurocranium (vomer), sphlanchnocranium (maxilla, quadrate, angular), pectoral girdle (cleithrum), and postcranial axial skeleton (caudal vertebrae). In both shell-bearing EUs, abdominal and caudal vertebrae are also significantly better represented than elements of the mandibular arch (e.g. premaxilla, maxilla, dentary, and angular) and pectoral girdle (e.g. cleithrum) which are typically dense and readily identifiable. It is possible that Atlantic tomcod vertebrae exhibit higher density relative to cranial axial and appendicular elements, leading to over-representation in the assemblage; however, at present there is no species-specific bone volume density data to evaluate this. Pacific cod, whose average length at maturity 67.0 cm (Luna n.d.), might represent a poor analog for a
smaller but closely related species such as Atlantic tomcod, with a maximum total length 38 cm (Scott and Scott 1988:282). This inference is supported by the fact that bone volume density of elements from smaller Pacific cod (43.8 cm standard length (SL)) have significantly lower densities than larger specimens (Smith 2008:48, 58), suggesting that size does play a mediating role in bone volume density. In other fish taxa, such as chinook salmon (*Oncorhynchus tshawytscha*), vertebrae exhibit higher bone density values than cranial elements (Butler and Chatters 1994:416–417) whereas others, such as largescale sucker (*Catostomus macrolepis*), display high variations in density both within and among anatomical regions (Butler 1996:710). Bone shape might be a determining factor, with the relatively compact and round vertebrae less easily fragmented than long, thin elements.

It is difficult to precisely determine the extent to which mastication, digestion and burning might have impacted the skeletal part representation in the assemblage by reducing either identifiability or sample size. Experimental burning of fish bones demonstrates that vertebrae endure thermal alteration better than other skeletal elements, with various bones of the splanchnocranium (particularly the mandibular arch) and pectoral girdle surviving but less well-represented (Nicholson 1995:51–54). Mastication and digestion also select against the preservation of certain elements, with experiments on herring, mackerel, haddock, plaice, and snapper demonstrating that vertebrae survive better than most elements, although elements such as the quadrate and palatine also fare well (Wheeler and Jones 1989:69–74). Experiments studying the survivorship of tui chub remains in modern human and coyote feces demonstrate that vertebrae tend to survive better than most other elements (Butler an Schroeder 1998:961–966).
Ethnoarchaeological research at shoreline fishing camps along Lake Turkana, Kenya (Stewart 1991; Butler 1993; Stewart and Gifford-Gonzalez 1994; Gifford-Gonzalez et al. 1999) suggests that butchery and preparation practices can bias skeletal part representation toward vertebrae even when fish are consumed and deposited *in situ*. Thus, while the patterns of element representation generally seem to indicate a higher presence of vertebrae relative to other durable elements, this pattern is readily accounted for by the taphonomic history evinced in the assemblage. Taken together, the skeletal part frequency and taphonomic history of the assemblage indicate that whole fish were deposited during the occupation of BgDs-15.
**Table 5.1:** Volumetric data for the BgDs-15 column samples, including total volume processed, total NSP and NISP of fish per unit, and densities of fish remains (NSP/L and NISP/L).

<table>
<thead>
<tr>
<th>Excavation Unit</th>
<th>Total Volume</th>
<th>Total NSP</th>
<th>NSP/L</th>
<th>Total NISP</th>
<th>NISP/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>N100 W116</td>
<td>2,380 ml</td>
<td>301</td>
<td>126</td>
<td>134</td>
<td>56</td>
</tr>
<tr>
<td>N102 W114</td>
<td>2,072 ml</td>
<td>2,186</td>
<td>1,055</td>
<td>1,158</td>
<td>559</td>
</tr>
<tr>
<td>N104 W113</td>
<td>2,873 ml</td>
<td>730</td>
<td>254</td>
<td>433</td>
<td>151</td>
</tr>
</tbody>
</table>
Table 5.2: Primary data summary for fish remains (NISP (%NISP)) recovered from column samples from each excavation unit in BgDs-15.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Common Name</th>
<th>N102 W114</th>
<th>N104 W113</th>
<th>N100 W116</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clupeidae</td>
<td>herring family</td>
<td>12 (1)</td>
<td>8 (2)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Gadidae (cf. M. tomcod)</td>
<td>cod family</td>
<td>215 (19)</td>
<td>100 (23)</td>
<td>23 (17)</td>
</tr>
<tr>
<td>Microgadus tomcod</td>
<td>Atlantic tomcod</td>
<td>931 (80)</td>
<td>325 (75)</td>
<td>110 (82)</td>
</tr>
<tr>
<td><strong>Total NISP</strong></td>
<td></td>
<td>1158</td>
<td>433</td>
<td>134</td>
</tr>
<tr>
<td><strong>Unidentified Fish</strong></td>
<td></td>
<td>1028</td>
<td>297</td>
<td>167</td>
</tr>
</tbody>
</table>
Table 5.3: MNI values for fish taxa recovered from column samples from each excavation unit in BgDs-15.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Common Name</th>
<th>N102 W114</th>
<th>N104 W113</th>
<th>N100 W116</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clupeidae</td>
<td>herring family</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><em>Microgadus tomcod</em></td>
<td>Atlantic tomcod</td>
<td>31</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total MNI</strong></td>
<td></td>
<td><strong>32</strong></td>
<td><strong>7</strong></td>
<td><strong>3</strong></td>
</tr>
</tbody>
</table>
Table 5.4: Quantitative data for primary taphonomic signatures identified in BgDs-15 column sample fish bone assemblage, including relative abundance and density.

<table>
<thead>
<tr>
<th>Excavation Unit</th>
<th>Total NSP</th>
<th>Burnt NSP</th>
<th>Burnt %</th>
<th>NSP/L burnt</th>
<th>Crushed NSP</th>
<th>Crushed %</th>
<th>Crushed NSP/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>N100 W116</td>
<td>301</td>
<td>300</td>
<td>99.7</td>
<td>109</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>N102 W114</td>
<td>2,186</td>
<td>95</td>
<td>4.3</td>
<td>46</td>
<td>87</td>
<td>4.0</td>
<td>42</td>
</tr>
<tr>
<td>N104 W113</td>
<td>730</td>
<td>308</td>
<td>42.2</td>
<td>107</td>
<td>9</td>
<td>1.2</td>
<td>3</td>
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</tbody>
</table>
Table 5.5: Skeletal element analysis for EU N102 W114, organized by anatomical region. Note that, for the purposes of this analysis, the taxa Microgadus tomcod and Gadidae (cf. M. tomcod) have been aggregated (NISP 1146).

<table>
<thead>
<tr>
<th>Skeletal Element</th>
<th>NISP</th>
<th>MNE</th>
<th>MAU</th>
<th>%MAU</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Neurocranium</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mesethmoid</td>
<td>1</td>
<td>1</td>
<td>1.00</td>
<td>3.22</td>
</tr>
<tr>
<td>vomer</td>
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<td>14.00</td>
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</tr>
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<td>11</td>
<td>11.00</td>
<td>35.48</td>
</tr>
<tr>
<td>sagittal otolith</td>
<td>20</td>
<td>14</td>
<td>7.00</td>
<td>22.58</td>
</tr>
<tr>
<td><strong>Mandibular Arch</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>premaxilla</td>
<td>25</td>
<td>23</td>
<td>11.50</td>
<td>37.10</td>
</tr>
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<td>maxilla</td>
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<td>17</td>
<td>8.50</td>
<td>27.42</td>
</tr>
<tr>
<td>dentary</td>
<td>14</td>
<td>11</td>
<td>5.50</td>
<td>17.74</td>
</tr>
<tr>
<td>angular</td>
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<td>14</td>
<td>7.00</td>
<td>22.58</td>
</tr>
<tr>
<td><strong>Palatoquadrate</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>palatine</td>
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<td>11</td>
<td>5.50</td>
<td>17.74</td>
</tr>
<tr>
<td>quadrate</td>
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<td>5.00</td>
<td>16.13</td>
</tr>
<tr>
<td><strong>Opercular Series</strong></td>
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<td></td>
</tr>
<tr>
<td>preopercle</td>
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<td>5</td>
<td>2.50</td>
<td>8.06</td>
</tr>
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<td>opercle</td>
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<td>8</td>
<td>4.00</td>
<td>12.90</td>
</tr>
<tr>
<td><strong>Hyoid Arch</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>hyomandibula</td>
<td>16</td>
<td>16</td>
<td>8.00</td>
<td>25.81</td>
</tr>
<tr>
<td>symplectic</td>
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<td>6</td>
<td>3.00</td>
<td>9.68</td>
</tr>
<tr>
<td>hypohyal</td>
<td>5</td>
<td>5</td>
<td>1.25</td>
<td>4.03</td>
</tr>
<tr>
<td>anterior ceratohyal</td>
<td>11</td>
<td>10</td>
<td>5.00</td>
<td>16.13</td>
</tr>
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<td>posterior ceratohyal</td>
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<td>3</td>
<td>1.50</td>
<td>4.84</td>
</tr>
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<td>interhyal</td>
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<td>2</td>
<td>1.00</td>
<td>3.23</td>
</tr>
<tr>
<td>urohyal</td>
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<td>6</td>
<td>3.00</td>
<td>9.68</td>
</tr>
<tr>
<td><strong>Branchial Arch</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>epibranchial</td>
<td>9</td>
<td>9</td>
<td>0.89</td>
<td>2.87</td>
</tr>
<tr>
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<td>15</td>
<td>13</td>
<td>6.50</td>
<td>20.97</td>
</tr>
<tr>
<td>phrayngobranchial toothplate</td>
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<td>7</td>
<td>1.75</td>
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</tr>
<tr>
<td><strong>Pectoral Girdle</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>posttemporal</td>
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<td>16</td>
<td>8.00</td>
<td>25.81</td>
</tr>
<tr>
<td>supracleithrum</td>
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<td>10</td>
<td>5.00</td>
<td>16.13</td>
</tr>
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<td>cleithrum</td>
<td>8</td>
<td>5</td>
<td>2.50</td>
<td>8.06</td>
</tr>
<tr>
<td><strong>Vertebral Column</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>vertebra, atlas</td>
<td>31</td>
<td>31</td>
<td>31.00</td>
<td>100.00</td>
</tr>
<tr>
<td>vertebrae, abdominal/caudal</td>
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<td>811</td>
<td>15.30</td>
<td>49.35</td>
</tr>
<tr>
<td>urostyle</td>
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<td>1</td>
<td>1.00</td>
<td>3.22</td>
</tr>
</tbody>
</table>
Table 5.6: Skeletal element analysis for EU N104 W113, organized by anatomical region. Note that, for the purposes of this analysis, the taxa *Microgadus tomcod* and Gadidae (cf. *M. tomcod*) have been aggregated (NISP 425).

<table>
<thead>
<tr>
<th>Skeletal Element</th>
<th>NISP</th>
<th>MNE</th>
<th>MAU</th>
<th>%MAU</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Neurocranium</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mesethmoid</td>
<td>1</td>
<td>1</td>
<td>1.00</td>
<td>16.67</td>
</tr>
<tr>
<td>vomer</td>
<td>2</td>
<td>1</td>
<td>1.00</td>
<td>16.67</td>
</tr>
<tr>
<td>basioccipital</td>
<td>8</td>
<td>6</td>
<td>6.00</td>
<td>100.00</td>
</tr>
<tr>
<td>sagittal otolith</td>
<td>14</td>
<td>10</td>
<td>5.00</td>
<td>83.33</td>
</tr>
<tr>
<td><strong>Mandibular Arch</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>premaxilla</td>
<td>5</td>
<td>5</td>
<td>2.50</td>
<td>41.67</td>
</tr>
<tr>
<td>maxilla</td>
<td>7</td>
<td>7</td>
<td>3.50</td>
<td>58.33</td>
</tr>
<tr>
<td>dentary</td>
<td>3</td>
<td>3</td>
<td>1.50</td>
<td>25.00</td>
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<tr>
<td>angular</td>
<td>10</td>
<td>9</td>
<td>4.50</td>
<td>0.75</td>
</tr>
<tr>
<td><strong>Palatoquadrate</strong></td>
<td></td>
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<tr>
<td>palatine</td>
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<td>2</td>
<td>1.00</td>
<td>16.67</td>
</tr>
<tr>
<td>quadrate</td>
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<td>1</td>
<td>0.50</td>
<td>8.33</td>
</tr>
<tr>
<td><strong>Hyoid Arch</strong></td>
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<td>hyomandibula</td>
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<td>6</td>
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<td>50.00</td>
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<td>symplectic</td>
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<td>1</td>
<td>0.50</td>
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<td>hypohyal</td>
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<td>2</td>
<td>0.50</td>
<td>8.33</td>
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<td>2</td>
<td>2</td>
<td>1.00</td>
<td>16.67</td>
</tr>
<tr>
<td>interhyal</td>
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<td>1</td>
<td>0.50</td>
<td>8.33</td>
</tr>
<tr>
<td><strong>Branchial Arch</strong></td>
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<td>epibranchial</td>
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<td>3</td>
<td>0.38</td>
<td>6.33</td>
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<td>pharyngobranchial toothplate</td>
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<td>1</td>
<td>0.50</td>
<td>8.33</td>
</tr>
<tr>
<td><strong>Pectoral Girdle</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>posttemporal</td>
<td>4</td>
<td>4</td>
<td>2.00</td>
<td>33.33</td>
</tr>
<tr>
<td><strong>Vertebral Column</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>vertebra, atlas</td>
<td>5</td>
<td>5</td>
<td>5.00</td>
<td>83.33</td>
</tr>
<tr>
<td>vertebrae, abdominal/caudal</td>
<td>347</td>
<td>309</td>
<td>5.83</td>
<td>97.17</td>
</tr>
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</table>
**Figure 5.1:** Horizontal stacked bar graph displaying the relative percentages (mass) of the matrix constituents from the EU N102 W114 column samples, subdivided by natural layers and arbitrary excavation levels.
Figure 5.2: EU N102 W114, surface of Layer 2, showing general composition of the shell-bearing deposits from BgDs-15. Note the marine shell exposed on the surface of the site.
Figure 5.3: Horizontal stacked bar graph displaying the relative percentages (mass) of the matrix constituents from the EU N102 W114 column samples, subdivided by natural layers and arbitrary excavation levels.
CHAPTER 6: INTERPRETING THE PRECONTACT FISHERY

The Atlantic tomcod is a small member of the family Gadidae, averaging 30.5–33.0 cm total length (TL) when fully grown, with a maximum length of 38.1 cm reported (Scott and Crossman 1973). In body plan, it closely resembles the larger Atlantic cod, with a robust, elongate body, projecting upper jaw, paired chin barbels, three dorsal fins, two anal fins, thoracic pelvic fins, and a white lateral line (Stewart and Auster 1987:1; Scott and Scott 1988:282). The tomcod is visually differentiated from related species by the rounded profile of the caudal fin and the second rays of the pelvic fins, which are twice the length of the other rays.

The cultural significance of Atlantic tomcod is indicated by Wabanaki place-nomenclature. The Peskotomuhkati place-name for one location in Cobscook Bay, near modern-day Pembroke, Maine, is Punamuhkatik, which translates to “at the place where the tomcod are caught” (Francis and Leavitt 2008:462). Similarly, a Mi’kmaw place-name near Salmon River, Nova Scotia, is given as Boonāmookwŏde or “tomcod-ground” (Rand 1875:98). While there were undoubtedly other tomcod-fishing locales, given the abundance of this species across the Maritime Peninsula, the fact that these two place-names have been retained attests to the importance of this fish. It seems that this regard for tomcod was shared among many Eastern Algonquian peoples throughout their range. For example, at the time of European contact, tomcod were considered among the fish held “in greatest request” by the southern New England Algonquian peoples alongside bass, sturgeon, salmon, lamprey, eel, lobster, and clam (Josselyn 1865:76).
Method of Capture

The Atlantic tomcod is an exclusively inshore, shallow-water species which rarely strays to depths greater than 6 m or more than 1.5 km offshore (Collette and Klein-MacPhee 2002:243). Tomcod are distributed from southern Labrador to Virginia, and are locally abundant in shallow estuaries, bays, and harbours around Newfoundland, the Gulf of St. Lawrence, the Bay of Fundy, and Gulf of Maine. Freshwater landlocked populations occur in Lac Saint-Jean, Quebec, Deer Lake, Newfoundland, and possibly elsewhere in Atlantic Canada (Scott and Scott 1988:282). Although individual fish may occasionally travel nearly 250 km (e.g. Vladykov 1955:11), most tomcod populations are essentially non-migratory and closely associated with individual water bodies. Movement in the species is primarily linked to diel feeding patterns and spawning runs.

The daily foraging rhythms of Atlantic tomcod closely follow the tidal cycle. The fish concentrate along the front of the advancing tide, especially during rough weather, presumably to take advantage of prey which has recently settled out of suspension (Howe 1971:34; Salinas 1980:29–30). Food is located primarily with the sensitive chin barbels and feeler-like pelvic fins whilst the body is angled between 30 to 45 degrees, aided by the sense of smell (Herrick 1904:262–264). Tomcod are indiscriminate benthic predators, consuming a variety of crustaceans, polychaetes, molluscs, and, occasionally, small fish in proportion to their abundance in the environment (Alexander 1971; Grabe 1978, 1980; Howe 1971; Salinas 1980). Due to these proclivities, tomcod will readily take a bait of clams, shrimp, worms, fish, or even pork liver and can thus be captured from shore using hook-and-line in all seasons (Vladykov 1955:12; Collette and Klein-
Tomcod feed most intensively during the early morning (Alexander 1971:10) and perhaps during the night, given that the best fishing occurs at night (Vladykov 1955:12) and that they undergo much of their movement at night (Bergeron et al. 1998:100).

Atlantic tomcod are particularly amenable to mass capture techniques due to their tendency to forage in the intertidal zone; weirs, gill nets, seines, and bag nets have all proven to be effective methods (Cox 1921:12–13; Hunstman 1922:67–68). In one recorded instance from the early twentieth century, over three thousand tomcod were captured during a single seine haul in a weir at Bass River, Nova Scotia (Leim 1931:21). All of these methods, or analogs thereof, would have been available to Peskotomuhkati fishers during the Historic period (see Chapter 2) and, in all likelihood, prior to European contact.

A potential anthropogenic feature was identified at the mouth of Sam Orr’s Pond near the upper sill which may represent the remnants of a fish trap structure (Figure 6.1). At this location, a circular ring of rocks is visible, particularly at low tide, composed of large fragments of material derived from the local bedrock and approximately half the width of the sill in diameter. This circular rock alignment has been tentatively identified as a precontact fish trap (Dickinson and Broster 2007); however, the vicinity of Sam Orr’s Pond has not remained undisturbed from the time BgDs-15 was occupied. It is unclear to what extent the incipient oyster aquaculture, biological surveys, or other undocumented postcontact activity may have altered the structure of rocks in the area. This uncertainty, taken in conjunction with the lack of any means to securely date the
rock alignment using either radiometric or typological methods, makes it difficult to confidently ascribe this structure to precontact fisheries.

Archaeological mass capture facilities are common along the Northwest Coast of North America (e.g. Moss et al. 1990; Eldridge and Acheson 1992; Moss and Erlandson 1998; Stevenson 1998; Byram 1998, 2002; Tveskov and Erlandson 2003; Prince 2005; Losey 2010) as well as in other parts of the globe (e.g. Godwin 1988; Dortch 1997; Bowen 1998; Gilman 1998; O’Sullivan 2004; Rowland and Ulm 2014) and, while Indigenous weir facilities have been identified in the larger Northeast (e.g. Johnston and Cassavoy 1978; Décima and Dincauze 1998) and on the Maritime Peninsula (e.g. Lewis 2006; Petersen et al. 1994; Miller 2006), they remain relatively understudied in the region. There are several ethnohistoric accounts of Wabanaki brush-and-stake weir construction from the seventeenth century, primarily from ancestral Mi’kmaq territory:

This is how a Fish-weir is made; stakes are driven, side by side, at the mouth of Streams & Rivers into which the Sea rises; the Fish pass over it at high Tide on their way to fatten on the Ooze of the Marshes; when the Sea has run quite far out & the Fish begin to lack water, they follow the ebb, or reflux, & being no longer able to pass over the stakes, because the water is too low, they are arrested, & can be taken [Diereville 1933:114].

Fish abound… everywhere, such is the fertility of this country. In order to catch them the savages make a hurdle, or weir, across the brook, which they place almost erect, propped up by wooden bars, like buttresses, and leave a space therein for the fish to pass, which find themselves caught at the fall of the tide in such numbers that the savages allow them to rot [Lescarbot 1914:236–237].

At the narrowest place of the rivers, where there is the least water, they make a fence of wood clear across the river to hinder the passage of the fish. In the middle of it they leave an opening in which they place a bag-net like those used in France, so arranged that it is inevitable the fish should run into them. These bag-nets, which are larger than ours, they raise two or three times a day, and they always find fish therein. It is in spring that the fish ascend, and in autumn they descend and return to the sea. At that time they placed the opening of their bag-
net in the other direction [Denys 1908:437].

Taken in conjunction with high tidal amplitudes, the intensity of Holocene sea level rise in the QR (Gehrels et al. 2004; Greenberg et al. 2012) means that, even if intertidal fish traps were a significant capture technology in the past, they are unlikely to have survived to the present day. The Sebasticook weir complex from south-central Maine is well-documented (Petersen et al. 1994; Miller 2006), and represents repeated episodes of construction spanning ca. 5080–1760 BP, suggesting that it served as a focal point on the landscape for millennia.

It is also important to note that the physical geography of Birch Cove and Sam Orr’s Pond generates a natural fish trap that would require little or no alteration to utilize effectively. The outer pond adjacent to BgDs-15 becomes isolated from Birch Cove and Sam Orr’s Pond during ebb tide, effectively creating a potential fish trap with each tidal cycle. Any fish trapped therein could easily have been scooped or speared with little recourse for escape. Indeed, it seems that similar structures may have been constructed by the Wabanaki during the Protohistoric period, as evinced by a brief and cryptic account from the late sixteenth century. In 1593, the Marigold sailed “foure leagues to the West of Cape Briton” and “passing somewhat more into the land… founde certaine round pondes artificially made by the Sauages to keepe fish in, with certaine weares in them made to take fish” (Hakluyt 1889:56). Moreover, fish could easily have been stranded on the rocky sills that isolate the outer pond; in fact, just such a situation occurred during the 2004 field school when many herring (Clupeidae) were discovered stranded on the sills at low tide. Atlantic tomcod are frequently observed in fish
assemblages stranded in the intertidal zone (e.g. Bleakney and McAllister 1973), no doubt due to their propensity to forage with the movement of the tides. Therefore, significant numbers could conceivably be collected with minimal technological investment during stranding events.

In the absence of unequivocal technological evidence, the quantitative data from the BDs-15 column samples themselves may shed light on precontact fishing techniques. Unfortunately, the remains of mass capture facilities are rarely directly comparable with archaeological deposits, an understandable challenge given the intricacies of temporally and functionally associating these two very different types of archaeological signatures. In this respect, a comparison with the Q’umu?xs Village site (DkSf-19), located in Comox Harbour, British Columbia (Caldwell 2008, 2011) may be especially informative. At Q’umu?xs, archaeological deposits originating from an ethnographically documented winter village site (dating as far back as ca. 2400 BP) are positioned alongside the remnants of over 200 precontact wooden weir structures in Comox Harbour dated from 1230±60 to 120±40 BP, including heart- and chevron-winged traps. These radiocarbon dates overlap with those from Area 3 of Q’umu?xs, where Pacific herring (Clupea pallasi) density in bucket auger samples ranged from 149–2,040 NISP/L (Caldwell 2011:242). These densities of fish bones overlap with those from the shell-bearing column samples from BgDs-15 (151–1,158 NISP/L), offering strong supporting evidence that these represent the remains of fish captured using weirs or other bulk procurement methods. Whether Birch Cove and Sam Orr’s Pond were anthropogenically modified to create a fish trap or simply utilized in their natural state as an analog, it is likely that this was a significant factor in attracting settlement to the area.
Seasonality

Atlantic tomcod are anadromous fish that enter estuaries and streams during winter up to the head-of-tide to spawn in fresh or brackish water. Tomcod have earned the common name “frostfish” throughout their range due to the observation that they become abundant in estuaries following the first severe frost (e.g. Perley 1852:211). In the QR, spawning occurs from late December to January (Peterson et al. 1980:156). The preponderance of tomcod remains at BgDs-15 would seem to indicate a cold-season occupation of the site. This interpretation was suggested by Dickinson and Broster (2007:114) who erroneously referred to “cod” spawning in estuaries during the winter. However, it is important to consider that, while tomcod represent a common component of winter estuarine fish communities in the QR, they also regularly occur in summer beach communities alongside juvenile gadids, clupeids, and other taxa (MacDonald et al. 1984). It has long been observed that tomcod could be taken throughout the year along the shores of the Maritime Provinces (Perley 1852:211; Vladykov 1955:11). Due to the fact that tomcod are present nearshore throughout the year and could plausibly have been captured during all seasons, simple presence/absence data alone are insufficient for seasonality determination (cf. Black 1992:123).

Instead, it is necessary to examine the taxonomic structure of the assemblage and consider how this might reflect seasonality. The fish bone assemblage from BgDs-15 is overwhelmingly dominated by Atlantic tomcod and small gadid remains, which together constitute approximately 99% of the identified assemblage, clupeid remains comprising
the remainder. It may be instructive to compare these taxonomic frequencies in the archaeological fauna to those obtained through modern fisheries research.

A thirteen-month beach seine survey in the outer Bay of Fundy from August 2003–2004, including three sites each from Passamaquoddy Bay and St. John Harbour, produced cumulative fish assemblages dominated by Atlantic silversides (53.95% of individuals), with rainbow smelt (18.70%), sticklebacks (*Gasterosteus* spp. (4.61%)), Atlantic herring (9.25%), winter flounder (3.86%), and Atlantic tomcod (3.86%) forming the most significant minority components (Arens 2007:37–41, 60). Similar results were obtained from another survey at Black Beach in late September 2004, although tomcod formed an even smaller component (0.39%) of the assemblage (Arens 2007:67). Seining surveys conducted in Chignecto Bay and Minas Basin in the upper Bay of Fundy from June to September, 1978, identified a summer estuarine-mudflat fish community dominated by tomcod (68.36%), with smelt (16.53%), smooth flounder (*Pleuronectes putnami* (6.84%)), and silversides (6.26%) forming the most significant minority components (Dadswell et al. 1984:170–174). Tomcod also predominated (48.27%) the five-minute beach seine hauls at Peck’s Cove, Cumberland Basin from March 22 to September 11, 1979; again, they were accompanied by significant quantities of silversides (31.02%), as well as gaspereaux (8.13%), smooth flounder (6.00%), and smelt (5.65%) (Dadswell et al. 1984:182). Thirty-minute bottom trawls taken in September from the Cumberland Basin were generally dominated by tomcod, white hake (*Urophycis tenuis*), and silver hake (*Merluccius bilinearis*) (Dadswell et al. 1984:183). These data align with other surveys conducted throughout the Gulf of Maine (Fiske et al. 1967; Ayvazian et al. 1992; Targett and MacLeave 1974; Tort 1997; Lazzari
et al. 2003; Lazzari and Stone 2006), southwestern Nova Scotia (Black and Miller 1991), and eastern New Brunswick (Brenmer et al. 2015).

Although it is problematic to equate the quantities of species recovered during modern fisheries surveys with those of an archaeological sample, the expectation generated by these data is that a warm-season assemblage should include a greater taxonomic diversity and smaller relative frequency of Atlantic tomcod remains than in the BgDs-15 archaeofauna. Thus, the high relative abundance of tomcod in the archaeological assemblage suggests that they were taken during a time of significant aggregation, which is most acute during the winter spawning season. Indeed, the period of tomcod spawning coincides with a period of general decline in inshore fish species richness and abundance in the QR (Arens 2007:37–41, 74) associated with the winter offshore movement of many species (MacDonald et al. 1984), implying that this might have been a particularly advantageous time to fish tomcod from a resource scheduling standpoint.

Such an interpretation is supported by the ethnohistoric record of Wabanaki and other Eastern Algonquian peoples. In 1616, writing about the Mi’kmaw subsistence round he observed in Port Royal, Father Pierre Biard states that “[I]n December (wonderful providence of God) comes a fish called by them Ponamo, which spawns under the ice” (Thwaites 1898:81). In this case, “ponamo” is the equivalent of poonāmoo, the Mi’kmaw word for Atlantic tomcod (Rand 1888:266), a cognate of the Peskotomuhkati-Wolastoqewi word for tomcod, punam (Francis and Leavitt 2008:462). Whether Biard’s invocation reflects the Indigenous regard for tomcod or his own, it is a
clear testament to the importance of this fish that it is denoted by its Mi’kmaw name. Further evidence for the importance of the tomcod to the Mi’kmaw can be found in LeClerq’s description of the Mi’kmaw calendar. He describes the Mi’kmaw equivalent of December as Bonodemeguiche, which “signifies that the Tomcod ascends into the rivers; they catch this fish with the line, making a hole in the ice” (LeClerq 1910:139). In Rand’s (1875:103) orthography, this month is listed as Boonãmooe-goos’ or “Frost-Fish Month” and is instead equated with January. Likewise, the Peskotomuhkati-Wolastoqewi term for the lunar month which approximates December–January is punamuwi-kisuhs; literally, “frostfish moon” (Francis and Leavitt 2008:462). This ethnohistorical and linguistic evidence strongly associates tomcod with midwinter in Wabanaki culture, suggesting that this was both an important fishery at this time of year and that the spawning aggregations of tomcod served as a sort of cultural mnemonic for the seasonal round. This may have been the case throughout the Gulf of Maine system.

In his A Key into the Language of America, Williams gives the name for tomcod as Paponaumsũog among the southern New England Algonquians, describing it as a “winter fish, which comes up in the brookes and rivulets… in times of frost and snow” (1643:108).

Provisioning

Provisioning of fish carcasses, as evinced by skeletal part frequencies, is generally modelled in two ways based on archaeological data and ethnoarchaeological analogy: 1) relatively even skeletal part representation indicating in situ or on-site butchery and consumption, and 2) uneven representation indicating the removal of
certain body parts to facilitate transportation away from the capture location or preservation for delayed consumption (Stewart 1991; Butler 1993; Stewart and Gifford-Gonzalez 1994; Barrett 1997; Zohar and Cooke 1997; Belcher 1994, 1998, 2011; Lubinski and Partlow 2012). The skeletal part representation evinced by the BgDs-15 column samples indicates that whole carcasses were deposited at the site, suggesting *in situ* procurement, processing, and consumption of fish; however, this does not necessarily preclude processing and transportation of fish off-site. Cross-culturally, small fish (ca. <325 mm SL) such as Atlantic tomcod are typically consumed and preserved whole or minimally processed by removing the viscera and branchial skeleton (e.g. Raymond and Sobel 1990; Stewart and Gifford-Gonzalez 1994:247; Zohar and Cooke 1997:60, 64; Belcher 1994: 173, 1998:170, 176, 2011:96–99). Moreover, if fished in winter, tomcod can be frozen almost immediately (Vladykov 1955:12) and easily transported whole if temperatures remain sufficiently frigid. Thus, skeletal element representation on its own is inadequate to elucidate fish provisioning at BgDs-15 and the taphonomic history of the assemblage must be evaluated.

Evidence for the mastication and probable digestion of fish bones, in the form of distorted and weathered elements, demonstrates that fish were consumed on-site. Whether it was humans or dogs directly consuming whole fish, or dogs consuming the discarded remnants of human meals, and subsequently regurgitating or defecating the bones onto the shell-bearing deposits, this signature suggests *in situ* provisioning. The presence of burnt fish bones in archaeological deposits is often interpreted as direct evidence for either cooking or processing for long-term storage (e.g. Stewart 1991:596–597; Stewart and Gifford-Gonzalez 1994:247; Koch 1995:45; Gifford-Gonzalez et al.
1999:414; Matsui 2005; Carvajal-Contreras et al. 2008). I consider it unlikely that the burnt fish remains from BgDs-15, particularly the calcined specimens which must have been heated to temperatures of 700°C or higher (Nicholson 1993:414, 1995:56–58), represent the direct results of either cooking or preservation; exposure of bone to such excessive temperatures would have destroyed any adhering flesh and rendered it unsuitable for human consumption. Instead, a more parsimonious explanation is that the fish bones were deposited into fire as refuse or, perhaps, lost to fire incidentally during cooking or smoking. If the latter is the case, the sheer abundance of burnt fish bone would suggest relatively large-scale processing; unfortunately, the experimental and ethnoarchaeological literature is insufficient to substantiate this interpretation at present. Regardless, the presence of burnt fish bone suggests on-site consumption by humans prior to deposition in a fire. Taken together with the skeletal part representation, the taphonomic history of the assemblage lends credence to the hypothesis of in situ provisioning. Thus, the evidence from BgDs-15 is consistent with residential, rather than logistical mobility (sensu Binford 1980).
Figure 6.1: The possible anthropogenic rock ring at the mouth of Sam Orr’s Pond in August 2017, facing southwest. The dashed line indicates the presumed outer perimeter of the alignment.
CHAPTER 7: BROADER CONSIDERATIONS

In this chapter, I attempt to integrate the findings from BgDs-15 within the wider context of QR precontact archaeology. As described in Chapter 5, two radiocarbon assays were obtained from BgDs-15, one of which (160±30 BP; Beta-376315) is rejected due to its essentially modern date. The accepted date, 1270±30 BP (Beta-365483), with a 2σ calibration of 1288–1172 cal BP and 1159–1147 cal BP; and 1132–1129 cal BP and 1108–1091 cal BP (Calibrated at 2σ with the program OxCal 4.3.2 [IntCal13; Bronk and Ramsey 2017; Reimer et al. 2013]), places the occupation within the earlier Late Maritime Woodland period (Black 2002:304; Hrynick and Black 2016:24). This situates the precontact occupation of BgDs-15 near a critical juncture in regional culture history: the Middle-to-Late Maritime Woodland transition. This transition has been reviewed in detail by Black (2002), who compiled artifactual, site structural, and subsistence-settlement data from the mainland and insular QR to characterize the shift.

A Brief Overview of the Middle-to-Late Maritime Woodland Transition

From the vantage of site structure, Middle Maritime Woodland (MMW; 2200–1350 BP) components tend to be thick and intricately stratified, consisting of interdigitated shell-bearing deposits, gravel living floors, and hearth features (Black 1991; 1992:36–37; 1993:40–44; Spiess et al. 1990). Such deposits likely the result of repeated episodic occupation and are frequently stratified above older and below younger archaeological deposits (Black 2002:309–311). This period overlaps with Ceramic Periods (CP) 2 and 3 in the Petersen and Sanger (1991) typology, featuring grit-
tempered pottery decorated with a variety of dentate, pseudo-scallop, linear, and punctate motifs (Petersen and Sanger 1991:132, 137). Formal stone tools of the MMW are characterized by straight- or contracting-stemmed points, amorphous bifaces, and a variety of unifacial scraper types (Black 1992:150; Bishop 1994:22–24). Flaked stone artifact densities are low and toolstones consist of predominantly local materials and a relatively low percentage (<15%) of apparent regionally exotic toolstone (Black 1992:68, 70–71; Bishop 1994:22–23).

Vertebrate zooarchaeological assemblages are often dominated by fish remains, including clupeids, gadids (including Atlantic cod and pollock), monkfish, and sculpin; however, an array of cervids, marine mammals, furbearers, waterfowl, and seabirds are also present (Bishop and Black 1988:22–26; Black 1992:99–100, 1993:72–86). Shellfish assemblages are relatively diverse, containing high volumes of soft-shell clam (Mya arenaria), green urchin (Strongylocentrotus droebachiensis), horse mussel (Modiolus modiolus), Atlantic dogwhelk (Nucella lapillus), common whelk (Buccinum undatum), and blue mussel (Mytilus edulis), with trace amounts of other taxa (Black 1992:99–100, 1993:56–60; Spiess et al. 1990:). Seasonality data suggest that MMW occupations occurred in all seasons, but not necessarily year-round at individual sites (Bishop and Black 1988:30–32; Black 1992:146, 1993:93–98).

Stark structural changes coincide with the onset of the early Late Maritime Woodland (eLMW; 1350–950 BP); namely, a shift to shallow, more horizontally differentiated deposits dominated by greasy “black soil middens” (sensu Black 2002), gravel lenses, rock alignments, pit features, peripheral shell-bearing deposits, and
specialized activity areas (Sanger 1987:22–32; Black 1992:37; Blair 1999:78–86). In some cases, eLMW components are virtually shell-free, resulting in acidic soils which inhibit bone preservation (Black 1992:40). This period aligns with CP 4, which is characterized by grit- or shell-tempered pottery with cord-wrapped stick and cylindrical punctate designs (Petersen and Sanger 1991:142–143). In the IQR, ceramic densities drop significantly following the onset of the LMW (Black 1992:76). Stone tools include small side- or corner-notched stemmed bifaces and small “thumbnail”-type scrapers, often made from presumed regionally exotic toolstone (Sanger 1987:36–46; Black 1992:76, 90; Blair 1999:86–89). Lithic artifact densities are high in eLMW components; concomitantly, the percentage of exotic toolstone rise, comprising 50% or more of lithic material at some sites (Black 1992:76, 89).

Vertebrate assemblages from the IQR exhibit increased taxonomic diversity and include relatively even amounts of mammal and fish bone, with a minor amount of bird remains (Black 1992:100, 105, 2002:308). Conversely, eLMW shellfish assemblages exhibit decreased taxonomic diversity and are often dominated by soft-shell clam (Black 1992:243, 2002:308). Mainland eLMW archaeofaunas are dominated by mammal remains, particularly beaver and cervids, and include small, but relatively diverse bird bone assemblages (Stewart 1974; Burns 1978; Sanger 1987:66, 70). Shellfish remains likewise consist primarily of soft-shell clam at mainland sites (Burns 1978:38; Sanger 1987). The seasonality of eLMW components from the IQR is indicative of spring-through-autumn “warm-season” residency (Black 1992:146–147, 2002:307); conversely, mainland components are thought to consist of “cold-season” occupations,

Components dating to the later Late Maritime Woodland (lLMW; 950–550 BP) are generally under-represented in the QR archaeological record (Black 2002:313). Those that have been identified are relatively shallow, organic-rich, shell-bearing deposits without discernable features and are not stratified above older components (Sanger 1987:89; Black 1992:41). The lLMW CP 5 pottery is largely a continuation of CP 4 attributes; however, shell temper became dominant (Petersen and Sanger 1991:144–148). Lithic artifact densities from insular sites are relatively low (Black 1992:90); however, the assemblage from the McAleenan site (BhDr-1) in Digdeguash Harbour includes narrow side- or corner-notched stemmed bifaces and small scrapers (Sanger 1987:89).

Vertebrate remains from lLMW contexts in the IQR are sparse, with dog, waterfowl and codfish identified in small quantities at the Lighthouse Cove and Pintlowes Cove sites (Black 1992:106). Shellfish remains from these sites consist almost entirely of soft-shell clam (Black 1992:243). Clam thin-sections, along with fish and bird migratory patterns, indicate warm-season occupations for these components (Black 1992:147). The vertebrate archaeofauna from McAleenan is more substantial and dominated by moose, beaver, and waterfowl (Savage 1970). Although quantitative data for shellfish at McAleenan are not provided, Sanger (1987:89) describes a midden of “badly crushed” soft-shell clam. Seasonality at McAleenan was interpreted as fall or
spring, with no support for summer residency, but a winter occupation was not precluded (Savage 1970).

**Accounting for the Transition**

Black (2002:311) has interpreted the MMW archaeological record as indicating a residential mobility pattern (*sensu* Binford 1980), wherein groups moved seasonally within the QR, settling at both mainland and insular locations throughout the year. The evidence from eLMW components has led Black (2002:313) to suggest that Peskotomuhkati settlement continued to be residential in nature, but differentiated into a cold-season mainland/warm-season insular settlement pattern. In part, this may have occurred to take advantage of coastal watercraft-based exchange, particularly of exotic toolstones, which proliferated during the LMW generally (Bourque 1994:34–35). The continued occupation of MMW habitation sites, albeit with greater horizontal extent, may suggest an increased population size (Black 2002:314). Despite being the most proximate period to the present, the ILMW remains poorly envisaged archaeologically. Black (2002:313–315) has suggested that the few ILMW components that have been identified are consistent with logistically oriented, specialized, short-term resource extraction camps. The dearth of components may be attributable to aggregation into larger settlements, perhaps analogous to large LMW sites identified elsewhere on the Maritime Peninsula such as Goddard (Bourque and Cox 1981), or nucleation into villages at the head-of-tide on river systems, as indicated by the ethnohistoric record. Whereas many eLMW components are stratified atop MMW deposits, there appears to be widespread abandonment of these localities during the ILMW, based on available
radiometric and stratigraphic data (Blair and Webb, in prep.), perhaps lending credence to the hypothesis of nucleation.

**The Vantage from BgDs-15**

Poised as it is amidst a restructuring of precontact Peskotomuhkati subsistence-settlement systems, the eLMW component from BgDs-15 offers an opportunity to bring new data to bear on several longstanding questions in regional archaeology. Virtually all previous excavations from the MQR are problematic in some respect. For instance, at the Teacher’s Cove site, radiocarbon assays of 1170±100 BP (S-608) and 1635±60 BP (S-609) were obtained from a single dwelling feature (Davis 1978; Sanger 1987:103), suggesting that multiple episodes of occupation occurred. This impression is further reinforced by the presence of MMW CP 3 pottery (Petersen and Sanger 1991:138) and probable Late or Terminal Archaic stemmed bifaces from Teacher’s Cove (Davis 1978:55–56). The Carson site likewise produced artifactual and radiometric evidence for both older and later components (Sanger 1987). Other sites, such as Simpson’s Farm, Minister’s Island, Orr’s Point, Holt’s Point, Phil’s Beach, and Eidlitz, lack clear stratigraphic associations, radiocarbon assays, or zooarchaeological analyses altogether, substantially narrowing the dataset.

The small overall size of BgDs-15, its shallow stratigraphy, and the apparent homogeneity of the shell-bearing deposits (see Chapter 5) may avoid some of the problems inherent in examining large, heterogeneous multi-component sites. In fairness, such problems are not isolated to the mainland archaeological record. It was only during reanalysis in the 1990s and 2000s (MacDonald 1995:97–100; Black 2002:306–307) that
a LMW occupation, stratigraphic component 3, was identified in the uppermost strata of Units 1 and 4 at Partridge Island. Nevertheless, a radiocarbon assay of 1550±50 BP (Beta-3968) was obtained from a gravel and black soil living floor in Unit 1 (Black 1993:44, 2002:307), falling within the Middle Maritime Woodland chronology despite the association of shell-tempered pottery and a preponderance of apparently exotic toolstone. The seeming conflict between the radiocarbon assay and ceramic typology is symptomatic of the difficulty in separating vertically superposed components, particularly when there is evidence for postdepositional disturbance.

The abundance of fish remains from both the shell-bearing deposits and the shell-free Feature 1 at BgDs-15 demonstrate the importance of marine resources to the precontact inhabitants of the site, particularly when taken in conjunction with the abundant shellfish remains that constitute the site matrix. Fish bone density values (NSP/L and NISP/L) for the BgDs-15 shell-bearing units are comparable to or exceed those calculated for many sites from the Northwest Coast culture area (e.g. Caldwell 2008, 2011; Cannon 2000; McKechnie 2005, 2007, 2012; Patton 2011), where intensification of precontact Indigenous fisheries is an inextricable component of long-term cultural change (e.g. Ames 1994, 2005; Butler and Campbell 2004; Moss and Cannon 2011). In stating this, I do not advocate that broad cross-cultural analogies should be drawn between the Maritime Peninsula and Northwest Coast, particularly concerning trajectories of increasing social complexity; rather, I propose that these data indicate a similarly concentrated marine subsistence orientation.
To further underscore this point, it is pertinent to consider the dietary contribution of fish more fully. Comparing the vertebrate archaeofauna of the whole unit samples with those of the column samples (2.0 m² and 0.02 m² at BgDs-15, respectively) to generate a paleodietary reconstruction is often challenging, especially given the vagaries of applying “correction factors” in zooarchaeology (e.g. Thomas 1969; James 1997; Cannon 1999; Shaffer and Baker 1999). Nevertheless, it has been demonstrated that bulk-sampling procedures derived from limited areas produce comparable archaeofaunal assemblages to those of adjacent, more extensive excavations (Cannon 2000). Simply multiplying the abundances of Atlantic tomcod plus Gadidae (cf. M. tomcod) remains from the BgDs-15 column samples by one hundredfold to produce an aerial equivalent of the whole unit samples yields 114,600 NISP and 3,100 MNI for EU N102 W114 and 42,500 NISP and 600 MNI for EU N104 W113. Even the more conservative of these numbers—which cannot account for bones destroyed by various taphonomic agents (see Chapter 5)—dwarfs the potential dietary contributions of both dog (Canidae; NISP 33; MNI 1) and beaver (NISP 48; MNI 3) at BgDs-15. Such a multitude of fish suggests a relatively specialized subsistence strategy targeting a focal resource—winter spawning tomcod—supplemented with some terrestrial mammals.

This impression is further reinforced by the calcined bone assemblage from Feature 1, nearly all of which is comprised of fish remains. This contrasts sharply with other calcined bone assemblages from the QR (e.g. Hrynick et al. 2017) and the

3 Note that MNI calculations for EU N104 W113 were determined based on the median number of total vertebrae for tomcod. Therefore, multiplying this value may produce misleading results.
Maritime Peninsula generally (e.g. Spiess 1992; Spiess and Mosher 2006; Robinson et al. 2009:2186), which are usually dominated by mammal bone fragments. Lithic artifact densities from BgDs-15 are low and the toolkit consists almost entirely of debitage, lacking typical big game hunting and processing tools such as stemmed bifaces and scrapers. Admittedly, the lack of formal tools may be a function of the limited excavation area; however, it is consistent with a specialized fish processing site which would necessitate little investment in stone tool production. The density of pottery fragments is likewise low, consisting of only a few friable sherds. In this respect, BgDs-15 is an interesting counterpoint to the nearby BgDs-35, where surface collecting produced a sizeable assemblage of typically LMW formal stone tools (including stemmed points), no pottery, and the bones of large terrestrial mammals. The apparent functional differentiation between these two nearby, and presumably closely temporally affiliated, sites is compelling and deserves further exploration. Unfortunately, it is impossible to draw further comparisons between them without additional data.

Taken together, the evidence from BgDs-15 almost wholly contradicts Sanger’s (1987) Quoddy Tradition framework. Whereas Sanger characterized Maritime Woodland (ca. 2200–350 BP) subsistence-settlement patterns as diffuse or generalist and primarily directed toward terrestrial resources, the results presented in this thesis suggest a relatively specialized, focal strategy oriented toward marine resources occurred at some sites. Without the column sample data, the BgDs-15 archaeofauna would consist of an unremarkable assemblage of terrestrial mammals and a few fish, bearing little distinction from other assemblages analyzed from the MQR (e.g. Sanger 1987:93) aside from a relatively small sample size. BgDs-15 is instead more reminiscent of LMW
assemblages from the IQR by being relatively focal and having a primarily marine orientation (Black 1992:117–118). These findings suggest greater variability in LMW subsistence strategies on the MQR than has previously been appreciated.

Regarding seasonality, eLMW sites from the MQR are considered cold-season occupations based on the presence-absence of migratory fowl, seal migratory patterns (particularly for hooded seal (*Cystophora cristata*)), cervid antler shedding patterns, beaver tooth-sectioning, the scarcity of mammals known to hibernate overwinter, and a lack of fish remains (Sanger 1987:68–71; Stewart 1974:30–38; Burns 1978:37–38). However, these interpretations may not be completely supported by zooarchaeological data. Whereas overwintering species account for 17% (21 NISP) of the Carson site bird assemblage, year-round residents make up the majority (80%; 98 NISP), and summer-resident species comprise a minority component (3%; 4 NISP). Hooded seals are known from the Gulf of Maine-Bay of Fundy system only as rare, extralimital records; nevertheless, they represent a significant quantity of the seal remains identified in the QR archaeological inventory, possibly due to identification error (Black 2017:77). The lack of hibernating mammals such as woodchucks (*Marmota monax*) may instead be attributable to their marginal food value.

Moreover, the paucity of fish remains is potentially an artifact of sampling bias rather than an actual reflection of their abundance in archaeological deposits (see Chapter 2). What fish remains have been identified from mainland sites, such as haddock and flatfish from Carson and longhorn sculpin from Teacher’s Cove, indicate warm-season occupation, given that these taxa are known to undertake offshore
migrations during the winter in the QR (MacDonald et al. 1984). Although I do not dispute the strong cold-season indicators, it is clear from the available data that many of the taxa deposited at mainland sites could have been taken year-round, or indeed during the summer. At best, these signatures indicate potential year-round occupation of the mainland, perhaps with a central tendency toward cold-season occupation. The opacity of the seasonality data may be an artifact of unit construction, such that employing the site as the primary analytical unit, with a consequential increase in sample size, aggregates multiple seasonally distinct occupations (cf. Black 1992:147).

As discussed in the previous chapter, the preponderance of Atlantic tomcod remains in the BgDs-15 fish bone assemblage is in accord with a cold-season occupation. Ironically, it seems conventional seasonality interpretations posited for the eLMW on the MQR are corroborated by a line of evidence which has not previously been examined in detail. I stress that this does not negate the evidence for multi-season occupation at mainland sites, which has generally been dismissed. Rather, I see this as illustrating the complexity of interpreting seasonality data from the existing dataset and emphasizing the need to approach the MQR archaeological record stratigraphically and utilize units of analysis finer than the site level.

Finally, I consider the potential for the BgDs-15 findings to shed light on the Middle-to-Late Maritime Woodland transition. Black (2002:313–315) has invoked increased sedentism and logistical mobility, population expansion, and climate change as possible factors driving the changes evinced in the archaeological record. A similar transition has been detected at Port Joli Harbour, Nova Scotia, where substantial warm-
season processing middens and smaller interior cold-season habitation sites characterize the MMW, whereas LMW settlements consist of considerable year-round black soil middens at the head of the harbour accompanied by wintertime satellite camps (Betts et al. 2017:38). The large black soil middens may have been strategically positioned to harvest spring gaspereaux runs. Paleoclimatic reconstructions suggest that the transition at Port Joli also coincided with climate change to warmer, wetter conditions (Neil et al. 2014). Analogous changes in the archaeological record are evident from other locations elsewhere in southern Nova Scotia and coastal Maine (e.g. Bourque and Cox 1981; Cox 1987; Sheldon 1988, 1991).

The configuration and structure of BgDs-15, with its small area, horizontally separated task-specific areas, lack of apparent stratigraphic superposition over an older component, and soft-shell clam dominated midden, displays traits that are intermediate between the eLMW and lLMW in Black’s (2002) formulation. While this pattern is reminiscent of other peri-contemporaneous single-component eLMW sites such as Northeast Point and Newton’s Point from the IQR, it contrasts with sites such as Partridge Island, Camp, and Weir, where eLMW components are stratified above older MMW components. It is possible that multi-component sites from the mainland which have yielded eLMW radiocarbon dates and diagnostic artifacts but are less well-documented, such as Minister’s Island, Holt’s Point, Eidlitz, and Orr’s Point, may have a similar continuity of occupation. Although it is anomalous in comparison with other sites identified from the MQR, BgDs-15 might belong to a class of smaller, less visible satellite sites which have been overlooked in favour of larger, more conspicuous ones. Given that the estuaries in which Atlantic tomcod spawn are located primarily on the
mainland, it is likely that sites with a similar configuration to BgDs-15 will not be encountered on the IQR, suggesting one possible dichotomy between insular-mainland subsistence-settlement patterns.

There are hints from the archaeological record of the QR and coastal Maritime Peninsula that suggest similar components do exist at other sites. The concentration of burnt fish bone encountered at the McAleenan site, with an associated radiocarbon date of 680±160 BP (GSC-1313) (Sanger 1987:90), may be analogous to Feature 1 at BgDs-15. Extending beyond the QR to site 43.18 on Mount Desert Island, Maine, a subsample from Feature 1—at a cobble-lined hearth radiocarbon dated 810±40 BP (Beta-239515)—produced thousands of burnt fish remains, most of which were identified as Atlantic tomcod (Spiess 2008). Site 16-198, located at the head of Parsons Creek Inlet in the Sheepscot River estuary, yielded 5,126 tomcod bones comprising 99% of fish NISP from the site (Carlson 1986:208–210). The site, attributed to the “early Contact” (Protohistoric?) period based on the presence of Iroquoian-like pottery and European copper, is remarkably like BgDs-15, consisting of shallow (ca. 25 cm depth) shell-bearing deposits, having a small surface area (ca. 3 x 11 m), and being located at the head of a small coastal inlet (Carlson 1986:92–93). Tomcod remains have been recovered in smaller quantities at other sites outside the QR, including sites throughout coastal Maine (e.g. Carlson 1986; Spiess and Lewis 2001; Spiess et al. 2006; Spiess and Haliwell 2011) and AlDf-30 in Port Joli Harbour (Betts et al. 2017:26).

The pattern of eLMW occupations continuing at the same locations as MMW sites, but with increased surface area, plus the addition of new peri-contemporaneous
settlements, could be explained by demographic expansion over the course of the Maritime Woodland period, at least in a proximate sense. An increase in population size and its attendant challenges would necessitate growth of the subsistence base, a process typically modelled under the framework of “intensification” (e.g. Boserup 1965, Morrison 1994; Morgan 2015). In the context of hunter-gather resource intensification, increased resource output is operationalized through three primary strategies: specialization, diversification, and “intensification proper” or investment (Morrison 1994:137; Betts and Friesen 2004:358–359). In this tripartite scheme, the evidence from BgDs-15 appears to fit best with a strategy of specialization through which emphasis was placed on the bulk procurement of tomcod.

The eLMW archaeological record may represent a hybrid strategy whereby resource diversification was achieved through extensification of settlement across the landscape whilst simultaneously specializing on key animal resources. It is plausible that small, single-component sites such as BgDs-15 represent specialized, ancillary resource extraction sites established to support a larger population that simultaneously reoccupied MMW sites. However, as the high percentage of exotic toolstone at Northeast Point potentially indicates, sociopolitical factors such as trade and interaction with extraregional groups may have been equally important drivers of long-term cultural change. The sparse archaeological record of the ILMW is consistent with a pattern in which multi-component sites had been abandoned in favour of larger, strategically located sites on river systems, perhaps analogous to the larger settlements recorded by European observers during the early Historic period in other parts of the Maritime Peninsula.
The small, ephemeral sites attributed to the ILMW, such as Lighthouse Cove and Pintlowes Cove on the Bliss Islands, may be the remnants of logistical forays throughout the region to support larger aggregations. It should be cautioned that such settlements might not constitute a “village” in the sense that the term is usually construed. Increasingly, the archaeological record of the larger Northeast demonstrates that coalescence into larger sociopolitical units was an historically contingent process (Birch 2013) that may have produced settlements which were dispersed across the landscape such that they did not necessarily fit ethnohistoric analogs (e.g. Leveillee et al. 2006). Ultimately, these tentative suggestions cannot be substantiated based on limited excavations from a single small site and must await future detailed archaeological field excavation and analysis to satisfactorily resolve. What is clear is that such inquiry can only proceed through detailed examination of multiple lines of evidence from a representative sample of multiple site types from the regional archaeological inventory.
CHAPTER 8: CONCLUSION

In this thesis, I have demonstrated that a fine-screening of bulk soil and column samples from the QR can yield significant quantities of small fish bones of sufficient quality for identification and analysis. Contrary to previous findings, my research has confirmed that precontact Peskotomuhkati economies on the MQR could exhibit a significant marine focus rather than being primarily reliant on terrestrial resources. Furthermore, fish—in this case, Atlantic tomcod—can be the dominant vertebrate remains recovered from mainland sites by a significant margin. Such findings are more in accord with the historic richness of fisheries in the QR and the reliance of both Peskotomuhkati and European peoples on marine and river fisheries as a source of sustenance. Integrating the archaeological record of the QR remains difficult, as my attempts to summarize precontact fisheries and general subsistence-settlement data illustrate. This is the outcome of over 150 years of sporadic research programmes which have employed disparate methodologies and interpretive approaches, resulting in uneven analysis and reporting. One of the unfortunate consequences of this history of research is that the character and significance of precontact fisheries remains significantly underdeveloped; however, on a more positive note, this means that a great deal remains to be discovered and there is considerable latitude for future research.

The importance of Atlantic tomcod, hinted at by my findings and research in Maine (Spiess 2008; Carlson 1986), deserves further exploration. Since the estuaries in which this winter-spawning fish congregates are located predominantly, if not exclusively, on the mainland, it is possible that tomcod may have underpinned mainland
settlement to an unknown degree. This might also indicate a fundamental dichotomy between mainland and insular precontact fisheries. The regional dataset tentatively suggests that tomcod fishing was more intense, if not necessarily more widespread, during the LMW than MMW, indicating that mass capture of tomcod through the winter could have been an important development following the Middle-to-Late Maritime Woodland transition. A total absence of fish larger than ca. 30 cm TL in the BgDs-15 assemblage is surprising considering that large gadids (cod/pollock/haddock) are the predominant taxa identified in archaeological deposits from the IQR. Recent excavations in ILMW and Protohistoric deposits at the Devil’s Head and BgDs-25 sites (Blair et al. 2017; Hrynick et al. 2017) likewise yielded fish assemblages overwhelmingly dominated by similarly small fish. These findings hint at a shift from exploitation of larger fish using spears and/or hook-and-line in the MMW to mass capture of small fish using stationary weirs in the LMW. I caution that this pattern may be more apparent than real, since these studies employed either comprehensive column sample analysis or 3.2 mm screens during field excavations, undoubtedly resulting in better fish bone recovery. The abundance of small fish taxa may be significantly underestimated in the extant database, as alluded to by the presence of herring and “herring-like” fish at the Bliss Islands sites and profusion of small, burnt fish bones from the McAleenan site. Clearly, more research is required to substantiate or refute these and other questions about precontact fisheries in the QR.

A more general implication of my research is that even small, seemingly insignificant sites and limited horizontal excavations can yield a wealth of information that meaningfully contributes to understanding Maritime Woodland subsistence-
settlement systems. This serves as a potent reminder that, despite several decades of professional research, the regional archaeological narrative remains nascent in many respects. Incorporating data from large, deeply stratified and small, single-component sites, both shell-bearing and shell-free, will be instrumental to illuminate key processes in the regional archaeological record and periods of seemingly abrupt change, such as the Middle-to-Late Maritime Woodland transition.

This thesis adds to a growing body of research that demonstrates the efficacy of fine-screening protocols to recover the remains of small fish. Given the significant pre-existing literature on this subject, it may seem unnecessary to emphasize this point; however, fine-screening is still not routinely incorporated into archaeological research (cf. Hrynick 2011; Betts et al. 2017; Blair et al. 2017; Hrynick et al. 2017) and, in fact, the regional literature sometimes discourages the practice. Bourque (1995:24) has claimed that systematically screening shell-bearing archaeological deposits is inadvisable on three grounds: 1) the time and costs associated with screening impede horizontal excavation, 2) that screening damages delicate material such as fish bones, and 3) that excavators become complacent due to reliance on screens and may under-recover animal bones. More recently, he has argued that “unlike shell-free sites where excavators can rely on screens to separate wanted materials from the unwanted soil matrix, shell middens can’t be effectively screened because the largest and most ubiquitous objects recovered are the shells themselves” (Bourque 2012:40).

While I suspect that most archaeological field researchers throughout the Maritime Peninsula routinely utilize screens during excavation nowadays, I nevertheless
feel it is necessary to address these reproaches since they occur in prominent, relatively current, book-length treatments on regional archaeology. The costs of increased methodological rigour versus the benefits of extensive excavation is a perennial conundrum in field archaeology, for which there is no one-size-fits-all solution. Increasingly, however, it is apparent that expediency comes at the expense of data resolution. Recent research in coastal Nova Scotia targeting dwellings and other architectural features has prioritized fine-grained data recovery and horizontal exposure over speed of excavation (Hrynick et al. 2012; Betts and Hrynick 2014), with compelling results. Ultimately, resolving the lingering questions of regional archaeology will require data recovery at a finer scale than has occurred in the past. Despite the slow and careful excavation which occurred during the 2004 field school under close supervision, many thousands of fish remains must have been overlooked or passed through screens. While Bourque is correct that shell-bearing matrices make it difficult to discern small fish bones, this is an incentive to employ screens rather than a deterrent. The assertion that screening damages delicate bone is likewise not supported by my findings. All the fish bones analyzed herein were passed through a series of at least four screens along with quantities of shell, rock, and other particles, yet no bone was visibly damaged and delicate features such as the neural and haemal processes of tiny vertebrae were unharmed by the process. Undoubtedly, some bone was damaged during screening; however, the wealth of data retrieved vastly outweighs the level of this risk. Finally, excavator complacency—or, to put it another way, inter-analyst variability—is inherent to archaeological fieldwork and cannot be totally controlled during excavation, given the various backgrounds and experience levels of field crew (Gobalet 2001). In fact, bulk
sampling of sediments and processing by qualified personnel represent the only way that this variable can be controlled.

Unfortunately, I am forced to reiterate conclusions that Black (1993:100–102) had reached during his analysis of the Partridge Island site during the early 1980s; namely, that fine-screening procedures should routinely be implemented during future excavations and a comprehensive regional skeletal reference collection for fish must be developed. It is unfortunate that, after more than three decades, neither of these recommendations has been fully implemented. Screening whole units through 3.2 mm mesh is becoming more commonplace during research-oriented fieldwork in the QR (e.g. Blair et al. 2017; Hrynick et al. 2017), representing an encouraging sign. All future archaeological research projects in the QR should employ at least 3.2 mm mesh to screen whole unit samples, supplemented by fine-screening (with ca. 1.0 mm mesh) of column or bulk soil samples to yield more representative samples of small animal bones and other material culture, such as micro-debitage, comminuted pottery, and botanical remains.

Column and bulk soil samples from previous excavations in both the insular and mainland QR are housed at several regional research institutions, including UNB, ASNB, and the Canadian Museum of History. Processing these samples using a methodology such as that described in this thesis could yield a significant quantity of fish bones. A fine-grained analysis of the archaeological matrix from these samples could also help to elucidate the stratigraphy of sites where no soil layers were recognized in the field, resolve the chronological affiliations of apparently multi-
component sites, and recognize specialized depositional contexts (e.g. domestic architecture (Hrynick et al. 2012)). As the results presented in this thesis demonstrate, such a project could yield significant amounts of data, the analysis of which could help frame research questions before proceeding with additional excavation.

Additionally, both my background research and findings from BgDs-15 suggest that previous archaeological analyses from the QR, particularly those conducted before the 1980s, may need to be revisited. As alluded to in the previous chapter, it seems that some zooarchaeological identifications from the past, such as the seal remains from mainland sites, may be spurious (Black 2017). It is possible that these analyses used comparative material geared toward the Arctic and Subarctic culture-geographic regions, introducing identification bias. Moreover, too few of the fish remains recovered from mainland sites have been identified and it is also evident that fish identifications from the IQR could be further refined. For example, identifications of “cod-like” or “herring-like” fish and the dentary of a “large fish” identified in Weir site stratigraphic component 3 (Black 1992:100) could almost certainly be refined to at least the family level. Zooarchaeological quantitative data for the QR also should be standardized to facilitate synthesis. Assemblages that have only been tallied by MNI (e.g. Black 1992, 1993, 2002; Pearson 1970) should be reanalyzed or republished to produce NISP values, since MNI is a derivative measure which is less suited to certain statistical procedures (Grayson 1984; Lyman 2008). The destruction of the archaeological record due to ongoing relative sea-level rise and modern shoreline development dictates that as much information as possible be gleaned from extant collections. It is tempting to simply advocate for new excavations which apply more rigorous methodologies, but previous
excavations may have targeted sites or site types that are no longer represented in the unimpacted archaeological inventory. Thus, re-analysis of the material curated from past excavations could be invaluable in pursuing archaeological research questions, even if the resolution of past excavations is not optimal.

Toward these ends, it will be necessary to develop more comprehensive, regionally-specific comparative collection of fish skeletal material. At present, no regional research institution houses a comparative collection that contains the entire suite of regional fish species and is amenable to zooarchaeological analysis. Minimally, any such collection should include:

1) a diverse range of taxa… with multiple individuals per taxon representing size, age, environmental, and sexual differences; 2) complete skeletons, properly prepared and labelled; 3) a hierarchically arranged collection which is ordered either taxonomically and/or synoptically; and 4) comprehensive aids to identification, in the form of biological and taxonomic information, osteological reference manuals, photographs, and other materials (Betts et al. 2011:757).

Although I have been able to amass a small personal collection of a dozen species for this study, to which I am steadily adding additional specimens, this task is beyond what a single individual researcher can reasonably hope to accomplish.

Acquiring marine fish, especially pelagic and demersal species, often requires specialized equipment, expertise, and permits—not to mention time and expense—which are not necessarily accessible to most individuals. Although some species (mostly salmonids, gadids, flatfish, and some schooling species) are readily available in supermarkets throughout the year, they represent the limited set of taxa targeted by modern commercial fisheries and rarely include eclectic yet edible species, such as
sculpin, targeted by precontact fishers. Thus, amassing a comprehensive comparative
collection would best be undertaken by a research institution with the resources to
support such an endeavour. I stress that a collection ought not be proprietary, such that it
is monopolized by one individual or institution; rather, it must be made available to any
researcher with reasonable grounds for its use. Nevertheless, I recognize that there are
prosaic costs associated with collecting, preparing, and curating reference specimens for
long-term use; therefore, if a regional comparative collection must be monetized, it
should be made accessible for a nominal fee, or perhaps managed cooperatively among
multiple institutions. Academic freedom and transparency of findings should be
prioritized above the profit motive. Researchers and institutions from other jurisdictions
may be able to provide models upon which such a collection, and the logistics of
accessibility, could be built.

Finally, I turn to the most pressing threat to the coastal archaeological record of
the QR: erosion driven by relative sea-level rise and exacerbated by anthropogenic
climate change. Rising sea-levels have profound implications for the destruction of
archaeological deposits located along marine and estuarine shorelines, given that wave
energy is most intense at the surface and is concentrated at high tide due to increased
water depth (Desplanque and Mossman 2004:49). The coast of Maine and the Maritime
Provinces has been subsiding steadily over the Holocene due to collapse of the forebulge
of the Laurentide ice sheet and ocean loading on the continental shelf, resulting in a sea-
level rise of approximately 1.0 m per millennium over the late Holocene in the outer Bay
of Fundy (Grant 1970; Shaw et al. 2002; Gehrels et al. 2004). These natural processes
alone would increase tidal high water in the Gulf of Maine-Bay of Fundy system in the order of 0.3 m by 2100 (Greenberg et al. 2012:274).

These natural trends have been amplified by anthropogenic greenhouse gas inputs since the onset of the industrial era. Sea-level rise across the twentieth century averaged 1.7 mm/year globally, whereas an average rise of 3.3 mm/year occurred from 1993 to 2016 (Pickering et al. 2017:50), suggesting that the rate is accelerating. These results are largely mirrored by the record from the northwest Atlantic (Gehrels et al. 2005). The Intergovernmental Panel on Climate Change estimates a global mean sea level rise of 0.44–0.74 m by 2100, depending on atmospheric carbon dioxide concentrations (Wong et al. 2014:369). With climate change taken under consideration, sea-levels in the Bay of Fundy may rise by as much as 1.0 m by 2100 (Greenberg et al. 2012:274). However, the upper limit of global sea-level rise may be as high as 1.8 m by 2100 (Jevrejeva et al. 2014), underscoring the degree of uncertainty inherent in modelling and the urgency of the crisis. The Atlantic Provinces in general are highly sensitive to the potential impacts of increased high-water levels, particularly to the possibility of storm surges (Shaw et al. 1998).

In the past, storm surges have wreaked havoc on the coast of the Maritime Peninsula, most notably during the Saxby Gale of 1869, which caused tides at least 1.5 m higher than normal, and the Groundhog Day storm of 1976, with a comparable surge (Desplanque and Mossman 1999). Both extreme weather events are known to have had deleterious effects on the archaeological record. A horizontal loss of 1.0–2.0 m from several sites throughout Passamaquoddy Bay over the 1970s was largely attributed to the
Groundhog Day storm (Davis and Christianson 1979:4). Many of the archaeological sites recorded by Baird (1881) from the Grand Manan Archipelago may have been impacted by the Saxby Gale (Blair 1999:31). Significant uncertainty remains in modelling the impacts of climate change on storm events; however, projections suggest that, while the number of tropical cyclones in the Atlantic may decrease over the next century, the intensity of the storms and associated rainfall will increase, with the storms increasingly maintaining intensity while trending poleward (Bender et al. 2010; Knutson et al. 2013; Kossin et al. 2014). These projections suggest that storms comparable to the Saxby Gale and Groundhog Day Storm, and their accompanying surges, may occur with greater regularity than the centennial-level scale observed until now. Taken together, the threat of erosion brought about by rising sea levels and increased storm action means that much of the precontact archaeological record of the QR has a projected lifespan of less than a century.

The threat of shoreline erosion to archaeological sites has long been recognized in the Maritime Provinces (Smith and Wintemberg 1929) and was the topic of considerable discussion during the late 1970s and 1980s (Simonsen 1978, 1979; Davis 1980, 1982; Davis and Christianson 1979). These efforts were headed by the Council of Maritime Premiers’ Maritime Committee on Archaeological Cooperation, an interprovincial body with representatives from government, academia, and museums. Significant efforts were made at that time to expand the regional site inventory through shoreline surveys, document natural and anthropogenic impacts on archaeological sites, and develop measures to mitigate these impacts, culminating in projects such as the Ministers Island seawall (Ferguson and Turnbull 1980). Throughout the 1980s, the New
Brunswick provincial archaeological authority, ASNB, also fostered ongoing site survey and excavation in the IQR (Black 1992; Black and Turnbull 1986).

Beginning in the 1980s and intensifying in the 1990s, the role of government has shifted away from problem-oriented archaeology and coastal salvage toward managing the burgeoning Cultural Resource Management (CRM) industry. This is attributable, in part, to environmental legislation which has mandated CRM archaeology and several large-scale archaeological projects stemming from highway and linear corridor developments in the interior of New Brunswick, particularly the Lower St. John River valley (Blair 2004:22–24). The shift from a relatively equal quantities of academic to CRM field research permits to an overwhelming predominance of CRM permits in the mid-1990s—concomitant with a decrease in the number of zooarchaeological publications throughout the Maritimes—is indicative of this trend (Webb et al. 2017). In recent years, ASNB has taken a more active role in the CRM industry, both in its traditional role as regulator and outright consultant, including large-scale mitigation of archaeological sites identified by private firms, heritage resource impact assessments for the Department of Transportation and Infrastructure, and development of mechanical testing methodologies (Colwell-Pasch 2017; Hamilton 2017; Suttie and Jarratt 2017), with a particular emphasis on identifying Archaic and Paleo-American contexts (Suttie et al. 2017). During this time, fieldwork by regional universities has shifted from large-scale research projects toward smaller-scale, targeted excavations of individual sites (Blair 1999; Gilbert 2011; Blair et al. 2017; Hrynick et al. 2017). Simultaneously, Parks Canada underwent significant funding cuts in 2012 under Bill C-38, severely limiting this important institution’s capacity to contribute to archaeology in the region. While
none of these developments are wholly detrimental in and of themselves, they do signal a tack away from coastal research and salvage at a precarious juncture.

The archaeological record of the QR represents an invaluable and irreplaceable archive of paleoclimate, marine resource exploitation, and Peskotomuhkati heritage. It is lamentable that, at a time when Indigenous rights and cultural rapprochement are at the forefront of public discourse, an environmental crisis generated largely by industrialized colonial powers is poised to eradicate much of the material legacy of the colonized. Rather than allowing this process to proceed unabated and, in a sense, continue to perpetuate historical injustices, I assert that public institutions, including governmental agencies, publicly-funded universities, and crown corporations, have a moral responsibility to preserve archaeological heritage as part of the nation-state’s fiduciary responsibility toward Indigenous peoples (see Ferris 2003:168–172). This responsibility requires implementing a broad programme of wholesale coastal salvage, which will necessarily entail triaging sites according to their vulnerability to erosion. Admittedly, the scale of the proposed programme is vast and, given the logistical constraints of resources, personnel, and time, may require a strategy of bulk sampling for later laboratory analysis in conjunction with traditional excavation techniques. Such a strategy will require the synergistic cooperation between the Peskotomuhkati Nation and regional research institutions to rescue, preserve, and illuminate precontact lifeways in Peskotomuhkatihkuk.
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142
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