

AN EXAMINATION OF THE PRE-DORSET CARIBOU HUNTERS FROM THE  
DEEP INTERIOR OF SOUTHERN BAFFIN ISLAND, NUNAVUT, CANADA

by

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## Abstract

The faunal remains from four archaeological sites on the northwest shore of Mingo Lake, in the interior of Southern Baffin Island, are examined in this thesis. All four sites have been radiocarbon dated to the Pre-Dorset time period (4500 – 2700 BP) and diagnostic artifacts also indicate a Pre-Dorset occupation. The faunal assemblage is dominated by caribou remains. As such, this study is the first, large-scale faunal analysis of an interior Pre-Dorset site with a reliance on caribou as a main subsistence resource. Presently, archaeologists know more about the marine component of the Pre-Dorset seasonal round since research has historically focused on sites in coastal locations. As such, the data presented will supply much needed information on the terrestrial component of the Pre-Dorset seasonal round.

In total 18,710 faunal bones were examined. Elemental frequencies, species representation, fracture patterns, bone burning, and butchering patterns will provide important insights into the lifeway of the Pre-Dorset. In particular, information will be presented on the subsistence strategies, site function, and length of occupation.

The results of the thesis indicate that the Pre-Dorset were utilizing the Mingo Lake area during the late summer into early fall. Based on the quantity of identifiable caribou specimen, the main activity at all four sites was caribou hunting while an analysis of fracture patterns indicates that marrow extraction was especially important. The sites served dual purposes as habitation and butchering sites and were occupied for varying lengths of time.

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## Chapter 1 – Introduction

### **Introduction**

Early Palaeo-Eskimo lifeways are typically envisioned in terms of the “dual-economy” model where small groups of people moved long-distances between inland and coastal areas in order to exploit seasonally optimal resources in each respective locale (Bielawski 1982: 37, 1988: 56; McCartney and Helmer 1989: 144; Milne 2003: 60; Milne et al. 2012: 270, In Press). However, archaeological research in the Arctic has historically focused on coastal sites; this creates a bias in the data available to accurately reconstruct mobility and subsistence strategies for these earliest populations (Bielawski 1988: 58; Milne 2003: 60; Milne and Donnelly 2004: 90). Further compounding this problem is the fact that very little terrestrial fauna from early Palaeo-Eskimo sites actually exist (see Meyer 1977; Murray 1996), due in part to poor organic preservation in many Arctic regions (Milne 2003: 2; Milne and Donnelly 2004: 90). As a result, little is known about the terrestrial component of the early Palaeo-Eskimo adaptation (McCartney and Helmer 1989: 145; Milne et al. 2012: 271) despite the fact that most interpretations are structured by assumptions grounded in the dual-economy model (Bielawski 1988: 58; McCartney and Helmer 1989: 152).

My research will make a significant contribution to this topic since it involves a zooarchaeological analysis of exceptionally well preserved faunal remains recovered from four early Palaeo-Eskimo (Pre-Dorset) sites located in the deep interior of southern Baffin Island. These sites are situated along the northwest shore of Mingo Lake and have been investigated by Milne (2004, 2007), Park (2008), and Stenton (1991). My primary objectives are to determine the function of each site and to assess the subsistence

strategies that were used by Pre-Dorset hunters. I will meet these objectives by identifying the species hunted at each site, their relative abundance, the methods used in butchering, and the season they were hunted. The results will be essential for understanding how early Palaeo-Eskimo peoples, in this region of the Arctic, were using the terrestrial ecosystem. It will also add to what is presently known from the only other identified Pre-Dorset inland site in the area – Mosquito Ridge (MaDv-11) – with preserved faunal remains (as described in Milne 2003 and Milne and Donnelly 2004).

### **The Pre-Dorset**

The Palaeo-Eskimos are the original inhabitants of the eastern Arctic. It is thought that sometime around 4500 years ago, small groups of Palaeo-Eskimo peoples migrated from Alaska eastward during the terminal phase of the Holocene Thermal Maximum when the climate in the Arctic was warmer than it is today. The Palaeo-Eskimo people were highly mobile and it is hypothesized they had a flexible social structure that facilitated their rapid migration eastward into the Canadian Arctic and Greenland (Hodgetts 2007: 353). Full colonization may have occurred within 500 years or less (Maxwell 1985: 49). Once these populations settled, they developed variations in their material culture that reflected differences in local micro-environmental conditions and species diversity. Archaeologists have used this variation to identify several regional variants of the early Palaeo-Eskimo culture. On southern Baffin Island these earliest peoples are known, archaeologically, as the Pre-Dorset and their descendants are referred to as the Dorset, or late Palaeo-Eskimo (Maxwell 1985: 80; Milne and Park, In Press).

The remains of Pre-Dorset sites are found in the Eastern Arctic, Western Arctic, High Arctic, Labrador, and Northern Manitoba and date from 4500 – 2700 BP (Milne and Park, In Press). The Saqqaq (Greenland) and Independence I (Greenland and the High Arctic) are other cultures that existed during the same time as the Pre-Dorset. Because comparatively little information exists on the terrestrial component of Pre-Dorset adaptation (Milne and Park, In Press), I have included in this study information on the Saqqaq and Independence I subsistence strategies for regional comparative purposes.

Archaeologists have traditionally interpreted Pre-Dorset culture from their lithic remains (Milne 2003: 58). The spalled burin and burin spalls (detached from the burin working edge to extend the tool's use-life) are considered diagnostic of Pre-Dorset occupations (Maxwell 1985: 91). The Pre-Dorset hunted land mammals with the lance and the bow and arrow (Maxwell 1984: 361). The hunting implements are identified by the presence of concave or square-based triangular endblades, straight stemmed endblades, straight stemmed bifaces, and bipointed side blades (Helmer 1991: 209; Maxwell 1985: 68; Milne and Park, In Press).

The Pre-Dorset were seasonally mobile moving between interior and coastal areas to exploit seasonally specific resources in each respective locale (Bielawski 1988: 56-57). The remains of sites in both interior and coastal locations indicate they travelled long distances but based on site density at some locations, the Pre-Dorset remained fairly sedentary once they reached their camp (Milne 2003: 60, Milne and Park, In Press). The Pre-Dorset lived in elliptical shaped skin tents in the summer months (represented by stone circles in the archaeological record) and snow houses or tents banked with snow (manifested by the absence of stone circles but the presence of Pre-Dorset habitation

features) in the winter months (Helmer 1991: 305; Maxwell 1985: 97; Milne 2003: 58-59; Milne and Park, In Press; Ramsden and Murray 1995: 106). The Pre-Dorset lived in small, flexible, egalitarian bands (three to five families or 15 to 20 people) that were widely dispersed throughout the low Arctic (Hodgetts 2007: 354, Milne 2003: 58; Milne and Park, In Press) and in a few rare instances, High Arctic locales as well (e.g. McGhee 1976, 1978; Schledermann 1990; Sutherland 1996).

Marine and terrestrial mammals were exploited in order to fill subsistence and resource requirements (Milne and Park, In Press) as were migratory birds and fish. Seals (*Phocidae* sp.) were an extremely important resource for the Pre-Dorset but they also hunted caribou (*Rangifer tarandus*) effectively (Helmer 1991; LeBlanc 1994; Maxwell 1985; McCartney and Helmer 1989; Milne and Donnelly 2004; Milne and Park, In Press; Ramsden and Murray 1995).

### **Skeletal Structure**

It is important to have a cursory knowledge of skeletal structure before undertaking a zooarchaeological analysis. As such, I now describe the important components of both bone and teeth so as to facilitate an understanding of the classification categories presented in chapter five. I begin by describing the skeletal structure of mammals, fish, and birds; thereafter, I consider the processes involved in tooth formation, and the differences between the different types of teeth found in the archaeological record.

## Bone Structure

Bone is a fundamental part of the skeleton since it provides a structure for muscles and ligaments to attach themselves and bone also provides protection for the brain, a vital organ in all animals (Reitz and Wing 2008: 60). Cartilage is another important skeletal component because it aids in locomotion by acting as a bridge between connective tissues while also protecting the ends of bone from the stress loads associated with walking, jumping, and climbing; however, because it is so rarely found preserved in the archaeological record, and is entirely absent from the faunal assemblages included in this study, it is not discussed further (Reitz and Wing 2008: 55). There are two types of bone found in most mammalian elements. The first is cortical or compact bone, which is the thick, dense bone located on the outer shafts of the long bones (humerii, femora) surrounding the medullary cavity. The medullary cavity is where bone marrow is produced and stored. Cortical bone is also found on the outer surfaces of the flat bones (ribs, scapulae). The second type of bone is known as cancellous or trabecular bone. This type of bone is spongy and porous; it is located at the epiphyses of long bones as well as in the interior of flat bones (Lyman 1994b: 76; O'Connor 2000: 6; Reitz and Wing 2008: 55-56).

Birds have a similar bone structure to mammals (O'Connor 2000: 7). Bird bones contain cortical and trabecular bone but the medullary cavity is filled with calcium instead of marrow. The calcium reserves are used to produce egg shells (Lyman 1994b: 77). Bird bones are light (the cortical bone is thinner than the diameter of the bone) and hollow (Lyman 1994b: 77); this allows them to fly.

There are three main sections to all long bones in mammals and birds; they are the epiphyses, shaft, and medullary cavity. The epiphyses are located at either end of the bone and contain trabecular bone; the epiphyses can be used to age an assemblage if comparative data are available. The shaft is made of cortical bone and is located between the epiphyses. The final section of bone is the medullary cavity and it contains the bone marrow. In order to access bone marrow, one must drill through or fracture the shaft of the bone. Among archaeologically recovered bones, the medullary cavity is often hollow because the bone marrow would have been extracted prior to discard or it would have decomposed when the associated bone broke.

Fish possess one of two types of skeletons. The first is a cartilaginous skeleton which, like it sounds, is a skeleton made only of cartilage with some mineralization occurring on stress-bearing elements like the mandible. Examples of cartilaginous fish are sharks, rays, and skates (O'Connor 2000: 7). The second type of fish skeleton is a bony skeleton; this type of skeleton is much more common. The zooarchaeological assemblage examined in this study contains the remains of bony fish, namely Arctic char.

### Tooth Structure

Mammalian teeth comprise two elements: a crown and a root. The crown is located above the gum line while the root (found below to gum line) anchors the tooth into either the mandible (lower jaw) or maxilla (upper jaw). The crown is covered in a layer of enamel, which gives the teeth a glossy, hard coating, while the root is covered in cementum, which acts like cement and keeps the tooth in place (Hillson 1992: 11; Lyman 1994b: 79-80). The interior of both the crown and the root is filled with dentine. Dentine

is softer than both cementum and enamel, and becomes exposed teeth wear over time (Hillson 1992: 11; O'Connor 2000: 12).

The crown of a tooth contains cusps, fissures, and ridges. Cusps are the high points of the teeth while fissures (pits) and ridges connect the cusps (Hillson 1992: 11). Mammals are classified based on their crown structure making teeth one of the most easily identifiable elements in an archaeological assemblage. Canine teeth have high cusps and sharp ridges; these form the dagger-like teeth present in all carnivores (Hillson 1992: 11). Crown structure among caribou is notably different than that observed for canines in that caribou have very high cusps that are connected by deep fissures known as infundibulum. The crowns of caribou teeth have pronounced infolding of enamel down the lingual and vestibular sides (Hillson 1992: 11).

There are two types of teeth found in the archaeological record: deciduous and permanent. Deciduous teeth are also known as milk teeth or baby teeth. They fall out of the mandible and maxilla as mammals mature. There are fewer deciduous teeth than permanent teeth since the jaws of baby animals are smaller than adult animals. Deciduous teeth are also smaller than permanent teeth and have roots that are less defined (Hillson 1992: 11; O'Connor 2000:13).

Four kinds of teeth can be identified in the archaeological record. They are incisors (i), canines (c), premolars (p), and molars (m). Each mammal has its own dental formula; the dental formula is different for the deciduous and permanent teeth. The maxillary teeth dental formula is displayed as the top number while the mandibular teeth formula is displayed as the bottom number of the set. Caribou have a deciduous dental formula of  $d_{i0/3} d_{c0/1} d_{p3/3}$  and a permanent dental formula of  $i_{0/3} c_{0/1} p_{3/3} m_{3/3}$ .

Since canine teeth are also found in the zooarchaeological assemblages included in this study, their dental formula is also presented. The deciduous canine dental formula is  $di3/3$   $dc 1/1$   $dp3/3$  while the permanent formula is  $i3/3$   $c1/1$   $p4/4$   $m2/3$  (Hillson 1992: 12-13). Using dental formulae allows archaeologists to determine how many of each animal are at a site.

### **Organizational Framework**

Chapter Two presents a regional description of the large lakes area in the interior of southern Baffin Island as well as descriptions for each site included in the study. Specifically, the subsistence resources found near Nettilling, Amadjuak, and Mingo Lakes is discussed in detail because this information is used to link the ethnographic record of the area with the associated archaeological record. Chapter Three further discusses subsistence resources available in the interior by examining the relevant zooarchaeological studies in the Arctic. Special attention is given to all Pre-Dorset sites with caribou remains, including those sites previously identified in the interior of Baffin Island. Chapter Four presents a discussion of ethnographic analogy and traditional knowledge. Both ethnographic analogy and traditional knowledge – also known as oral traditions – allow me to make informed interpretations of the archaeological record. I also discuss the different theoretical perspectives needed to link information derived from the ethnographic record in order to understand identified patterns among the archaeological sites included in this study. Chapter Four concludes with the presentation of my hypotheses and related test expectations.



Chapter Five discusses the methods used to analyse the zooarchaeological assemblages from Mingo Lake. These include quantitative strategies as well as the strategies used to age and sex the assemblages. A brief description of fracture patterns and butchering patterns is also discussed. Chapter Six presents the results and the interpretations of the faunal analysis. Each site is discussed individually and then a summary of the overall patterns visible at the four Mingo Lake Sites is given. Next, I present my interpretations, which are grounded in the information discussed in chapters three and four. Chapter Seven begins with an evaluation of my hypotheses and related test expectations. I then discuss other ways the Pre-Dorset appear to have used the interior of Southern Baffin Island. Chapter Seven concludes with a critical examination of the methods used in this study including some of the shortcomings that were experienced. Chapter Eight concludes this study, and presents my final remarks on its findings including the implications they have for future studies focusing on Pre-Dorset subsistence strategies from terrestrial locations.

## Chapter 2 – Site Information

### Introduction

The four sites (LdFa-1, LdFa-12, LdFa-13, and LdFa-14) included in this study are located along the northwest shore of Mingo Lake. Mingo Lake is the smallest of three lakes that together make up the Large Lake Region that characterizes the interior of southern Baffin Island (Figure 2.1). All three lakes have been an integral part of the terrestrial ecosystem in this region and were used by every cultural group (i.e. Pre-Dorset, Dorset, Thule, and Inuit).



Figure 2.1. Regional Map of Southern Baffin Island (Google 2013a).

## **Regional Description**

The Large Lake Region in the interior of Baffin Island comprises three lakes and the tributaries that flow between them. Nettilling Lake is the largest, and most northern, of the three lakes and drains into the Foxe Basin via the Koukdjuak River. Amadjuak Lake connects to Nettilling Lake via the Amadjuak River while Mingo Lake drains into the southwest shore of Amadjuak Lake via the Mingo River (Milne 2003: 15).

Amadjuak Lake and Nettilling Lake provide an important moderating influence for the interior region and generate temperatures that are, on average, two degrees Celsius higher than neighbouring coastal areas (Jacobs and Grondin 1988: 218; Milne 2003: 19). The lakes act like a heat reservoir which supports flora typically found in the low Arctic (e.g. *Betula glandulos*) (Jacobs and Grondin 1988: 212; Stenton 1989: 91). This microclimatic variation creates an ideal environment for both animals and humans as this region is warmer and drier than the other regions of Baffin Island (Milne and Donnelly 2004: 93; Milne and Park, In Press).

### Nettilling Lake

Nettilling Lake is located between 65° 56' N and 67° 02' N and is elevated 30 metres above sea level (a.s.l) (Milne 2003: 15; Stenton 1989: 88). It is the largest lake in the Canadian Arctic Archipelago but is relatively shallow with an average depth of 20 metres (Jacobs and Grondin 1988: 215; Stenton 1989: 88). The Great Plain of Koukdjuak forms the western margin of Nettilling Lake; the local geology is dominated by undivided carbonate and siliciclastic rock including chert (de Kemp et al 2006; Milne et al 2011:

122). The eastern margin of Nettilling Lake is formed by the Precambrian Highlands. Raised beaches, low hills, eskers, and moraines are the main topographic features surrounding Nettilling Lake (Stenton 1989: 90).

### Amadjuak Lake

Amadjuak Lake is an important location for chert procurement. The chert-bearing formations that characterize the Great Plain of Koukdjuak extend towards the western margins of Amadjuak Lake (de Kemp et al 2006; Milne et al 2011: 122). As such, the Inuit know Amadjuak Lake as the place where chert comes from (Milne 2005: 6, 2008: 7; Milne et al 2011: 122). Amadjuak Lake is elevated 90 metres a.s.l. (Milne 2003: 15; Soper 1928: 2). The land surrounding the lake is relatively low and consists of gently rolling hills (Soper 1928: 24). Boas (1974: 416) commented that the Inuit would carry their kayaks from Hudson Strait, over land, to Amadjuak Lake because the land was quite low in the area.

### Mingo Lake

Mingo Lake has an elevation of 90 metres a.s.l. (Milne 2003: 15; Soper 1928: 2). The southwest shore of Mingo Lake is characterized by steep hills while the north shore is the location of the Mingo Lake Esker. The terrain becomes a glacial plain as you advance towards Amadjuak Lake from the Mingo Lake Esker (Milne 2005:6, 2008:7). The landscape of Mingo Lake is highlighted in Figure 2.2.

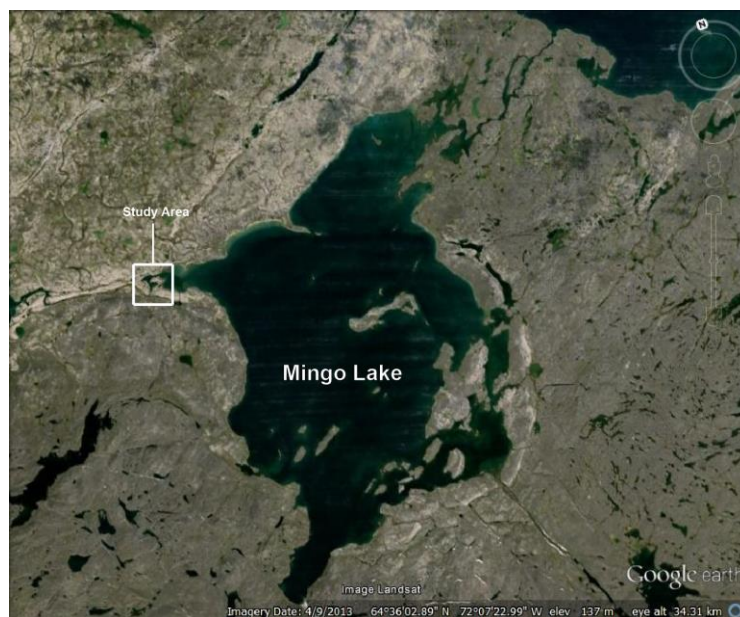


Figure 2.2. Map of Mingo Lake with study area highlighted (Google 2013b).

### Resources

The Pre-Dorset, Dorset, Thule, and Inuit repeatedly returned to the interior lake system to access resources not available on the coast. The Large Lake Region supports a wide range of subsistence resources that are relatively rich and stable. The seasonally available resources are more predictable in this region than other regions in the Arctic (Milne and Donnelly 2004: 93). Lithic raw materials, namely chert, are also widely available throughout the area and would have been an essential resource for the Pre-Dorset to acquire while they were inland since good lithic sources are not available on the coasts of southern Baffin Island (Milne 2003: 26, 2005: 25; Milne et al. 2011: 122).

There is a wide range of edible vegetation found around the Large Lake Region. Sorrel leaves (*Oxyria digynia*) and knotweed root (*Polygonum viviparum*) as well as bilberry (*Vaccinium uliginosum*), cranberry (*Vaccinium vitis-idaea*), bearberry (*Arctostaphylos aplina*), and crowberry (*Empetrum nigrum*) are all edible plants available

in the area. Willow (*Salix*), birch (*Betula*) and Arctic heather (*Cassiope tetragona*) are the fuel sources easily accessible in the interior (Stenton 1989: 94).

The main subsistence resource exploited in the interior is caribou. Other subsistence resources available in the region include fish such as Arctic Char (*Salvelinus alpinus*), three-spine stickleback (*Gasterosteus aculeatus*), ninespine stickleback (*Pungitius pungitius*), and northern Pollack (*Theragra chalcogram*), as well as nesting waterfowl, such as snow geese (*Chen caerulescens*), eider (*Somateria*), loons (*Gavia*), terns (*Sterna paradisaea*), and Ptarmigan (*Lagopus*). Arctic fox (*Alopex lagopus*) and wolf (*Canis lupus*) are also found in the area (Milne 2003: 22-23; 2005: 6; 2008: 8; Milne and Donnelly 2004: 94; Stenton 1989: 93-94).

### *Caribou*

Caribou are an essential food resource but they also provide other essential raw materials such as hides for waterproof tent skins and clothing, and bone and antler for tools (Stenton 1991a: 18, 1991b: 4). Caribou can be found in large numbers throughout the interior as Baffin Island supports several resident, non-migratory herds (Milne and Donnelly 2004: 94; Milne et al 2012: 274; Stenton 1989: 95). These animals are readily found around Nettilling Lake, Amadjuak Lake, and Mingo Lake in large numbers throughout the Arctic winter, spring, and summer (Stenton 1989: 96; Milne 2003: 24). The areas surrounding the lakes have milder, wetter winters than the other areas of Baffin Island; this makes the area more attractive to the caribou due to the easy foraging conditions (Jacobs 1989: 55). When caribou populations are stressed they tend to contract to the interior of southern Baffin Island (Stenton 1989: 84, 1991a: 36). In times of climate

fluctuations, the Large Lake Region would have provided a stable food resource for the Pre-Dorset peoples (Milne 2008: 12).

Caribou seasonally migrate around southern Baffin Island moving from calving grounds (occupied in the spring and summer) to winter grazing areas (migration begins in the fall) (Burch 1972: 345). The fall migrations from the calving grounds in the interior to the grazing areas along the coast of Baffin Island are erratic and difficult to track (Soper 1928: 96). Fortunately, the ethnographic record has recorded the general migration route. The South Baffin herd are exploited in the Large Lake Region and they congregate in four main areas throughout the year. The herd can be found along the north shore of Nettilling Lake as well as coastal areas such as the Foxe Peninsula, Hall Peninsula and the Meta Incognita Peninsula in the winter. (Boas 1974: 434; Jacobs and Stenton 1985: 62; Milne and Donnelly 2004: 94; Soper 1928: 96; Stenton 1989: 96). They also occupy the northeast region of Amadjuak Lake and the north shore region of Nettilling Lake in the spring and summer and the Chorback Inlet district (Hudson Strait) in the summer (Stenton 1989: 96). Small groups of the herd will remain along the southern coast of Baffin Island year round (Jacobs and Stenton 1985: 62; Milne and Donnelly 2004: 94).

### *Snow Goose*

Snow geese are found throughout the Plain of Koukdjuak from May to September. They breed in the area and are an important subsistence and raw material resource. Snow geese are hunted when their fat stores are high; this allows for an injection of fat into the protein heavy diet of the Palaeo- and Neo-Eskimo. Snow geese also provide eggs that would be a welcome dietary change and they provide feathers for

clothing and blankets (Boas 1974: 554; Milne and Donnelly 2004: 102; Soper 1928: 91). Snow geese were easily hunted by being forced into stone enclosures or driven out of the wetlands onto beaches and eskers during their annual moult (Milne and Donnelly 2004: 97; Soper 1928: 91; Stenton 1989: 95). Snow geese were an abundant resource and proved to be quite reliable and predictable (Milne and Donnelly 2004: 107-108; Milne et al 2012: 275).

### *Arctic Char*

Arctic char are the fish species that makes the most significant contribution to human subsistence in the Large Lakes region and they are generally found in shallower lakes (Milne and Donnelly 2004: 94; Milne et al 2012: 275). Since Nettilling Lake is quite shallow it supports a large stock of Arctic char (Soper 1928: 116; Stenton 1989: 93). They can be easily caught in large numbers during their seasonal migrations. Weirs have been found in the study area indicating that these fish were harvested by local human populations (Milne et al 2012: 275).

### **Site Description**

The four sites included in this study are LdFa-1, LdFa-12, LdFa-13, and LdFa-14 (see Table 2.1 for dates and Figure 2.3 for site locations). LdFa-1 is a large multi-component site; however, only fauna from a spatially discrete Pre-Dorset occupation consisting two adjacent tent rings are considered here. The three other sites (LdFa-12, LdFa-13, and LdFa-14) are all single component Pre-Dorset occupations. Milne tested these sites in 2004 and 2007, and each one produced well-preserved faunal remains,



diagnostic lithic artifacts (i.e. burins, burin spalls), and radiocarbon dates derived from caribou bone collagen.

Table 2.1. Radiocarbon Dates from LdFa-1, LdFa-12, LdFa-13, and LdFa-14.

Site	Laboratory ID	Measured $^{14}\text{C}$ Age B.P.	$\delta^{13}\text{C}$ (‰)	Conventional Age B.P.	Calibrated Date ( $2\sigma$ range)
LdFa-1	Beta-246443	3430 $\pm$ 40	-17.3	3560 $\pm$ 40	B.C. 2020 to 1860 and B.C. 1850 to 1770
LdFa-1	Beta-246444	3190 $\pm$ 40	-18.0	3300 $\pm$ 40	B.C. 1680 to 1500
LdFa-1	Beta-246445	3520 $\pm$ 40	-17.4	3640 $\pm$ 40	B.C. 2130 to 1900
LdFa-1	Beta-246446	3270 $\pm$ 40	-18.6	3370 $\pm$ 40	B.C. 1750 to 1590 and B.C. 1590 to 1530
LdFa-1	Beta-246447	3090 $\pm$ 40	-18.2	3200 $\pm$ 40	B.C. 1530 to 1410
LdFa-1	Beta-246448	1100 $\pm$ 40	-17.4	1220 $\pm$ 40	A.D. 780 to 1000
LdFa-1	Beta-246452	3150 $\pm$ 40	-17.3	3280 $\pm$ 40	B.C. 1650 to 1460
LdFa-12	Beta-246454	3270 $\pm$ 40	-16.5	3410 $\pm$ 40	B.C. 1870 to 1850
LdFa-13	Beta-246455	3190 $\pm$ 40	-17.8	3310 $\pm$ 40	B.C. 1690 to 1500
LdFa-14	Beta-246456	3420 $\pm$ 40	-17.8	3540 $\pm$ 40	B.C. 1970 to 1750

The Pre-Dorset occupied the Eastern Arctic from approximately 4200 BP until 2500 BP (Maxwell 1985: 78-79). On southern Baffin Island the earliest dates for the Pre-Dorset are 4690  $\pm$  380 BP from the Closure site (KkDq-11) located on southeastern Baffin Island. This date derives from marine mammal fat making it susceptible to

criticism even though it has been normalized to prevent any influence from the marine reservoir effect (Milne and Donnelly 2004: 96; Milne and Park, In Press). A more reliable date comes from the Mosquito Ridge site (MaDv-11) that is located near Nettilling Lake. A caribou bone taken from this site has been dated to between 4290 and 4080 BP (Milne and Donnelly 2004: 96; Milne and Park, In Press).

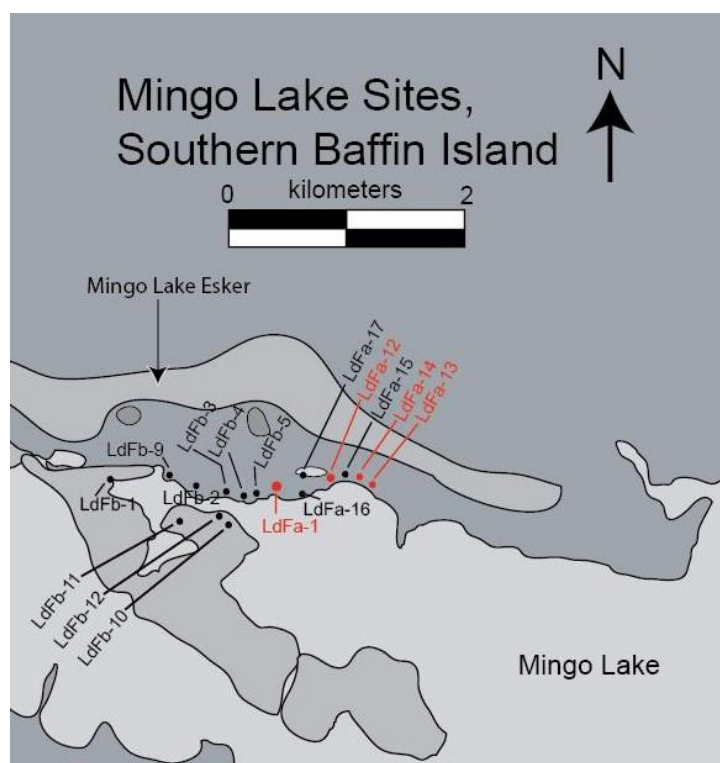


Figure 2.3. Map of the Mingo Lake sites in Southern Baffin Island. Modified map supplied by Milne.

The northwest shore of Mingo Lake is dotted with archaeological sites. Milne (2008) visited seventeen sites during the 2007 field season. These seventeen sites are located on both shores of a narrow section of Mingo Lake. This area is a perfect place for a caribou crossing; in fact caribou were seen crossing at this location in 2007 (Milne

2008: 7). Hunting blinds, tent rings, caribou drives, and caches are a few of the identified site types (Milne 2008; Stenton 1991c: 8).

### LdFa-1

LdFa-1 is a large multi-component site that was first identified by Stenton (1991c). Area 4 contains the Pre-Dorset component (3560 - 3200 +/- 40 BP). One Late Dorset date (see Table 2.1) was obtained from caribou bone collagen recovered from Area 4. Because LdFa-1 is a multi-component that includes a substantial Late Dorset component (Milne et al. 2012), this single date from the Pre-Dorset component is not entirely surprising since the Dorset would have moved throughout the entire site area during their occupation of Area 1 and Area 2. All of the artifacts recovered from Area 4 are attributable to the Pre-Dorset culture; there are no Late Dorset artifacts in this area indicating that only the Pre-Dorset occupied Area 4 for any length of time.

Area 4 includes two discrete features, which were excavated by Milne in 2007 (Milne 2008) and Park in 2008 (Park 2009). Feature 4 is a small, tightly packed stone circle that has no discernible entrance. It is unclear if the circle represents a tent ring or a cache. Feature 5 has been identified as a tent ring and has a discernible entrance located along its south edge (Milne 2008: 11). A total of 39.5 m<sup>2</sup> were excavated in Area 4 (Milne 2008; Park 2009).

### LdFa-12

LdFa-12 is located one kilometer east of LdFa-1 and is situated on top of a raised terrace that overlooks the shoreline. The Mingo Lake Esker and a dry pond are located

behind LdFa-12. Ground cover at the site is variable and includes dense to moderate grasses, willows, and mosses. LdFa-12 was excavated in 2004 and 2007 with a total of thirteen units excavated (Figure 2.4). LdFa-12 is dated to 3410 +/- 40 BP and yielded artifacts that are diagnostic for Pre-Dorset most notable of which include spalled burins, burin (Milne 2008: 18).

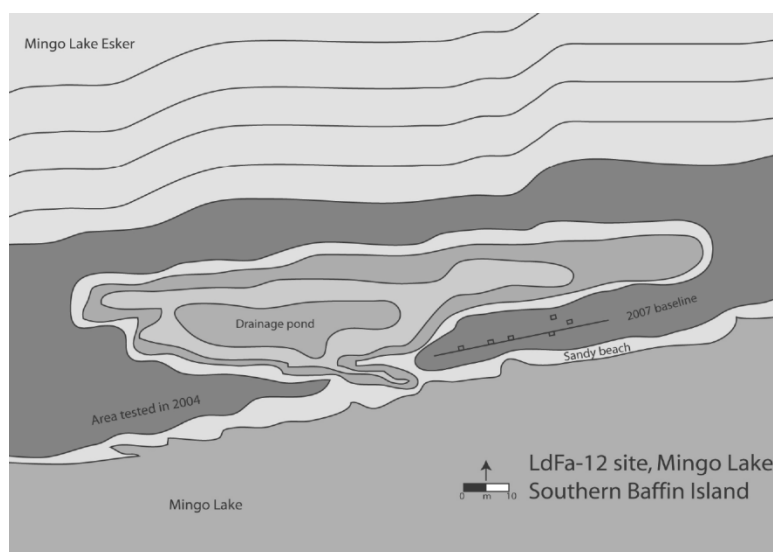


Figure 2.4. Map of LdFa-12. Modified map supplied by Milne.

### LdFa-13

LdFa-13 is located 150 metres east of LdFa-14. This site is situated on a raised beach terrace with the Mingo Lake Esker directly behind the site. The surface vegetation at LdFa-13 is extensive and obscures what appears to be a possible tent ring feature. LdFa-13 was tested in 2007 (Figure 2.5) with a total of four units excavated. Diagnostic tools such as burins and microblades as well as a radiocarbon date of 3310 +/- 40 BP indicate LdFa-13 is a Pre-Dorset occupation (Milne 2008: 19-21).

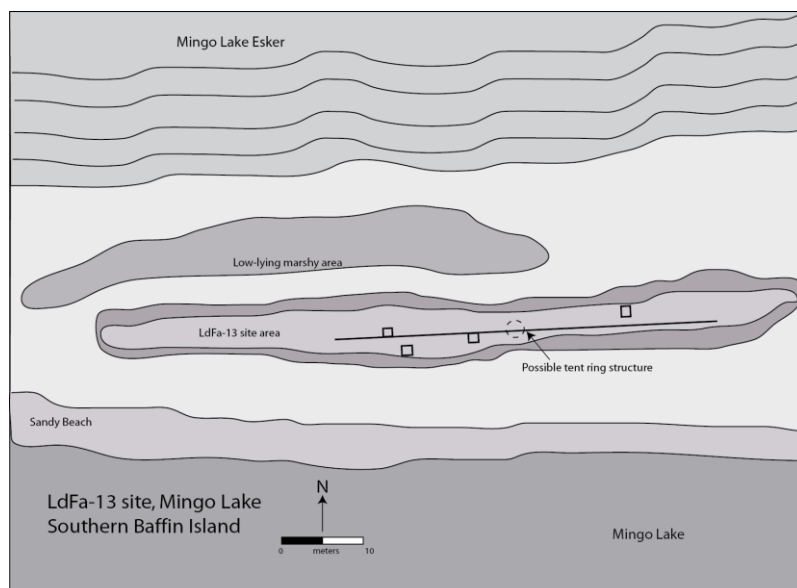


Figure 2.5. Map of LdFa-13. Modified map supplied by Milne.

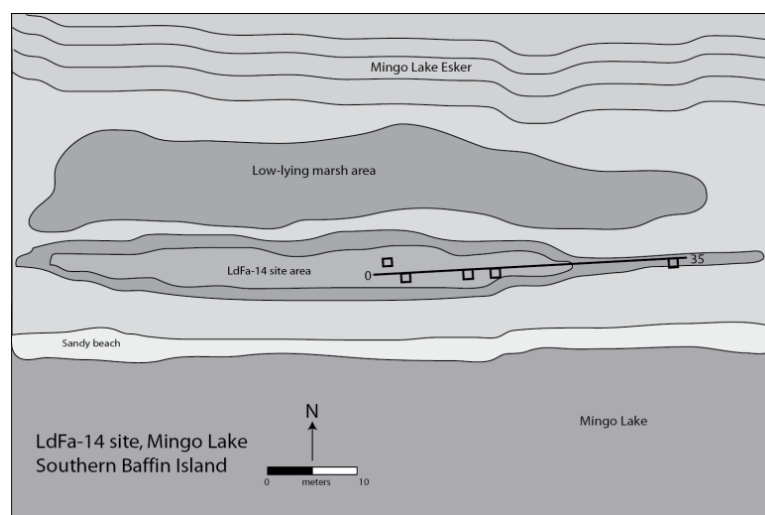


Figure 2.6. Map of LdFa-14. Modified map supplied by Milne.

### LdFa-14

The final site, LdFa-14 is located about 150 metres east of LdFa-12 and sits on the same beach terrace as LdFa-13 with the Mingo Lake Esker behind it (Figure 2.6). The site is heavily vegetated and appears entirely undisturbed. A total of six units were

excavated in 2007 all of which yielded diagnostic Pre-Dorset artifacts (i.e. burins and burin preforms). This site has one radiocarbon date of 3540 +/- 40 BP (Milne 2008: 21).

### Other Relevant Sites

There are a number of other archaeological sites located along the shores of Amadjuak Lake and Nettilling Lake. The sites that date to the Pre-Dorset period and that have associated faunal material are described. The first important site in the area is LeDx-42., which is located on the south shore of the Mingo River, two kilometres from where it drains into southwest Amadjuak Lake (Milne et al 2011: 123). LeDx-42 was excavated in 2004 and is traversed by several well-worn caribou paths. Caribou were frequently sighted in 2004 near the site as they crossed the Mingo River (Milne et al 2011: 123). LeDx-42 is a large and very productive site dating to Pre-Dorset and Dorset times. There are indications that intensive tool production and caribou hunting occurred in the area. The faunal remains at the site are well preserved and bone tools such as delicate needles were also found (Milne et al 2011: 123). Unfortunately, the faunal material from the site was not analyzed so these remains cannot be used for comparison to the four Mingo Lake sites included in this study. Mosquito Ridge (MaDv-11) is the second site and it is located on the southwest shore of Burwash Bay, which forms the southern margin of Nettilling Lake. Mosquito Ridge is discussed in detail in chapter three as it contains a faunal assemblage that has been analyzed and interpreted.

## Chapter 3 – Arctic Zooarchaeology

Zooarchaeologists study animal remains from past cultures to infer information on subsistence, hunting, and butchering practices. All Arctic peoples relied on both marine and terrestrial resources as dietary staples. In this chapter I summarize other zooarchaeological studies dating to the Pre-Dorset period that include a terrestrial component. This will provide an important interpretive context against which to compare the results of my analysis of the Mingo Lake sites. Given the limited number of investigated sites from the study area that contain preserved caribou remains dating to the Pre-Dorset period (McCartney and Helmer 1989: 145), this summary necessarily includes all relevant early Palaeo-Eskimo faunal assemblages from coastal Baffin Island, the High Arctic, the Western Arctic, and Greenland.

### **Eastern Arctic**

In the Eastern Arctic, there are three areas with published information on Pre-Dorset faunal assemblages. They include Baffin Island, Igloolik, and Nunavik. However, the Nunavik data derive from sites dating to the Pre-Dorset/Dorset transition period (Nagy 1996, 2000). Still the patterns identified among these sites are relevant to the present study and are therefore included in this discussion.

### **Baffin Island Terrestrial Sites**

Few sites located on Baffin Island dating to the Pre-Dorset period contain preserved faunal remains (see Maxwell 1973; Milne 2003). The largest known assemblage derives from a multi-component site named Mosquito Ridge (MaDv-11). The

Pre-Dorset, Thule, and Inuit have all occupied the area over time (Milne and Donnelly 2004: 95; Stenton 1989: 194, 204-205). Mosquito Ridge is located on the southwest shore of Nettilling Lake, very close to the Great Plain of the Koukdjuak. This area is home to hundreds of thousands of migratory waterfowl in the spring and summer months (Milne and Donnelly 2004: 91). The analysis of the recovered faunal remains indicates the Pre-Dorset occupying Mosquito Ridge were intensively exploiting snow geese as their main subsistence resource.

Given the dearth of preserved faunal material from Pre-Dorset sites on southern Baffin Island, Milne and Donnelly (2004) undertook a review of Pre-Dorset sites on Igloolik Island for comparative purposes. What they discovered is that Mosquito Ridge is extremely unique; no other Pre-Dorset archaeological site presently known contains such a high percentage of avian remains (Milne and Donnelly 2004: 102).

Most of the snow geese bones from Mosquito Ridge were split but it is not thought that the Pre-Dorset were exploiting marrow from inside the bird bones because very little marrow is found within them. It is more likely that taphonomic processes such as trampling by caribou and high moisture levels caused the fracturing (Milne and Donnelly 2004: 98). There are also highly fragmented large mammal remains found at Mosquito Ridge as well as identifiable caribou remains. Of the caribou remains, cranial fragments, teeth, mandibles, and vertebrae are the most common. The elemental distribution, coupled with the limited number of caribou remains (MNI of 6) makes it difficult to determine if caribou were being hunted in the area. However, it is clear that some butchering occurred at the site due to the presence of cut marks on the caribou bone. This information indicates that even though snow geese were the dominant



subsistence resource exploited in the area, caribou were still being hunted at or near the (Milne and Donnelly 2004: 99).

The seasonality of Mosquito Ridge is deemed to be late spring to early summer. The seasonality is based upon the migration patterns of snow geese as well as the occurrence of the annual moult. The Pre-Dorset would have exploited the abundant and predictable number of snow geese at this time because their fat stores would have been high and the snow geese would not have been able to fly away while they were moulting (Milne and Donnelly 2004: 102; Soper 1928: 91). The source of fat provided by these birds would have been important to prevent potential protein poisoning at this time of year (Cachel 2000).

Snow geese are available in most other areas of southern Baffin Island (although not in the same abundances as they are found on the Great Plain) suggesting that there must have been another resource that drew the Pre-Dorset into the area. Lithic raw materials are locally abundant in the interior yet absent along the coasts. Milne and Donnelly's (2004: 102-103) analysis of the lithic remains from Mosquito Ridge indicates that the Pre-Dorset hunted avian species at the site and that they were also intensively manufacturing stone tools (Milne and Donnelly 2004: 104). It is concluded that stone tool procurement was an equally important activity as subsistence hunting when travelling inland. The reliable food resources available in this region, like moulting snow geese would have enabled the Pre-Dorset to easily acquire sufficient food resources so that they could then focus more of their attention on tool manufacturing and lithic procurement (Milne and Donnelly 2004: 107). This site provides an important comparative example

for the four Mingo Lake sites especially when determining the primary goal of occupying the four sites in question.

Stenton (1989) discusses the Mosquito Ridge caribou remains he excavated from a Thule occupation. House 9 is dominated with caribou bones (Stenton 1989: 204). There is a high frequency of high yield elements (i.e. ribs and femora), which would have been brought into the site for subsistence purposes. There are few low yield elements (i.e. metapodials and carpals) found at Mosquito Ridge suggesting that caribou were being brought into the camp in a butchered state. There are also few signs of marrow extraction indicating that this activity occurred at another location (Stenton 1989: 324). An attempt is made to determine the ratio of bulls to cows at MaDv-11 by measuring the condylar breadth of the metapodials (see chapter five for a further discussion of this technique). It is proposed that House 9 is a residential feature with a late summer to early fall occupation (Stenton 1989: 330). Stenton (1989) also mentions the Pre-Dorset components of the Sandy Point Site (LIDv-10) but does not go into any detail about the faunal composition of the site.

### Baffin Island Coastal Sites

There have been archaeological investigations in both the Frobisher Bay and Lake Harbour Districts of Southern Baffin Island (Jacobs and Stenton 1985; Maxwell 1973). However, of the Pre-Dorset components that have been located in these regions, none have detailed published information on the faunal assemblages and therefore, are not considered further in this study.

### Igloolik Island

There are two Pre-Dorset sites on Igloolik Island with available faunal data that is relevant to this study (Murray 1996). The first site is NiHf-58 and it is located on the western coast of Igloolik Island. There are a total of six features from NiHf-58 that yielded faunal remains. All six features contained mammal remains; two contained Arctic char; and, three contained bird remains (Murray 1996: 56). Seal is the dominant species and is found in all six features. Caribou is not an abundant species at the site. Only two features contained caribou remains for a total of two caribou bones identified (Murray 1996: 57). The site was occupied from early summer to mid winter based on the seasonality of available species (Murray 1996: 58).

The second site on Igloolik Island is Lyon Hill (NiHf-2). It is a large Pre-Dorset site that was likely occupied repeatedly (Murray 1996: 60). Murray (1996: 62) discusses three features all of which contain mammal and bird remains. Marine mammals, namely seal, once again dominated the faunal assemblage. Migratory waterfowl, mostly duck, were also exploited heavily at the Lyon Hill site. Arctic fox was the predominant terrestrial mammal exploited while the presence of caribou was minimal ( $N = 3$ ) (Murray 1996: 62). The seasons of occupation for the site were likely from early spring through to the fall (Murray 1996: 63). The lack of caribou bones at both Pre-Dorset sites is attributable in large part to the fact that these animals do not exist on Igloolik Island. Therefore, the limited remains found strongly suggests that the Pre-Dorset left Igloolik Island to hunt caribou on neighbouring Baffin Island or the Melville Peninsula; they then brought back with them butchered elements for consumption (Murray 1996: 84).

## Nunavik

Nagy (1996) examined the faunal remains from two Pre-Dorset sites, two Pre-Dorset/Dorset transitional sites, and one Dorset site at Ivujivik, Nunavik. All the sites contain high percentages of sea mammal bones. Caribou bones were entirely absent from the two Pre-Dorset sites yet they were recovered from the two Pre-Dorset/Dorset transitional sites. The hind and fore quarters of two caribou were found at the Pita site (KcFr-5) (Nagy 1996: 120). The limb bones were fractured indicating that the people at the Pita site were extracting marrow from the bones (Nagy 1996: 120). Other relevant faunal remains from the site are snow goose and canine (i.e. fox and wolf). Fox was the most intensively exploited terrestrial mammal with a minimum of three individuals identified (Nagy 1996: 123). The second Transitional site Nagy (1996) examines is Ohituk (KcFr-3A). This site also contains the remains of two caribou (one juvenile and one adult) yet the elemental distribution is different than the Pita site. Cranial fragments as well as rib fragments and limb bones were found at the Ohituk site (Nagy 1996: 142). Both sites indicate that caribou were hunted elsewhere and elements were selectively brought to the coastal sites for further consumption.

## **Western Arctic**

Pre-Dorset remains have been recovered on Banks and Victoria Islands and from the Bathurst Peninsula on the northern coast of mainland Canada, respectively, in the Western Arctic. On Banks Island, three sites have been investigated and have published data. On Victoria Island, two sites have published data although they are more cursory in

detail. The Bathurst Peninsula contains one site with published data on Pre-Dorset faunal assemblages.

### Banks Island

Arnold (1981) examined the Lagoon Site (OjR1-3) on Banks Island. It is dated to the Pre-Dorset/Dorset Transition period. The site is located next to a salt water lagoon with multiple terrestrial species (i.e. musk ox and caribou) found in the area (Arnold 1981: 29-30). The faunal analysis from Area A of the Lagoon Site suggests a preference by hunters to exploit migratory birds. This is supported by the fact that over half of the identified assemblage is bird bone. Seal remains are found at the Lagoon Site while caribou are identified by the presence of worked antler (Arnold 1981: 113). Musk-oxen were heavily exploited at the site (Arnold 1981: 107). Arnold (1981) infers information for the Palaeo-Eskimo from the identified musk-ox remains; his interpretations on butchering practices are useful to my subsequent research. Even though caribou and musk-ox generally do not provide interchangeable resources, they supply meat in the same way. The presence of cut marks will show which elements were preferred and will hopefully help determine why the Palaeo-Eskimo exploited certain elements over others.

Both the Shoran Lake Site (no associated Borden number) and the Umingmak Site (PjRa-2) contain Pre-Dorset faunal assemblages that are dominated by terrestrial mammal remains. Musk-oxen were preferentially exploited over caribou at both sites. Over half of both assemblages (85% and 67% respectively) were musk-ox while caribou, birds, and other mammals constituted the rest of the assemblage (Savelle and Dyke 2002: 519; Taylor 1967: 227).

### Victoria Island

Caribou remains, dated to Pre-Dorset times, have also been found on Victoria Island. The Wellington Bay site (NiNg-7) faunal assemblage is dominated by seal remains, however, a few caribou bones were also recovered. Taylor (1967: 225) is puzzled by this assemblage since caribou is the predominant resource available in the area yet little of it is present in the recovered assemblage. No further information is available with which to explore this observation, however. The Menez site (NiNg-10) has a faunal assemblage dominated by caribou remains (Taylor 1967: 225), however, again, few details are available to interpret its significance.

### Bathurst Peninsula

The Crane Site (ObVr-1) is located on the Bathurst Peninsula and is considered an inland site (Le Blanc 1994) even though it is mere kilometers from the neighbouring coast. This site contains materials attributed to the Pre-Dorset/Dorset transitional phase (Le Blanc 1994: 111). Caribou is the predominant terrestrial subsistence resource identified at the site while the most abundant bird species is snow goose (Le Blanc 1994: 94). The caribou remains at the Crane Site are highly fractured suggesting intensive marrow extraction. There are also examples of butchering and burning bone (Le Blanc 1994: 96). The faunal assemblage at this site mirrors the faunal assemblages recovered from the Mingo Lake sites included in this study. As such, the Crane Site data will be important for comparative purposes to identify patterns in the Mingo Lake assemblages that reflect site seasonality, elemental distribution, and butchering patterns.

## **High Arctic**

High Arctic Pre-Dorset sites indicate the importance of a marine-based economy. Caribou are considered a secondary resource in the High Arctic as they are sensitive to over predation in this region (e.g. Darwent 2004). They also do not aggregate in large herds and are for the most part, non-migratory. As such, High Arctic Palaeo-Eskimo peoples would have had to exploit multiple herds or engaged in trade with various Greenlandic groups for essential resources (e.g. hides) (Helmer 1991: 315; McCartney and Helmer 1989: 151). Sites included in this section date to the Pre-Dorset and Independence I periods, and emphasize patterns associated with the exploitation of caribou; they are all located on Devon Island.

### Port Refuge

Port Refuge is located along the western edge of Devon Island. McGhee (1979) discusses the Independence I and Pre-Dorset occupations of Port Refuge. Two Independence I components contain faunal material; they are called the Cold component and the Upper Beaches component. The Pre-Dorset component at the site is known as the Gulf Cliff component.

The Cold Component contains several middens, which yielded a comparatively large number of preserved faunal remains. Remains of ringed seal dominate the overall frequencies of recovered remains while fox is the dominant terrestrial species. Only nine caribou bones were identified at the site (McGhee 1979: 35).

The Upper Beaches component is dominated by bird remains and no caribou bones were recovered. This component was not excavated to the extent that the Cold

Component was which could have skewed the faunal data. However, it is more likely the site was occupied for a short period of time in the summer months and used for the sole purpose of hunting migratory waterfowl (McGhee 1979: 61-62).

The Gulf Cliff component is dotted with Pre-Dorset features. Seals once again dominate the faunal assemblage. However, there are a higher proportion of caribou remains at the Gulf Cliff component than at either Independence I sites. Arctic fox is the dominant terrestrial mammal found in the Gulf Cliff assemblage; Musk oxen remains are also present at the site. Very few bird remains are found at Gulf Cliff (McGhee 1979: 94). The elemental distribution of seal at the Gulf Cliff component is skewed towards limb bones implying that the Pre-Dorset were killing the seals elsewhere and then transporting selected elements back to the site. On the other hand, the Independence I sites had higher proportions of axial elements than appendicular elements indicating that seals were being butchered at the sites and transported elsewhere for consumption (McGhee 1979: 93).

All three components from Port Refuge are dominated by marine mammal remains with a secondary focus on birds. Terrestrial mammals do not appear to have been as intensively exploited based on their overall frequencies in each respective assemblage. However, despite this, it appears that both Pre-Dorset and Independence I groups that occupied this region still needed to supplement their diet and resource voids with caribou, as indicated by the remains that were recovered.

### North Devon Lowlands

The North Devon Lowlands are located on the north eastern shore of Devon Island. The region supports an abundance of vegetation making it attractive to grazing



terrestrial species (McCartney and Helmer 1989: 146). The Lowlands contains multiple complexes dating to the Pre-Dorset time period. Some of the sites contain faunal remains while some do not. Of the sites with faunal remains there are relatively few preserved caribou bones; marine mammals dominate all of the assemblages (McCartney and Helmer 1989: 147). For instance, the Ice Breaker Beach Complex is dominated by seal remains with only a small portion of the faunal assemblage attributed to caribou (Helmer 1991: 305). Another grouping of sites that contains caribou remains is called the Twin Ponds Complex (Helmer 1991: 309). The fracture patterns as well as the high degree of fragmentation, especially when examining metapodials, indicates intensive marrow extraction. There is also a high frequency of skull fragments that could indicate antler harvesting (McCartney and Helmer 1989: 149).

## **Greenland**

Saqqaq sites date to the same time period as the Pre-Dorset and are known to have exploited caribou (Gotfredsen 1996; Grønnow 1994; Møberg 1999). Greenlandic archaeology has followed the same pattern of survey and excavation as most other Arctic archaeological investigations where the main focus has been on coastal sites.

Comparatively few inland areas have been investigated (see Schilling 1996). As such a marine mammal adaptation has been discussed for the Saqqaq with generally little being said about their terrestrial adaptation. There has been a push in the last couple of decades for the exploration of archaeological sites in the interior (Kapel 1996). As such there is now more information on the Saqqaq, concerning caribou hunting strategies, than other Arctic Palaeo-Eskimo cultures such as the Pre-Dorset.

### Disko Bugt

Grønnow (1994) examines the archaeological remains from the Qeqertasussuk site in Disko Bugt. The Saqqaq component is undisturbed and dates to 3900 BP to 3100 BP (Grønnow 1994: 220). The Saqqaq assemblage is dominated by seal remains with over half of the faunal assemblage attributed to various seal species (Grønnow 1994: 210). Various species of whale, including the bowhead whale (*Balena mysticetus*) and the narwhal (*Monodon monoceros*), are also present in the faunal assemblage. Bird remains are found in relatively large numbers and fish remains are also present at Qeqertasussuk (Grønnow 1994: 216). Terrestrial mammal is also present at the site. A small amount of caribou bone was found, indicating that the Saqqaq were most likely exploiting caribou in neighbouring inland areas. Tooth thin sections indicate that Arctic fox were heavily exploited in the winter months. The faunal assemblage from the Qeqertasussuk site demonstrates that the Saqqaq had a broad diet. It is believed that the site was used year round during the early stages of Saqqaq times but then transitioned into a summer camp for later Saqqaq peoples (Grønnow 1994: 217-218).

### Sisimiut

Gotfredsen (1996) and Møberg (1999) examined a Saqqaq site known as Nipisat, which is located in the Sisimiut District of Greenland. The Sisimiut District contains a broad stretch of ice free land along its west coast that provides reliable forage for mammals in the winter months (Gotfredsen 1996: 103; Møberg 1999: 453). Faunal remains from Nipisat indicate an extensive use of caribou by Saqqaq hunters at the site. The minimum number of individuals (MNI) for caribou is nine and is higher than any

other mammal species identified at the site (Gotfredsen 1996: 99). Even though there are a high number of caribou remains at the site, it appears that birds were also an important resource in the region. Birds were hunted near the site due to the high variability and frequency of many different bird species (Gotfredsen 1996: 98). This site provides important data relating to skeletal frequencies that will facilitate interpretations among the Mingo Lake sites relating to site function and seasonality since it appears that caribou were hunted elsewhere and then transported back to Nipisat (Møberg 1999: 457). Nipisat also provides basic information on how marrow was extracted from caribou bones in Saqqaq times (Gotfredsen 1996) and will provide important insights on the marrow extraction process by early Palaeo-Eskimo peoples.

## Chapter 4 – Ethnographic Analogy and Traditional Knowledge

Ethnographic analogy and traditional knowledge are important tools that facilitate the interpretation of zooarchaeological studies. Both sources of information provide important insights relating to seasonal land use, animal ethology, resource knowledge, hunting strategies, prey selection, and, butchering practices. Given the extensive and detailed ethnographic record describing Inuit traditional knowledge, this study focuses specifically on information that pertains directly to caribou. In order to effectively integrate details from the ethnographic record into interpretations of archaeological remains, a solid theoretical foundation and interpretive framework must be in place.

### **Theory**

Land-use strategies, site variability, and seasonal adaptations are important phenomena to consider when analyzing Pre-Dorset inland sites since all three are central to archaeological discussions of hunter-gatherer mobility patterns (e.g. Binford 1980, 2001). Hunter-gatherers tend to be classified as sedentary or mobile. However, the range of variability in human mobility strategies does not always easily fit into either one of these categories since populations tend to alternate between them in response to changes in seasonal resource abundances, settlement locations, social organization, time scheduling, and so forth.

Sullivan (1992) discusses the concept of land-use while Milne (2003) applies Sullivan's concepts to Pre-Dorset mobility on southern Baffin Island. Sullivan (1992) examines the density of lithic scatters in relation to land-use and states that the denser an artifact distribution is, the longer an area was occupied for. I apply this idea to my

interpretations of the faunal remains derived from the four sites included in this study. Specifically, a denser faunal assemblage should correlate with a longer or repeated occupation of a site. Land-use is connected to the uninterrupted occupation of a place by the same peoples and allows for interpretations to be made on site function and how site functions can change over time (Sullivan 1992: 100). This concept promotes an examination into the variability of site function and site type (Milne 2003).

Variability is found throughout Palaeo-Eskimo history and is visible in differing assemblages and settlement patterns. Variability is the driving force behind regional adaptation. A culture spanning the entire Eastern Arctic cannot be expected to adapt in the same way; adaptation strategies will be different on Greenland, Baffin Island, as well as on Nunavik and in the High Arctic and Western Arctic. Regional adaptations are identifiable in artifact assemblages, site structures and locations, resource exploitation strategies, and settlement patterns. Depending on resource distribution different groups of the same culture will be more mobile while others will be more sedentary (Bielawski 1988: 56). The local physiology strongly influences regional variations in human adaptations. For example, proximity to water, the presence or absence of beach ridges, access to suitable shelter, and access to resources would have played an influential role in determining where the Palaeo-Eskimo would have chosen to live (Bielawski 1988: 57).

People use a variety of behaviours to adapt to their local environments. Patterns of adaptive behaviours can be identified in the archaeological record when sites are occupied multiple times or over a long time span (Bielawski 1982: 37). Stenton (1989) describes how adaptation is useful when examining site function and mobility patterns. Adaptation is a fundamental premise that can be used to produce general cultural models,

which can then be used to interpret the archaeological record (Stenton 1989: 6).

Adaptation allows people to use rational thought when exploiting resources; the choices made are knowledge-based and allows for flexible decision making (Stenton 1989: 7).

Decisions are made based on where resources are found, at what time of year they are available, and in what abundances they can be reliably procured.

In order to be successfully adaptive, Palaeo-Eskimo peoples would have needed flexible strategies for caribou exploitation, particularly when resident herds experienced periodic declines in population numbers due to cyclical patterns (Stenton 1989: 2). Climate change, forage conditions, and predation are all factors that affect caribou population size (Stenton 1989: 2). The Palaeo-Eskimo likely adjusted their seasonal rounds depending on how plentiful caribou populations were near the coast. As coastal caribou resources declined, longer trips would be taken into the interior to procure caribou and other resources such as stone.

Hunter-gatherers tend to be categorized into two main groups: foragers and collectors. Each group leaves behind different archaeological signatures in terms of mobility and sedentism. Foraging systems are associated with camps and location sites. Foragers are more mobile than collectors and can cover great distances across the landscape; their group size also fluctuates with the seasons (Binford 1980: 5; Stenton 1989: 12). Forager groups will move seasonally amongst a variety of different patches of resources (Binford 1980: 5). Foragers do not store food, instead they gather food daily (Binford 1980: 5). The archaeological signature of a forager group is more ephemeral on the landscape because they are constantly on the move (Binford 1980: 7). Collectors, on the other hand, are logistically mobile (Binford 1980: 10). They live in a centralized

location and send small task-groups out to acquire resources such as tool stone and food (Binford 1980: 10; Stenton 1989: 12). Collector population dynamics are more consistent throughout the year; since they are more sedentary, their sites are more visible in the archaeological record because they stay in one location longer, build more substantial dwellings, and accumulate more refuse (Stenton 1989: 12). Collectors store their food resources in caches; caches are not found at sites created by foragers (Binford 1980: 12). Collectors create another distinct archaeological site known as a station. Stations are used primarily to gather information on animal migrations (Binford 1980: 12).

While Binford (1980) originally intended for his model to function as a continuum, archaeologists have more commonly classified hunter-gatherer populations as *either* foragers or collectors (e.g. Chatters 1995; Jones et al 2008; Kelly 1995; Lupo and Schmitt 2005). As Sullivan (1992) and Milne (2003) argue, it is more effective to conceive of these phenomena in less dogmatic ways particularly if little is actually known about the population in a given region. A move needs to be made from an either/or, idealistic perspective, towards a more continuum-based approach to classify populations of foragers and collectors. Through his combined use of ethnographic and archaeological data, Stenton (1989) has already established that Thule Inuit populations on Southern Baffin Island can be both collectors and foragers depending on the season and available resources.

Sullivan's ideas on land-use strategies are well suited for use in this study since comparatively few Pre-Dorset sites that are presently known in the interior; therefore, the sites can be examined without preconceived notions relating to mobility types and site structure. This will avoid the tendency to pigeonhole identified patterns in the analyzed

faunal assemblages into an existing model. Using this more flexible approach provides a more objective way to assess how the Pre-Dorset may have behaved *both* as foragers and collectors.

Analogy is an essential mechanism that allows archaeologists to construct bridging arguments between the ethnographic record and the archaeological past.

Analogy is an inferential argument that is used when examining two similar entities with an implied relationship that does not necessarily have to be direct (Binford 1967: 1). In order for analogies to be used successfully there needs to be some type of relationship between the archaeological context and the ethnographic record. These relationships can manifest themselves in the wear patterns found on tools, historical continuity, and/or similar artifact forms (Binford 1967:2).

Binford (1967: 9-10, 2001) provides a model for the proper use of analogy. In order to use analogy in my discussion of Pre-Dorset faunal assemblages, I must first recognize and demonstrate a positive analogy between the archaeological and ethnographic records. I must then consider the spatial difference between the archaeological record and the area where the ethnographic information was recorded. Thirdly, I need to consider the potential for continuity between the ethnographic and archaeological records (i.e. how far apart the dates are). After creating an analogy, it must then be compared to the ethnographic record. From here a set of testable hypotheses must be developed in order to determine the validity of the analogies (Binford 1967: 9-10, 2001).

Analogy can provide insight on Palaeo-Eskimo technology strategies, subsistence strategies, and, to a certain degree, on ideological and symbolic beliefs (Hood 1998: 25).



The use of analogy allows for a better understanding of complex cultural systems. For example, the act of butchering, and more specifically the cut marks themselves, can have multiple meanings and interpretations. Each cultural group will have different ways that they approach the butchering of an animal (e.g. which elements are preferentially chosen, which elements are distributed to the community and which remains with the hunter, etc.; Seetah 2008: 137). As such, archaeologists can use analogy to compare butchering activities to grasp a better understanding of how past peoples lived and made choices. In order to use analogy properly, an interpretive framework must be in place to determine which historic and modern cultures best reflect the archaeological people being studied.

### **Ethnographic Record**

Boas (1974) was the first person to record the lifeways of the Inuit who lived on Baffin Island. He travelled around the Eastern Arctic recording the oral traditions that different Inuit groups possessed. The information he recorded ranged from resource procurement to myths to personal adornment. As noted previously, my focus on the Inuit ethnographic record will be limited to information pertaining directly to caribou. This will include details on how caribou are used as a resource, places associated with caribou, as well as the various hunting methods the Inuit used to procure caribou. I place particular emphasis on information relating to the Baffinland Inuit since they occupied the southern two-thirds of Baffin Island (Kemp 1984: 463) including the Large Lake Region.

### Caribou as a Resource

Caribou supply several important raw materials to the Inuit. The different uses of caribou hides are described first followed by a discussion of how caribou were used as a food resource. Finally, I summarize how the Inuit used caribou bone and antler.

Caribou hides change with the seasons. In winter, caribou hair is long, thick and brittle making it unusable for skin clothing; instead winter caribou hides are used as blankets and sleeping bags (Burch 1972: 343). The Inuit procure caribou hides used for clothing during August and September since the warble flies have hatched from their caribou hosts by this time and the holes the insects create in the hide have healed by that time. Between 40-70 hides caribou hides were needed to sustain a family of five for the winter, and these hides were ideally procured in August since clothes made from them were not too warm or bulky (Burch 1972: 343; Stenton 1989: 55, 65).

Caribou hide clothing was superior to all other forms of clothing found in the Arctic, though clothing was still made from the hides of other animals (i.e. seal) in the Arctic. Caribou skin has insulating properties that help maintain thermal balance during the winter months. Caribou hair traps cold air before it gets to the body allowing the person wearing it to stay warm (Stenton 1991b: 4). Caribou hair is also light but strong making it an easy material to wear and to move around in. Caribou clothing is also used to portray personal information such as age, gender, and geographic origin (Stenton 1989: 56-59). Caribou hide clothing was necessary in order to have successful seal hunts. The Inuit needed to have waterproof, warm clothing in order to successfully exploit seal on the sea ice. If there was not a successful caribou hunt in the fall then the winter seal hunt would have been jeopardized (Stenton 1991b: 14-15).

Exploiting caribou as a food resource was essential since caribou can supply all the nutrients required in a healthy diet. If caribou are taken in their peak condition (highest level of fat) and the meat can be preserved, malnutrition will not occur (Burch 1972: 362; Stenton 1989: 51). It is difficult to preserve caribou meat when the hides are in their prime because August tends to be too warm to keep meat; however, by the time it is easy to preserve meat the caribou hides are too thick to be used for clothing (Burch 1972: 362). Bones had the potential to be saved for times when other food resources were scarce. The Inuit would fracture or boil the bone to remove the bone marrow and bone grease, both of which provided much needed nutrients (Burch 1972: 362). Fat can be used as a food resource or as fuel for lamps (Burch 1972: 362). Fat is also used to ward off protein poisoning. Protein poisoning occurs when too much lean meat is consumed and there is not enough fat in the diet to balance all the protein (Cachel 2000: 40).

Bone and antler are exploited as raw materials to make tools and utensils (Burch 1972: 362). Antler is important because it is typically available in large quantities and is easy to work. Given its desirable working properties, antler is commonly used to produce harpoons and arrowheads (Stenton 1989: 56). Caribou elements were also used in a variety of different ways. For example, the teeth were used for adornment while the metapodials provided the raw material for scrapers. Phalanges were used in games while scapulae were used to scrape hides. Sinew was used as a waterproof thread (it expands when wet preventing water from entering the stitch) for clothing or as a bowstring (Stenton 1989: 56).

### Caribou in the Landscape

The different caribou hunting regions on Baffin Island that have been described are the Foxe Peninsula, Amadjuak Lake, Mingo Lake, Nettilling Lake, Meta Incognita Peninsula, Hall Peninsula, Tassialukjuaq, and Cumberland Peninsula (Ferguson et al 1996; Jacobs and Stenton 1985; Kemp 1976). This study is particularly interested in the information gathered from hunting regions near Mingo, Amadjuak, and Nettilling Lakes. These three hunting locations are described in the ethnographic record for Baffin Island and are located on the southeast corner of Amadjuak Lake stretching towards Mingo Lake, and the Burwash Bay area of Nettilling Lake (Boas 1974: 421, 423, 430; Kemp 1976). It has been acknowledged that if caribou were scarce elsewhere on Baffin Island then there would still be caribou around Mingo Lake and Amadjuak Lake. Cows and calves are historically found around the lakes (Ferguson et al 1996: 208). Populations of caribou declined in the southern portion of the region between the 1930's to the 1950's; most caribou did not travel south of Mingo Lake between these years (Ferguson et al 1996: 208). The Nettilling Lake Hunting Region was exploited in the summer months and always contained a large supply of caribou around the shores of Nettilling Lake. While other regions saw a decrease in caribou, Nettilling Lake did not (Ferguson et al 1996: 210-211).

Caribou are also visible on the landscape via place names. Examples of this are found in the Kazan River Region. Places are given names based on location, the resources exploited in the vicinity, and the oral traditions associated with a place (Stewart et al 2004: 191). When orienting the places on a map, they are always oriented using the wind and currents, not traditional north and south measurements. Rivers are oriented at

right angles in relation to caribou migrations. Rivers are supposed to run east to west in relation to the north-south migration routes of the caribou (Stewart et al 2004: 194). The major caribou crossings were named on Thirty Mile Lake and had multiple archaeological sites associated with the south shores of these crossings. Caribou herds were given different names depending on when they crossed the river and the condition of the hide (Stewart et al 2004: 197). There were also taboos and rituals associated with river crossings. All camping was to be done on the south shore as not to scare away the caribou, and no butchering could occur on the north shore or else the caribou would get suspicious and leave the area (Stewart et al 2004: 198).

Large features associated with caribou crossings do not have any direct historical accounts associated with them but are deeply embedded in the oral traditions. The oral traditions of the people who live around the Kazan river are centred on how to treat the caribou so that they will always cross at specific river crossings. These river crossing display archaeological signs of long-term use to back up the oral traditions (Stewart et al 2004: 203). These detailed oral traditions strengthen the use of analogy to interpret the archaeological record of the Arctic.

### Caribou Procurement Strategies

It is commonly thought that groups of people can follow caribou herds; this affords them access to raw material and food resources year round (e.g. Gordon 1975, 1996). However, this is not actually possible. Caribou move too quickly (averaging 25-30 kilometres a day) to be followed by a human group (Burch 1972: 345). As such caribou hunters must come up with more realistic means of acquiring caribou. Caribou can be

hunted in a variety of ways with a variety of tools. Hunters have the choice to lie in wait for the caribou to pass through an area during the migration or hunters can wait for the caribou at the end of their migration routes (e.g. calving grounds or winter foraging sites) (Burch 1972: 346-347).

Caribou are easy to hunt for several reasons. They travel in large herds and do not wander aimlessly through the landscape. Caribou are fairly predictable in their movements since they tend to follow landscape features such as eskers or rivers. Caribou are also not dangerous prey; instead of fighting they will flee. Finally, caribou are a fairly curious and trusting species. They will not flee right away since it takes them a while to determine if an object on the landscape is harmless or harmful (Burch 1972: 361).

Caribou can be hunted with the bow and arrow, lances, snares, and pitfalls. The hunting implements depended on the season and topography (Boas 1974: 502-505; Burch 1972: 360; Spiess 1979: 104). Caribou can be forced into river crossings and then are speared by hunters; Inuksuit (drive fences) are also used to move caribou in a certain direction (Boas 1974: 434, 501; Spiess 1979: 105; Stenton 1989: 53). The presence of multiple Inuksuit along the head of Mingo Lake indicates that drive fences were most likely used to corral caribou into the river crossing (Milne 2008: 31).

### Inuit Treatment of Caribou

As it has been shown, the Inuit relied on caribou to provide resources that are not available anywhere else. In order to maintain a good relationship with the caribou, hunters implemented certain restrictions and limitations. One of the best known limitations has to do with contamination of the land and the sea. When hunting terrestrial

mammals, one could not use the implements used in hunting marine mammals and vice versa; if the implements were properly cleansed then the hunting tools could be used to exploit both resources. Marine and terrestrial meat could also not be cooked together or consumed in the same meal. The processing of caribou hides had to occur after the caribou hunt ended but before the seal hunt began; once the seal hunt began caribou hides could no longer be processed (Stenton 1989: 50-51). Caribou are believed to be sensitive to the presence of Inuit women, which meant that women had to follow a specific code of conduct in order for the male hunters to have a successful hunt (Stenton 1991b: 7).

The fall hunt on Southern Baffin Island began with an aggregation of people at a pre-hunt ceremony. This ceremony consisted of competitive games and was useful in developing social relationships between groups through marriage (Bilby 1923: 265-266; Stenton 1989: 50). During the hunt, processed caribou bones (i.e. fractured for marrow extraction) could not be visible on the land. Bones could also not be processed near caribou crossings as this was seen as disrespectful towards the caribou. It is believed that if the caribou were offended they would not allow themselves to be hunted by the Inuit. The consequences for breaking the taboos in place for a successful hunt were not harsh; usually the hunters would have a poor hunt that year (Stenton 1989: 51). However, a poor hunt could be a severe consequence if a hunter was unable to provide enough hides or meat for his family resulting in starvation and exposure to the cold.

### Baffinland Inuit

The Baffinland Inuit lived on the coast but also exploited resources in the interior of Baffin Island. They relied on marine, terrestrial, and freshwater resources for

subsistence purposes (Kemp 1984: 463). The Baffinland Inuit have adaptive roots that extend back to Pre-Dorset times; though this is not to be confused with their ancestral roots with the Thule (Kemp 1984: 463). In total, there are 20 different species that were exploited by the Baffinland Inuit; wolf is the only resource not exploited for subsistence purposes (Kemp 1984: 466). Caribou were the resource that drove the Baffinland Inuit into the interior; the hunts took place in the areas surrounding Nettilling Lake and Amadjuak Lake (Boas 1974: 419; Kemp 1984: 468). Narrow river crossings near both lakes were exploited as good hunting lands. As many caribou as possible were taken before the first snows; any leftover meat was cached and retrieved later in the winter. Arctic char were also caught in the interior during the fall (Kemp 1984: 468).

### **Interpretive Framework**

The Arctic is a challenging environment in which to live and requires specialized adaptations to survive the long, harsh winters and short, cool summers. All Arctic peoples (spanning both landscape and time) would have adapted to their environments in similar fashions since there is a limited range of resources available to exploit (Barry et al 1977: 195). Barry et al (1977) have shown that the Arctic climate is constantly cycling between warm and colder periods; this trend was present during Pre-Dorset times and it also present in modern times (Jacobs and Stenton 1985: 63). As such it seems plausible that adaptive behaviours developed by the Pre-Dorset were similarly used by later cultural groups precisely because they were successful. Indeed, among the best examples of this are the expansive multi-component sites found in the interior of southern Baffin Island containing deposits dating to Pre-Dorset, Dorset, and Thule Inuit periods (Milne et al



2012: 270). People returned to these sites repeatedly because they were near reliable hunting areas, they were centrally located to facilitate regional interactions among widely dispersed coastal populations, and they were culturally significant places on the landscape (Milne et al. 2012, 2013). This consistency in land use, settlement, and subsistence over time for all four cultural groups facilitates the use of the ethnographic record to interpret Pre-Dorset sites around Mingo Lake because it is highly likely that human populations were returning to these same sites for similar purposes (Bielawski 1982: 37).

Ethnographic analogy has been successfully used in other Arctic archaeological studies (McGhee 1996; Taylor and Swanson 1967) to provide insights into Palaeo-Eskimo society (Hood 1998: 25). The ethnographic record documents the habitual use of the interior of southern Baffin Island by the Inuit, particularly in those areas near Mingo, Amadjuak, and Nettilling Lakes where caribou were intensively hunted. This study draws on this available ethnographic information to interpret the zooarchaeological data acquired from the four Pre-Dorset sites near Mingo Lake to understand more specifically what human behaviours created these assemblages. There is also a link between the ethnographic record and the archaeological record at Mingo Lake in the way of site function. Several sites have been identified as hunting blinds, drive fences, or caches. The locations of the drive fences and hunting blinds are located near a narrow water crossing. The ethnographic record has shown that Inuit hunters tend to exploit caribou near water crossings while using drive fences to influence the movement of caribou. Therefore, these additional consistencies in land use and site functions will further strengthen the use of ethnographic analogy for interpretive purposes in this study.

Cultural meaning enhances the information gathered from the archaeological record which is why it is important to use traditional knowledge in interpretations when appropriate. The information that I draw on for the purpose of this study focuses on details relating to the seasonal round, preferential treatment of elements, and finally the marrow extraction patterns used by today's Arctic peoples.

## **Hypotheses**

Based on the information presented thus far, I have constructed three hypotheses and related test expectations that I will test against the data acquired from the zooarchaeological analysis of the four Mingo Lake sites and their associated faunal assemblages.

### Hypothesis 1

This hypothesis states that the four Mingo Lake sites were occupied in the winter months and are considered multi-occupation sites.

#### *Test Expectations*

If this hypothesis is valid, two potential patterns may be identified in the zooarchaeological assemblage. The first pattern is that high frequencies of marine mammal (i.e. seal) will be identified since marine mammals are typically exploited in the winter months. The seal remains would have been transported in from the coast or hunted at Nettilling Lake. Hunting seal through the ice at Nettilling Lake would have been difficult since the ice is so thick. However, there are ethnographic accounts of the Inuit

wintering at Nettilling Lake and partaking in a winter seal hunt on the lake ice (Boas 1974). Sledges would be used to transport the hunted seals back to the campsite in the winter months and typically only one seal would be hunted at a time (Boas 1974: 482). As such all seal elements would be represented if they were being exploited at Nettilling Lake. If seals were acquired from the coast and brought into the interior they would be transported in their butchered state. As such blubber and seal skin would be taken and the majority of bones would be left behind at the coast. The archaeological assemblage would consist of femora, humerii, and other high yield elements if seals were brought in from the coast. Since there is a high frequency of marine mammal bones present we would find few indications of marrow extraction from the few terrestrial mammal bones found at the site; the Pre-Dorset would be exploiting fat from the flesh of marine mammals instead of from the medullary cavity of terrestrial mammal bones. There would also be a noticeable absence of fish and nesting waterfowl species.

The second pattern associated with a winter occupation is the visibility of cached food resources. This specifically applies to the consumption of caribou that were acquired during the summer and fall hunts. High yield elements would be cached in areas close to the winter campsites and consumed as needed throughout the winter. There would need to be large caches in the surrounding areas of the four sites to signify a winter occupation of Mingo Lake. However, the Pre-Dorset are not commonly associated with food storage technology. The absence of food storage technology is one characteristic that separates the Pre-Dorset and Dorset cultures. It is thought that as the Dorset became more sedentary food storage technologies developed (Maxwell 1985). As such, the caches found at LdFa-1 (Milne 2008) may not be attributed to the Pre-Dorset occupation of the

site, rather to the Dorset occupation but intensive excavation or radiocarbon dating would be needed to identify when the caches were used.

### Hypothesis 2

This hypothesis states that the four sites were occupied in the summer and fall months. All four sites served the dual purpose of habitation (multi-occupation or single occupation) and butchering (multi-occupation or single occupation) sites.

### *Test Expectations*

If this second hypothesis is true, I would expect to find the same elemental frequencies at all four sites. Since the killing, butchering, and consumption activities were occurring at all four locations, there would be no need to selectively transport elements from a butchering area to a habitation area. The main resources exploited during the warm months would have been caribou and nesting waterfowl such as snow geese. Fish would also be found in the archaeological assemblages due to the close proximity to Nettilling Lake, Amadjuak Lake, and Mingo Lake. We would also see high frequencies of marrow extraction patterns as the Pre-Dorset prepare for their migration back to the coast for the winter months.

### Hypothesis 3

This hypothesis three states that LdFa-1 is a multi-occupation habitation site while LdFa-12, LdFa-13, and LdFa-14 are single occupation sites where the primary

purpose was to butcher caribou that was hunted nearby. All four sites are hypothesized to be occupied in the summer and fall months.

### *Test Expectations*

If this final hypothesis is true I expect to find different elemental frequencies between the two areas. One area would have a higher frequency of high yield elements (the habitation site) while the other would contain a higher frequency of low yield elements (the butchering sites). Different fracture patterns and butchering patterns are also expected. The butchering sites should show higher frequencies of both marrow extraction patterns while the habitation site should not show evidence of intensive marrow harvesting. The two areas will also contain different types of cut marks (see discussion in Chapter Five). Chop marks will most likely be highly visible at the butchering site due to the disarticulation of joints while the habitation site should contain higher instances of scraping and slicing marks. These two types of marks are indicative of food and hide processing.

## Chapter 5 – Methodology

This chapter describes the five methods used in my zooarchaeological analysis. I include definitions for terms that are particular to my research questions. I also include a brief discussion on the process used to identify the different skeletal elements. A discussion of counting strategies, butchering marks, marrow extraction, and ageing and sexing methods is also presented.

### **Data Organization**

The faunal remains were divided into four categories based on class after which they were further identified into four categories including: identifiable mammal, unidentifiable mammal, bird, and fish. These four categories facilitate the presentation and interpretation of the data. Each specimen included in the identifiable mammal category was individually measured and weighed. They were then identified to either a specific species or mammal category, and to a specific element or element category. I also sided (left or right) those specimens that had distinguishing features and recorded the pertinent features – this will be useful when employing the different counting strategies. I recorded information on bone fusion (yes, no, or partial), evidence of burning (yes or no), as well as natural modifications (weathering, staining, rodent marks, carnivore marks, grey polish, and white substances). Fracture patterns and presence or absence of cut marks were recorded for all identifiable specimens.

The unidentifiable mammal specimens do not have any features that permit them to be identified to an element or species category. They are treated as a bag and, therefore, no individual measurements are taken. Each bag is weighed and the specimens

are counted. Additional information that is recorded includes evidence of burning and natural modifications.

The bird and fish remains were recorded in an identical fashion to the identifiable mammal category. All identifiable bird and fish specimens were individually weighed and measured, assigned to a species and element category, sided, and had their features recorded. I also looked for bone fusion, evidence of burning, butchering marks, fracture patterns, and natural modifications. The unidentifiable bird and fish specimens were counted and weighed as a bag unless the bag count was one and then they were catalogued as an identifiable remain. I then recorded the evidence of burning and natural modifications for each unidentifiable bag.

## **Definitions**

Over the course of my research, it was necessary to create different size classifications for both species and elements. These classifications permit a more comprehensive study of the faunal remains for the study areas because they allow for previously unidentified remains to become identifiable. I employed the following classifications when distinguishing features were not present on a specimen.

The first set of classifications I needed to create relate to animal size. I created four size classifications for mammals. They are large mammal (caribou and polar bear), medium-large mammal (caribou and canine), medium mammal (canine) and small mammal (rodents). I based the classifications on overall bone shape and on cortex thickness. A long, wide, thick bone would be classified as a large mammal while a short, slender, thin bone would be classified as a small mammal. I also created classification

sizes for bird species. Birds were classified as large (snow goose), medium-large (gulls and ducks), and medium (tern). Small bird remains were not found in the assemblages so it was not necessary to include a small bird classification into my analysis. Since the fish remains were scant and difficult to identify, I was unable to use size classifications to aid in the analysis of the fish remains.

I also created size classifications that pertain to element size. Since the archaeological assemblages at all four sites are highly fragmented it was necessary to devise classification categories to make unidentifiable elements identifiable. The element classifications I created are long bone, flat bone, irregular bone, and limb bone (see Figure 5.1). Long bone fragments derive from the shafts of the long bones (femora, humeri, radii, etc.) so they tend to be long and wide, with a round shape. Long bones can also be from the mandible and the pelvis. Flat bones are bone fragments from the ribs, pelvis, scapulae, crania and vertebrae. They tend to be flat with two thin layers of cortex on either side of the cancellous bone (Hillson 1992: 4; O'Connor 2000: 6). Irregular bones are bones with multiple, non-uniform surfaces. The bones in this category are the various carpals and tarsals, as well as the second and fifth medial phalanges, sacrum and vertebrae. The final element classification is the limb bone. A limb bone can belong to any of the three aforementioned categories or it can also be a phalanx. The distinguishing feature of the limb bones is the fact that it is small in length and width, but it is relatively thick. The limb bone classification was almost solely associated with a large mammal classification. This was because the small but thick bones were clearly a large mammal but I was unable to distinguish which element or area of the skeleton the bone fragment belonged to.





Figure 5.1. Long Bone (left) and Limb Bone (right) models for size classifications.

Other terms that are used throughout my data spreadsheet are shaft frag, herbivore and carnivore. A shaft frag (or shaft fragment) is a specimen with no identifiable features and originates from the shaft of a long bone, flat bone, or limb bone. I recorded shaft fragments because they could either be attributed to a mammal size category or butchering marks were present.

The terms herbivore and carnivore are associated with the classification of the teeth. Herbivore teeth are generally high crowned and known as hypsodont. They are used for grinding plant materials and wear quickly (Reitz and Wing 2008: 52). Carnivore teeth that are triangular and pointy are used to grasp prey and rip apart flesh (Reitz and Wing 2008: 53). An herbivore tooth fragment is relatively large, square in shape, contains flat surfaces, and has a specific patterning to the dentine and enamel. On the other hand, a carnivore tooth fragment will not be flat and will not contain patterning of the enamel and dentine. I used the classifications of herbivore and carnivore when a tooth could not be directly matched to a specific mammal but had a tooth structure matching either an herbivore or a carnivore. In this context an herbivore is associated with caribou, while carnivore is associated with the canine family.

## **Comparative Methods**

Since the Anthropology department at the University of Manitoba does not possess a comparative caribou skeleton, I devised a hybrid technique to identify the faunal remains from the Mingo Lake sites. The hybrid method consists of a high-tech, internet resource as well as multiple low-tech resources. For the initial comparisons, I accessed an online database that is known as the Virtual Zooarchaeology of the Arctic Project (VZAP) and it is discussed by Betts et al (2011). I also employed the use of line drawings to aid in the identifications of mammals (Hillson 1992), bird (Gilbert, Martin and Savage 1981) and fish remains (Cannon 1987) until I became more comfortable with VZAP. Finally, I travelled to the Manitoba Museum to access a comparative caribou skeleton when I came across downfalls with VZAP. The terminology I use for identified elements is the same terminology used in VZAP. For example the metapodials are referred to as cannons in VZAP; the adoption of this terminology was intended to reduce any potential confusion between the comparative collection and the faunal assemblage from Mingo Lake.

VZAP is described as “a comprehensive aid to the analysis of osteological remains from northern archaeological (and palaeontological) sites,” (Betts et al. 2011: 755). It was created to replicate a traditional comparative collection with new degrees of functionality only possible through a digital medium (Betts et al. 2011). These functions include a zooming tool and an accurate (within 0.01 mm) 3-D measuring tool that allows for an accurate measurement of small bones or features (Betts et al. 2011: 761). VZAP allows for more accurate identifications than traditional line drawings and photographs

since they usually only depict major features and the general outline of an element (Betts et al. 2011: 756).

## **Quantification**

Quantification is important in zooarchaeological studies (O'Connor 2000: 54). Zooarchaeologists quantify faunal remains so that information such as subsistence practices can be inferred. A higher proportion of a species at one site signifies it is an important resource while element distribution can help interpret butchering practices and mobility strategies. When discussing quantification, zooarchaeologists need to keep in mind the taphonomic processes that are at work at a site (Grayson 1984: 2). These processes can affect the fragmentation ratio of a site and also which portions of the bone are preserved (Grayson 1984: 25). Taphonomic processes are a major reason that teeth are so well preserved in comparison to bone. Teeth are not as susceptible to degradation as bone. Teeth are dense and tend to stand up well to annual freeze-thaw cycles in temperate and Arctic regions, and to sporadic trampling by other large animals and humans. Bone, on the other hand, is porous and is easily affected by the burial process, changes in weather and soil conditions, and finally sporadic trampling from the surface.

The two most widely used counting strategies in zooarchaeological studies include the Number of Identified Specimen (NISP) and the Minimum Number of Individuals (MNI). NISP was the first counting strategy devised to examine faunal remains while MNI was created to address some of the problems associated with NISP.

### Number of Identified Specimen

NISP, at its most basic level, is the count of all bone fragments identifiable to the taxon (Hambleton and Rowley-Conwy 1997: 57; Lyman 1994a: 38). NISP is the simplest method used in quantifying zooarchaeological remains because it is a straightforward count of specimen in a location (Grayson 1984: 17; O'Connor 2000: 54; Ringrose 1993: 125), and it does not require any complicated mathematical procedures to make comparisons (Amorosi et al 1996: 138; Lyman 1994a: 38, 1994b: 100). Even though NISP is considered primary data, it is used to estimate relative frequencies of taxa in a location (Reitz and Wing 2008: 202). NISP is used to help understand subsistence practices by examining relative frequencies of taxon; this will aid in determining which species were exploited for food resources (Lyman 1994a: 48).

One of the problems with using NISP is the way that the term specimen is defined. A specimen is defined as a recovered bone that is complete, fragmented, or containing more than one element that can be identified to a taxonomic category such as a Cervid (Lyman 1994a: 39, 2005: 846; Ringrose 1993: 122). Since NISP counts specimen, a highly fragmented assemblage – like the one described in this study – will have a higher than normal count; one fragmented femur could be represented by three or four specimens (O'Connor 2000: 56; Ringrose 1993: 122, 126). Another problem associated with NISP is the overrepresentation of certain species because their bones are more easily identified than others (Grayson 1984: 21; O'Connor 2000: 56; Ringrose 1993: 125). Some animals (like birds and fish) are underrepresented in NISP counts because their bones do not survive in the archaeological record as well as the bones from large mammals (Grayson 1984: 21; Reitz and Wing 2008: 203). Zooarchaeologists also

need to consider that every animal has different bone counts in their body, which leads to the overrepresentation of animals with high bone counts (Hambleton and Rowley-Conwy 1997: 57; Ringrose 1993: 125). NISP records the composition of an archaeological assemblage but is not a good relative indicator of species composition because of the high fragmentation present at most sites (Hambleton and Rowley-Conwy 1997: 57; Lyman 1994a: 47). Butchering practices also affect the NISP of a site because of the preferential treatment towards certain taxa and their elements by hunter-gatherers (Grayson 1984: 20). NISP is deemed valid when it is describing discrete samples; it is not representative of the whole death assemblage (O'Connor 2000: 55).

Clearly, there are problems associated with the use of NISP in the studies of zooarchaeological assemblages. However, these shortcomings do not mean that this quantification measure should be abandoned (Grayson 1984: 24). Rather, zooarchaeologists must be aware of the inherent biases associated with using NISP especially since this method assumes that the taphonomic processes of a site affect faunal remains in the same way (Grayson 1984: 21). When using NISP for analytical purposes it is imperative that other methods are used in concert with it so as to gain a more accurate understanding of assemblage composition.

### Minimum Number of Individuals

Minimum Number of Individuals (MNI) is the second most popular measurement used in zooarchaeological studies. MNI was created as a response to the downfalls and problems of NISP – such as issues of interdependence (Amorosi et al 1996: 135; Gilbert and Singer 1982: 31; O'Connor 2000: 59). MNI measures the minimum number of

individuals (based on taxa) that are found at a site, in a unit, in a stratum, or in a level (Grayson 1984: 93; Hambleton and Rowley-Conwy 1997: 56). Lyman (2005: 846) defines MNI as the number of individual organisms necessary to account for all the specimens in any given collection. MNI allows for the consideration of the age, sex, and size of the different specimen of an assemblage (Lyman 1994a: 38, 1994b:100, 2005: 846). Specimens are identified to the element, taxa, and side in order to calculate the MNI. Once this information is collected, the sides are compared and the side with the most elements is considered the MNI. For example in an archaeological assemblage, if three left humerii are identified as caribou and two right humerii are identified as caribou then there are a minimum of three caribou represented by the archaeological assemblage. MNI can also be expressed in pair sharing – in this case there are two full caribou and one partial caribou represented in the assemblage (O'Connor 2000: 59).

When using MNI it is difficult to compare sites to one another because of the idiosyncrasies involved with taphonomic processes. MNI is effective when comparing different levels, stratum, and units of a particular site since the same taphonomic processes are at work and will not bias the sample in that sense. The bone counts associated with MNI are independent of one another; MNI does not allow for multiple counts of the same fragmented element (Grayson 1984: 28; Lyman 2005: 847). The degree that the information is aggregated will influence the MNI (Grayson 1984: 34). Units, levels, and stratum will all have different levels of aggregation which is why it is hard to compare site data based on the MNI; MNI is too site specific for valid comparisons across time and space. This same reasoning influences the notion that MNI cannot be used in ratios (O'Connor 2000: 60; Grayson 1984: 94). MNI does not have true

zero point, which is needed to compare ratios (Grayson 1984: 94). MNI is also only an estimate of taxonomic variability; archaeologists may never know the true make up of an assemblage and should not promote MNI numbers as being accurate (O'Connor 2000: 60; Reitz and Wing 2008: 206). Another problem with MNI is that it can be calculated a variety of different ways, two of which I mentioned (Amorosi et al 1996: 138).

Zooarchaeologists must be transparent in their use of MNI for the findings to be applicable for comparisons with other studies.

### **Fracture Patterns**

Throughout the course of this study, I examined each specimen for fracture patterns that could indicate if the Pre-Dorset were extracting marrow from the bone. I characterized the different fracture patterns as being broken, split, split with scars (i.e. percussion notches), split with cracks, oblique, transverse, or spiral. I also identified three other fracture patterns (splintered, grooved, and stepped) but they were relatively rare. A broken fracture pattern is not indicative of marrow extraction; the edges of the bone are rough and come to a peak. A split bone has smooth, flat edges (Outram 2002: 53). A split bone with scarring on it has smooth, flat edges with evidence of percussion notches along one or more edges. The fracture would have originated from these percussion notches. Percussion notches signify human intent to get inside the medullary cavity to gather marrow (Pickering and Egeland 2006: 462). A split bone with cracks also has flat, smooth edges but it has a crack emanating from one of the flat edges of the bone; this kind of fracture pattern was less common. The bones that are split only contain a portion of the shaft and are indicative of marrow extraction.

The middle three fracture patterns (oblique, transverse, and spiral) are all fracture patterns that are oriented on the long axis of the bone (Reitz and Wing 2008: 169). The guide I used was created by experimentally breaking bones using hammerstones (Sadek-Kooros 1975: 140). The three primary fracture types that were created were oblique, transverse, and spiral fractures. Sadek-Kooros (1975) provides a comprehensive guide on how to examine fracture patterns. Since a full-blown fracture analysis is outside the scope of this thesis, I focused on recording types of primary fractures (Fig 5.2.)

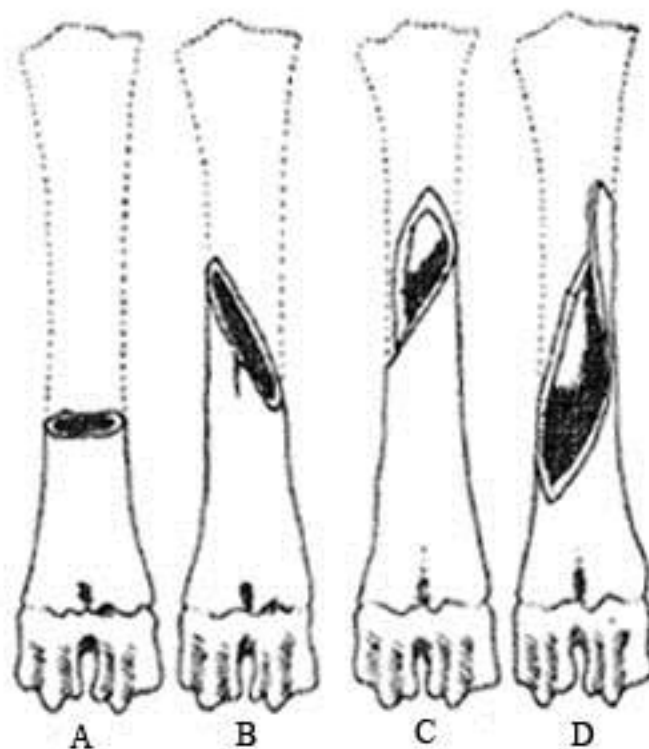


Figure. 5.2. Types of primary fractures: (A) transverse (B) oblique (C) spiral on end of fracture (D) spiral on entire fracture. Modified from Sadek-Kooros 1975: 149.



## **Butchering Practices**

Butchering practices are recorded by the presence or absence of cut marks on faunal remains. I have recorded the placement, the number, cut mark type, and the relative depth (shallow, medium or deep) of the cut marks to determine the different butchering practices that Pre-Dorset hunters used. Cut marks are recognized by the presence of striations. Striations need to be present in order for a mark on a bone to be deemed a cut mark and not a natural modification. Striations are marks made by the fine projections that are found on either edge of a stone tool (Shipman 1981: 365). Striations are very fine marks found along the inside edges of slice marks. Striations will vary in shape and size depending on tool type, application of force and angle of the tool (Fisher 1995: 14).

Cut marks are made while skinning, disarticulating, filleting and extracting marrow (Binford 1981). Each activity is indicated by different cut mark patterns on bone (saw marks, slice marks, scrape marks, chop marks, and percussion marks). The description of each cut mark type is listed below.

Saw marks are manifested in deep grooves on a bone. These deep grooves are created by a sawing motion which presents itself in multiple, closely spaced, parallel cut marks. These cuts show determination and need to be examined as their own separate cut mark (Fisher 1995: 17).

Slice marks can sometimes be confused with tooth scratches. The main distinction between the two is that slice marks contain fine striations while tooth scratches do not (Shipman 1981: 366). Slice marks are elongated, V-shaped grooves that have multiple, fine striations inside of the main groove (Shipman 1981: 365; Shipman and Rose 1983:

64). Slice marks are produced by directing the tool across a bone with the long edge of a tool (Potts and Shipman 1981: 577). An example of slicing would be cutting cake with a knife in one motion.

Scrape marks are a sub-category of cut marks that are defined by Shipman (1981). Scraping marks are found across broad areas of the bone and are manifested in a series of fine parallel striations; the marks are not confined to one main groove (Fisher 1995: 18; Potts and Shipman 1981: 577; Shipman 1981: 369). Bone shavings are also found between the striations associated with scraping activities (Fisher 1995: 19). The scrape marks are created by a tool that is moving perpendicular to the long axis of a bone (Fisher 1995: 18; Potts and Shipman 1981: 577). Activities that create scrape marks include the removing of the periosteum (Binford 1981: 134; Fisher 1995: 18). Sedimentary abrasions can sometimes be confused with scrape marks so care must be taken when distinguishing between the two processes; it should be noted that abrasions will not contain bone shavings (Fisher 1995: 19).

Chop marks are the final sub-category of cut marks to be described. They are made by a heavy blow to a material such as when an axe is used to chop a tree or a meat cleaver to disarticulate joints. Chop marks are often created by a motion perpendicular to bone (Potts and Shipman 1981: 577). Chop marks will have a V-shaped cross section that is generally broad and short (Fisher 1995: 19; Shipman 1981: 366). There are no striations associated with chop marks because the tool is forced into the bone, not across the bone. There will also be pieces of bone fragments found within the mark itself. Chop marks tend to look like elongated ovals in their outline (Shipman 1981: 366). Chop marks

can be confused with unsuccessful percussion marks because of the similar force load and the similar edge shapes of the tools (Fisher 1995: 19).

### **Ageing and Sexing Caribou Remains**

One of the main goals in zooarchaeological studies is to gather information about the age and sex of a faunal assemblage. Age is easier to determine than sex. Age can be determined using teeth, epiphyseal fusion, and metrics. Sex is usually indicated by sexually dimorphic characteristics such as size, and the presence of antlers.

Caribou prove to be a problematic species to age and sex. There are few data published on the epiphyseal fusion patterns of caribou bone (see Table 5.1), this means that zooarchaeologists are left to measure crown height and tooth wear. Caribou are sexually dimorphic meaning that male bones will be relatively larger than females but this is hard to measure in an assemblage that also contains juvenile and adult bones. It should be noted that both bulls and cows have antlers making it even more difficult to distinguish individual sex based on the presence or absence of antlers.

#### Age

To determine the average age at death of the archaeological assemblage, I use several methods. The first examines tooth eruption patterns. Spiess (1979: 73-78) describes mandibular tooth eruption in caribou. Tooth eruption is useful when an assemblage has intact mandibles with deciduous teeth, erupting teeth, or permanent teeth. The eruption of the first mandibular molar is the best indicator of age at death – based on tooth eruption – since it is found to erupt between the end of August and end of October

when calving season begins in May (Spiess 1979: 73). The eruption of the other permanent teeth have too broad an eruption schedule to be overly useful; the second mandibular molar has an eruption window of six months. However, erupting mandibular pre-molars can rule out a death between November and February (Spiess 1979: 73-75). Miller (1974) provides a better description of mandibular tooth eruption in caribou as well as information on wear patterns. Miller (1974) also provides photographs of wear levels at different ages (38-61) to help to determine just how worn a tooth is. Unfortunately most of the teeth from the Pre-Dorset assemblage are loose making it difficult to establish age based on mandibular tooth eruption and wear. It should be noted that I could not find any information on eruption or wear patterns for maxillary teeth.

Morrison and Whitridge (1997: 1097) provide a formula that can be used to determine age based on the crown height of the first mandibular molar. The measurements can only be taken on teeth with an intact root-enamel junction and a complete crown. Two measurements are taken on the teeth (one on each lobe) and the measurements are averaged to provide one final measurement. The measurement is then entered into the regression formula ( $\text{age} = -12.56 * \text{crown height} + 186.97$ ) and an age in month is calculated (Morrison 1997: 66-67; Morrison and Whitridge 1997: 1097). The measurements taken must be precise since an error of one millimetre can affect an age of death by one year (Morrison and Whitridge 1997: 1104). The main problem with this method is that the first mandibular molar is difficult to identify when it is found loose in the archaeological record. Pike-Tay et al (2000) have overcome this problem, however, by creating quadratic regression formulae for the second and third mandibular premolar as well as all three mandibular molars. These formulae are quite complicated and only

accurate when all five teeth – from one side of an individual – are present (Enloe and Turner 2002: 131).

Table 5.1. Compilation of the Available Data on Fusion Rates of Caribou Bone.

Source	Bone	Date of Fusion
Pasda, K., no date	Hind Cannon	3 years of age
Pasda, K., no date	Proximal Phalanx	3 years of age
Pasda, K., 2009	Proximal Ulna	43 to 76 months
Pasda, K. 2009	Distal Ulna	48 to 54 months
Pasda, K. 2009	Radius-Ulna conjunction	12 to 35 months (no specimen between time)
Pasda, K., no date	Scapula	3 years of age
Pasda, K., 2009	Scapula – Tuber	6 to 9 months
Pasda, K. 2009	Distal Humerus	43 to 76 months
Pasda, K. 2009	Proximal Radius	6 to 9 months
Pasda, K. 2009	Distal Radius	36 to 54 months
Pasda, K. 2009	Distal Fore Cannon	12 to 18 months
Pasda, K. 2009	Pelvis (Acetabulum)	6 to 18 months
Pasda, K. 2009	Proximal Femur	42 to 47 months
Pasda, K. 2009	Distal Femur	36 to 47 months
Pasda, K., no date	Atlas	4 years of age
Stenton, D. 1989, Pasda, K. 2009	Distal Tibia	1.5 years of age, 18 to 42 months
Stenton, D. 1989, Pasda K. 2009	Proximal Tibia	3-5 years of age, 18 to 42 months
Pasda, K. 2009	Distal Hind Cannon	18 months
Pasda, K. 2009	Proximal Phalanx	7 to 35 months
Pasda, K. 2009	Proximal Epiphysis of Medial Phalanx	6 to 9 months
Pasda, K. 2009	Sternum	Older than 138 months
Pasda, K. 2009	Sternal Rib Ends	42 to 54 months
Pasda, K. 2009	Cervical Vertebra	4 to <14 years
Pasda, K. 2009	Thoracic Vertebra	4.5 to <14 years
Pasda, K. 2009	Lumbar Vertebra	4.5 to 14 years

## Sex

As noted previously, caribou are sexually dimorphic meaning that male caribou are relatively larger than females. The mandible is a common element that is used to distinguish between male and female caribou in the archaeological record (Miller 1974; Morrison, 1997; Morrison and Whitridge 1997; Spiess 1979). The mandibular measurements (see Figure 5.3) include mandibular length (Miller 1974: 36; Spiess 1979: 82), length of the mental foramen to the posterior margin of the third molar alveolus (Spiess 1979: 82), length of the mental foramen to the posterior margin of the third molar alveolus combined with the maximum height of the body (Morrison 1997: 73; Morrison and Whitridge 1997: 1095), and diastema length (Miller 1974: 36; Morrison and Whitridge 1997: 1095; Spiess 1979: 82). Unfortunately, it is extremely rare to find a mandible in the archaeological record that is complete enough to undertake these measurements.

Cannon measurements are also be used to determine the sex of a caribou (Grønnow et al 1983; Morrison 1997; Stenton 1989, 1991a; Spiess 1979). The height and breadth of the distal condyles of the cannons are measured and then placed on a scatter plot. A range of measurement is not given so we are left to place data on pre-existing scatter plots (Morrison 1997: 75). The chosen scatter plots originate from Stenton (1991a) Figures 9 and 10, and they describe the distributions of male and female fore and hind cannons. There are also problems with using metapodials to determine sex. The sample sizes presented by Grønnow et al (1983) and Stenton (1989, 1991a) are quite small making it difficult to form concrete conclusions based on their respective data sets. In this study, cannon measurements are taken on complete distal epiphyses that have been

assigned to a specific side and established as either a fore or hind cannon. Unfused epiphyses are not measured since they will skew the numbers due to their juvenile nature.

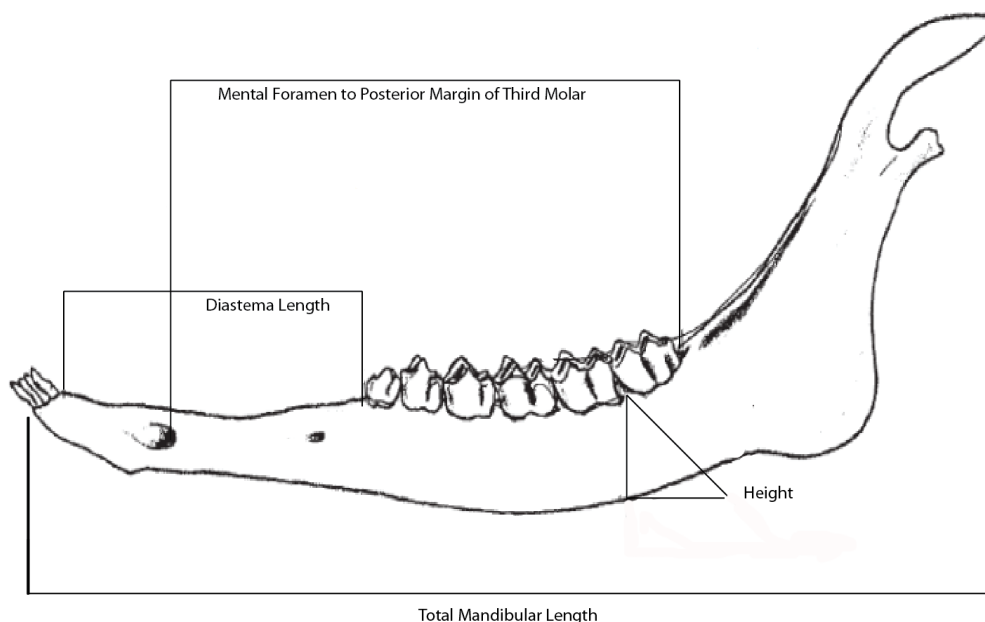


Figure 5.3. Various mandibular measurements used to infer sex. Modified from Morrison and Whitridge 1997: 1095.

## Summary

In this chapter, I have outlined how the data acquired through my analysis will be organized. I have defined the terms used that are particular to my study and discussed the two counting strategies (NISP and MNI) I will use to quantify the faunal remains in the assemblages from LdFa-1, LdFa-12, LdFa-13, and LdFa-14. I have described how activities including marrow extraction and butchering can be identified. Finally, I have addressed some of the challenges relating to ageing and sexing animals present within an archaeological assemblage comprised primarily of caribou bone.

## Chapter 6 – Results and Interpretations

This chapter presents the results of the faunal analysis. The results are discussed by site to facilitate comparisons among them, and to others not included in this analysis but described previously at the regional level. The data, including NISP, MNI, and elemental frequencies, are summarized in associated tables. Using these data, assessments of site function are made. I also include tables that outline butchering and fracture patterns as well as instances of bone burning to assess how the Pre-Dorset were exploiting caribou remains. My attempts to age and sex the faunal remains from the Mingo Lake sites are also detailed. I present my data interpretations at the end of each section and conclude the chapter with a general interpretation of all four Pre-Dorset faunal assemblages from Mingo Lake.

Before describing each individual site, I begin with a summary overview of the entire study assemblage. In total, 18,710 faunal remains were sorted and identified from the assemblages of Pre-Dorset remains excavated from Area 4 of LdFa-1 and from LdFa-12, LdFa-13, and LdFa-14. The total faunal assemblage was divided into Identifiable Mammal (6923), Unidentifiable Mammal (11620), Bird (144) and Fish (23). Mammal bones are dominant at all four sites with 60% of the mammal remains classified as unidentifiable. The high proportion of unidentifiable remains is due to taphonomic processes such as the thawing and freezing of the soil as well as scavenger activities. Human agents are also a factor in the high percentage of unidentifiable remains; there is an abundance of evidence indicating that bones were being intentionally fractured to access bone marrow. A detailed overview of the entire assemblage can be found in



Appendix A. This appendix contains a detailed elemental breakdown (of all identifiable remains) as well as information on the siding of all identifiable elements.

### **LdFa-1 Area 4: Results**

LdFa-1 Area 4 is the largest Pre-Dorset faunal assemblage included in this study. Given the volume of material from this site, I divide my discussion of it into three sections (see Figure 6.1). The first section includes units that begin with the letters A, B, C, D, and E. This section includes a large stone circle that is inferred to be a tent ring. The second section includes units beginning with F and G. The third and final section includes units that begin with the letters H, I, J, and K. This section contains a tightly constructed stone circle whose function is undetermined. Dividing Area 4 into three sections facilitates intra-site comparisons among the units to identify individual activity areas.

### Species Representation

To gain an overall sense of how the Pre-Dorset were using subsistence resources at this site, it is necessary to break down the study assemblage into faunal categories. Table 6.1 presents the frequencies of identifiable mammal, unidentifiable mammal, fish, and bird remains from LdFa-1 Area 4.

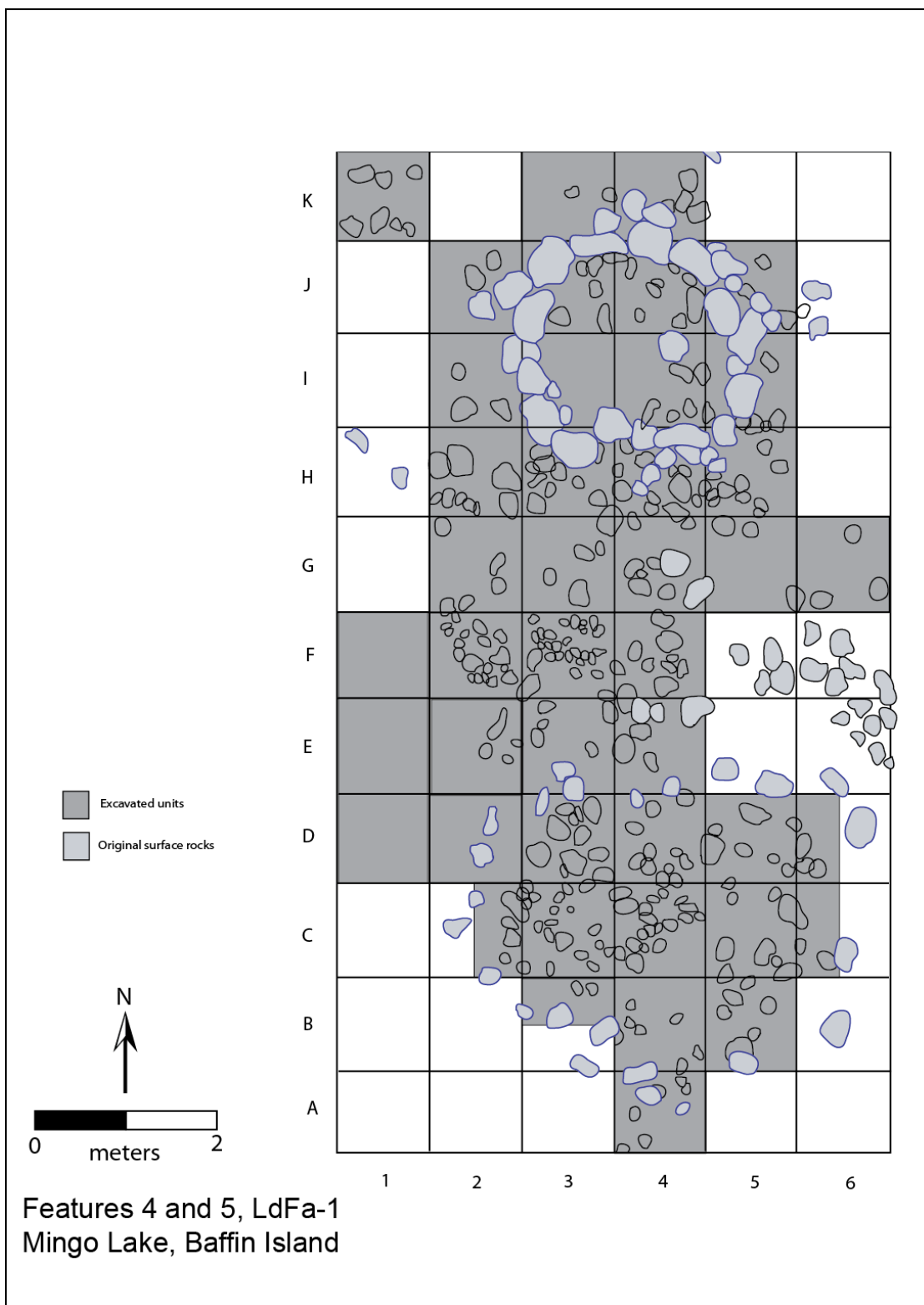


Figure 6.1. Map of LdFa-1 Area 4 (modified from Milne 2008).

Table 6.1. Classes Represented at LdFa-1 Area 4 (N=16, 818).

Category	Frequency
Identifiable Mammal	6344
Unidentifiable Mammal	10341
Bird	111
Fish	22

Unidentified mammal remains dominate the faunal assemblage from LdFa-1 Area 4. This is due to the high degree of fragmentation at the site. The average weight of the unidentified remains is 0.09 grams. Figure 6.2 presents an example of the small unidentifiable remains that are abundant at the site. It should be noted that there are nine bulk soil bags that inflate the unidentified mammal count as well as the fragmentation rate. If the 5180 bones weighing 200.19 grams are subtracted from the overall unidentified mammal tally, it leaves 5161 bones that collectively weigh 749.97 grams. This gives an average weight of 0.15 grams. This is still a small average bone weight considering the majority of the identifiable remains in the archaeological assemblage are caribou. The average weight indicates that there is a high degree of fragmentation present at the site.

Fragmentation can be caused by natural processes (such as trampling) or by human agents in the form of marrow extraction or butchering. The identifiable remains at LdFa-1 Area 4 show signs of intentional fracturing (as discussed in more detail later in chapter) and of trampling across all three classes present. The trampling would have been caused by both migrating humans and migrating caribou. LdFa-1 is a large multi-component site that was used by the Pre-Dorset, Dorset, and Thule Inuit (Milne et al 2012: 270). It is highly likely that human foot-traffic throughout the site was frequent

thus contributing to localized trampling of the remains. Moreover, Milne (2008: 9) describes the presence of three well-defined caribou paths running east to west across LdFa-1, which would further amplify fracture patterns associated with trampling. While these sources undoubtedly contributed to bone fracture patterns, the high frequencies observed are more likely the result of intentional fracture relating to extractive activities for marrow and bone grease production



Figure 6.2. Example of the fragmentation at the Mingo Lake Sites.

It is also important to examine the faunal structure of the identified mammal, bird and fish categories. The frequencies of each category provide insights on why Pre-Dorset hunters may have exploited certain fauna over others. Table 6.2 presents the frequencies of all specimens in the identified mammal, bird, and fish class categories.

Table 6.2 indicates that the Pre-Dorset relied heavily on caribou at LdFa-1 Area 4. Caribou accounts for 26% (N=6477) of the identified faunal assemblage while herbivore remains accounts for 10% (N=6477) of the assemblage and large mammal remains account for 57% (N=6477) of the identifiable faunal assemblage. In total these three categories account for 93% (6477) of the identifiable mammal, bird, and fish remains.

Table 6.2. Identification of Remains to Species or Animal Size for LdFa-1 Area 4 (N=6477).

Animal or Species Size	Frequency
Caribou	1682
Fox or Wolf	7
Canine	20
Herbivore	672
Large Mammal	3672
Medium-Large Mammal	163
Medium Mammal	89
Small Mammal	6
Unknown Mammal	33
Snow Goose	34
Large Bird	13
Medium-Large Bird	32
Medium Bird	13
Unknown Bird	19
Arctic Char	9
Unknown Fish	13

In this study, large mammal and herbivore remains are assumed to be caribou. As detailed in Chapter Two and Chapter Four, there is no other large mammal that is consistently exploited in the area of Mingo Lake. Even though there is polar bear (*Ursus maritimus*) in the area (Milne 2005: 6), there are no identifiable remains attributed to the polar bear in any of the four assemblages. I also attribute herbivore remains to caribou

since the only other large herbivore in the Arctic is the musk-ox. Musk-oxen live in the High Arctic and are not typically found on Baffin Island (Jacobs 1989: 50). As such the herbivore teeth that I have identified most likely belong to caribou. Examples of herbivore teeth are found in Figure 6.3. The large mammal and herbivore categories were created because it was not possible to concretely identify an element as caribou due to a lack of distinguishing features.



Figure 6.3. Examples of Herbivore Teeth from LdFa-1 Area 4.

Snow geese and Arctic char are seasonally available in the area as they are migratory animals that use the Large Lakes Region as nesting and spawning grounds, respectively. Bird remains tend to be better preserved in the archaeological record than fish remains. Fish remains are extremely fragile and do not preserve well in many circumstances. Bird remains are more durable than fish remains; however, it is also possible that fish were not exploited at Mingo Lake thus accounting for their absence in this assemblage. Arctic char are available in the region between May and August; by

early August the Arctic char have already begun their migration into the Hudson Strait via Amadjuak Bay (Soper 1928: 116). There are no ethnographic accounts of Inuit fishing at Mingo Lake. Nettilling Lake is the location where most of the fishing took place due to its large population of Arctic char during spawning season (Soper 1928: 116; Stenton 1989: 93). Fish remains at LdFa-1 are most abundant around the tight stone circle of LdFa-1 (units H-K). The remains of one exceptionally well preserved Arctic char were found in units K1 and K3; these units are located behind the tight stone circle.

The snow goose remains are clustered in and around the stone tent ring (units A-E) as well as in the area between the two stone circles (units F-G). The bird remains found in the remaining units are shaft fragments that have only been classified to a specific size category. The MNI of snow goose at LdFa-1 Area 4 is two. The elements are varied but most portions of the body seem to be represented. The wing bones are especially prevalent indicating that whole geese were being brought into LdFa-1 Area 4.

According to the ethnographic record, the birds' feathers may have been exploited for decoration on clothing (Boas 1974: 561). However, the small MNI of the snow geese leads me to believe that they were being brought into the area. The Mosquito Ridge Site (MaDv-11; Milne and Donnelly 2004) yielded an assemblage dominated by snow geese remains suggesting that the area around Burwash Bay in Nettilling Lake was used to strategically exploit snow geese particularly during the annual moult. Mosquito Ridge is located next to the snow geese nesting grounds at the Great Plains of Koukdjuak. The snow geese would have been hunted during the moult since they were unable to fly. The annual moult occurs in early July (Milne and Donnelly 2004: 94; Soper 1928). At this time of the year the caribou are not in peak condition due to warble fly infestations

(Stenton 1989: 55). By the time the caribou were in peak condition, and being hunted at the Mingo Lake Sites (August through to October) the snow geese would have already left the Large Lake Region. As such the lack of snow goose remains is not that surprising at LdFa-1 Area 4.

### Elemental Distribution

Information relating to elemental frequencies provides insights on site use and preferential exploitation of elements. Table 6.3 provides the elemental distribution, by species, of the identified mammal remains from LdFa-1 Area 4. These data indicate a noticeable preference for certain caribou elements. Teeth are the most commonly identified element in the faunal assemblage. Unfortunately this adds little interpretive value to the study since teeth are more likely to be preserved in the archaeological record than other elements due to their structure. Teeth are extremely dense and non-porous resulting in more consistent preservation. Teeth are also not used for activities, outside of decoration (Boas 1974: 560), so they are normally just tag-along elements when transporting the mandibles and crania of caribou. A high frequency of teeth could mean that the Pre-Dorset were preferentially using mandibles and crania for specific purposes. The hides from caribou heads are used to make hoods for children (Boas 1974: 557), which could indicate why the teeth are so abundant. Antler was exploited by the Pre-Dorset which could also be why there is a high proportion of teeth at LdFa-1 Area 4. The Pre-Dorset could have brought the entire crania to LdFa-1 Area 4 for the purpose of harvesting antler (McCartney and Helmer 1989: 149). Crania and mandibles are also transported back to habitation sites due to the presence of the brain and facial muscles



which were preferred food resources (Spiess 1979: 292). Mandibles are exploited for marrow since there is a large cavity of marrow directly underneath the teeth (Spiess 1979: 293). In total, the different features of the crania and mandible (including teeth and antler) account for 29% (N=1685) of the identified caribou remains at LdFa-1 Area 4.

Ribs make up 10% (N=1685) of the caribou assemblage from LdFa-1 Area 4. Ribs are considered a high yield element due to the intercostal muscles that provide a large amount of meat. It would be cumbersome to carry both the meat and the bones of the ribs back to the coast so it would make sense that the meat would have been butchered and then the bones left behind at the interior sites. Ribs may also have been the meat eaten in the interior. This inference is tested later when element quantifications and butchering evidence identified among all three sections of the LdFa-1 Area 4 assemblage are compared.

Cannons (fore and hind) account for 19% (N=1685) of the identified caribou remains, which is notably high. One reason for this is because the cannons are easy to identify; they have distinct ridges on both the anterior and posterior sections of the bone (Figure 6.4a). The distal epiphysis is also easily recognizable since it resembles a spool (Figure 6.4b). The ease of identification could be a reason for the high number of cannons present in the assemblage. However, a more plausible reason is that they were preferentially exploited as a food resource. The lower limbs bones (i.e. cannons, carpals, tarsals, and phalanges) from caribou fore and hind quarters are overrepresented in the archaeological assemblage at 42% (N=1685). The bones from the lower limbs tend to be low yield elements which means that they do not provide much in the way of sustenance; they contain very little meat and little marrow (outside of the cannons that have large

medullary cavities). Their proportionately high frequencies at LdFa-1 Area 4 could mean that they were being left behind by the Pre-Dorset who may have preferred to take high yield elements back with them to the coast or to another secondary location for later consumption. A high number of the lower limb bones could also indicate intensive marrow extraction at the site. The Pre-Dorset would have exploited elements such as the humeri, femora, and tibiae for their marrow, and, in the process, destroyed all features that would have been used in identification.

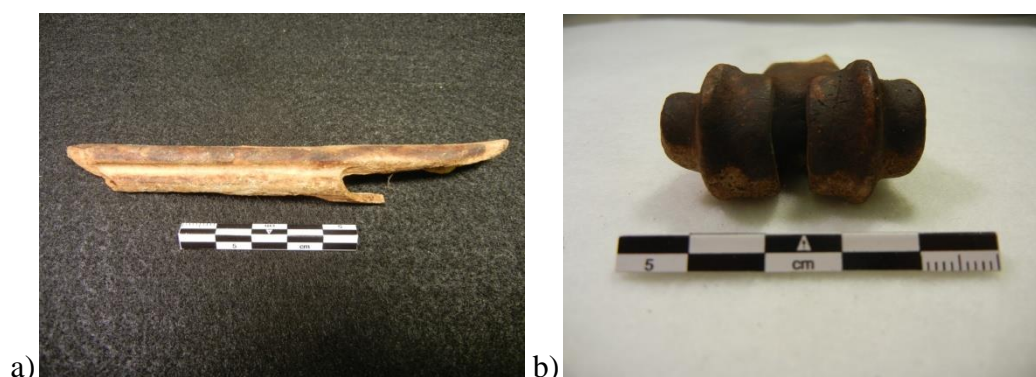


Figure 6.4. Photographs of a Hind Cannon Shaft (a) and Distal (b) portions to illustrate easy identifiability.

Limb bones dominate the large mammal, medium-large mammal, and medium mammal categories. This is likely due to the marrow extraction patterns utilized by the Pre-Dorset. There is no one element that was exploited more than the other in the fox or wolf category, and the canine category. Remains from the *Canis* family are uncommon at LdFa-1 so they were not a significant subsistence resource exploited by the Pre-Dorset.

Table 6.3. Elemental Frequencies for Identified Mammals from LdFa-1 (N=6344).

Element	Caribou	Fox or Wolf	Canine	Herbivore	Large Mammal	Medium-Large Mammal	Medium Mammal	Small Mammal	Unknown	Total
Crania	68				47	41	2	1	5	164
Mandible	72					1				73
Teeth	326		2	672						1000
Antler	17									17
Vertebra	20		2		3	5	6	1		37
Cervical Vertebra	14		2							16
Thoracic Vertebra	29	1	1							31
Lumbar Vertebra	5	1	2							8
Caudal Vertebra	2									2
Pelvis	34	1	4			2	1			42
Sacrum	2									2
Sternum	4									4
Ribs	174	4	2		8	1	10		1	200
Scapula	16									16
Clavicle	1									1
Humerus	7									7
Radius	30									30
Ulna	15									15
Radio-Ulna	67									67
Carpals	73									73
Fore Cannon	45									45
Proximal Phalanx (Manus)	23									23
Proximal Lateral Phalanx (Manus)	5									5
Medial Phalanx (Manus)	5									5
Femur	5		1							6
Patella	2									2
Tibia	19									19
Fibula	3		1							4
Tarsals	65									65
Hind Cannon	222									222

Element	Caribou	Fox or Wolf	Canine	Herbivore	Large Mammal	Medium-Large Mammal	Medium Mammal	Small Mammal	Unknown	Total
Proximal Phalanx (Ped)	20									20
Proximal Lateral Phalanx (Ped)	16									16
Medial Phalanx (Ped)	2									2
Second Proximal Phalanx (Ped)	1									1
Hyoid	4		1							5
Cannon	44									44
Metapodial	3									3
Phalanx	24		1		3		1			29
Proximal Phalanx	75		1							76
Proximal Lateral Phalanx	1									1
Medial Phalanx	64									64
Second Phalanx	2									2
Second Proximal Phalanx	4									4
Distal Phalanx	2									2
Fifth Distal Phalanx	2									2
Flat Bone					383	74	20		11	488
Irregular Bone	20				41	4	5		1	71
Limb Bone	2				1806	29	30	1		1868
Long Bone	26				1363	4	14	3	1	1411
Epiphysis						2				2
Shaft Fragment					18				14	32
<b>Total</b>	<b>1682</b>	<b>7</b>	<b>20</b>	<b>672</b>	<b>3672</b>	<b>163</b>	<b>89</b>	<b>6</b>	<b>33</b>	<b>6344</b>

### Quantitative Measurements

The quantification measurements permit comparisons among all four sites included in this study. As described in Chapter Five, I will examine the NISP and MNI calculated for each site. These counts provide insights on how the sites were used by the Pre-Dorset. It was possible to compile counts for caribou only since they are the only identifiable mammal found in sufficient abundance at all four sites. I cannot use the counting strategies to compare the mammal size classifications due to the lack of elemental information associated with these categories. The two quantitative counts will be described for each section of LdFa-1 Area 4 as well as for the whole site (Table 6.4); splitting LdFa-1 Area 4 into sections will help me to infer if the different areas of the site were being used for different purposes.

Table 6.4. NISP and MNI Counts for LdFa-1 Area 4.

LdFa-1 Section	NISP	MNI
A-E	872	16
F-G	417	5
H-K	393	5
Entire Site	1682	23

The MNI of LdFa-1 Area 4 section A-E is 16 caribou based on the presence of 16 right distal hind cannons. The MNI of section F-G is five caribou based on the presence of five right acetabulums. The acetabulum is a part of the pelvis. The MNI of section H-K

is five based on the presence of five right distal hind cannons and five left proximal radii. Finally, the total MNI of LdFa-1 Area 4 is 23. This count is based on the presence of 23 right distal hind cannons.

### Bone Modifications

Bone modifications are a good indicator of site function since high frequencies of butchering, fracturing or burning can indicate activity areas. Different activities will have different archaeological signatures. For example, a site that has high frequencies of cut marks indicates that butchering was the main activity whereas high frequencies of fracture patterns suggest intense marrow extraction.

### *Butchering*

Butchering is an important process where meat is removed from a bone in order to make it easier to consume and to transport (Binford 1978: 60; Reitz and Wing 2008: 126). Butchering is represented in the archaeological record via cut marks. As outlined in Chapter Five, there are four types of cut marks that I recorded for the archaeological assemblages. They are slice marks, scrape marks, chop marks and saw marks. Each type of cut mark is associated with a different activity. For example, a scrape mark commonly occurs when the periosteum is removed from the outer portion of a bone to make it easier to extract marrow and chop marks tend to be found on areas of the bone where it is too difficult to slice through the meat, such as around the shoulder or pelvis (Fisher 1995: 18-19). Chop marks are also commonly found when the carcass is dried out or frozen (Fisher 1995: 19). The location of a cut mark is indicative of certain activities such as

disarticulation (marks along the ends of long bones), skinning (marks on the carpal, tarsals, and metapodials) and defleshing (marks occurring on the shafts; Braun et al 2008: 1222). Table 6.5 lists the frequency of cut marks at LdFa-1 Area 4. The table includes the type of cut mark, its depth, and location.

Slice marks are the most frequently identified cut mark at LdFa-1 Area 4. They are regularly found on the shafts of the long bones of large mammals indicating that flesh was being removed from the bone. Fleshing could occur because it made the meat easier to transport; it also easier to cure and preserve meat once it is off the bone. Of the identified caribou remains, cut marks are commonly found on the lower limb bones (i.e. cannons and phalanges). The presence of cut marks along the lower limbs bones reveals that the Pre-Dorset skinned caribou for their hides. This supports the idea that the Pre-Dorset were utilizing caribou hides for clothing, blankets, and tents (Burch 1972: 343; Stenton 1989: 55, 65). There is one instance of disarticulation occurring at LdFa-1 (a chop mark on the glenoid fossa of a scapula); however, the lack of disarticulation marks leads me to believe that the primary processing of caribou occurred at another place.

### *Fracturing*

As noted previously, there is a high degree of fragmentation at LdFa-1 Area 4. Table 6.7 presents the fracture patterns for the entire LdFa-1 Area 4 assemblage. Only the identifiable mammal group is discussed because it is the only grouping with discernible human made fracture patterns; the hollow, fragile structure of bird bone makes it difficult to determine human made fracturing from natural trampling while all the fish bone is considered broken. The fracture patterns were not recorded for the unidentified mammal

category because the unidentified mammal remains could not be sorted into a specific species or element category making it difficult to identify human intent to fracture bones. Finally, the fracture patterns of teeth were not recorded as they were all broken. Adding the fracture pattern information for bird, fish, unidentified mammal, and teeth into my fracture pattern analysis would skew my data by inflating the number of fractured and broken bones in relation to the other interpretive categories discussed for each site.

McCartney and Helmer (1989: 149) detail the fracture patterns from three sites from the North Devon Lowlands. Caribou bones are almost completely destroyed leaving behind only the shafts. There are impact fractures and longitudinal breaks along the shafts indicating that marrow was harvested. Since McCartney and Helmer's (1989:149) assemblage also contained seal, they were able to confirm that the Pre-Dorset were not exploiting seal bones for marrow; most fracturing of seal bone was due to natural process. They also found a high proportion of fractured metapodials (cannon). This is likely attributed to observations that marrow from metapodials and phalanges was preferred over the marrow of other bones (Binford 1978; Jin and Mills 2011: 1808; McCartney and Helmer 1989: 149). The marrow from inside the metapodials, phalanges, and tibia were preferred because they contained higher percentages of oleic acid. Oleic acid allows marrow to melt in your mouth which is a property the Nunamiut peoples look for in bone marrow (Binford 1978: 23-24; Jin and Mills 2011: 1807).



Table 6.5. Frequency of Butchering Marks from LdFa-1 Area 4 (N=43).

Cut Mark Type	Depth	Animal Type	Element	Part	Frequency
Slice	Shallow (barely visible but can be noticed by touch)	Caribou	Calcaneus	Shaft	2
			Fore Cannon	Shaft	2
			Hind Cannon	Shaft	2
			Medial Phalanx	Distal	2
				Proximal	1
			Rib	Shaft	1
		Sternum	Body	1	
		Large Mammal	Flat Bone	Shaft	1
			Limb Bone	Shaft	5
			Long Bone	Shaft	23
		Medium-Large Mammal	Limb Bone	Shaft	1
		Medium Mammal	Long Bone	Shaft	1
		Unknown	Rib	Shaft	2
	Shaft		Shaft	1	
	Medium (visible on the bone surface, does not enter bone very far)	Caribou	Cannon	Shaft	3
				Proximal Shaft	1
			Hind Cannon	Shaft	6
				Proximal Shaft	1
			Medial Phalanx	Proximal Shaft	2
			Proximal Phalanx	Distal Shaft	4
			Radio-Ulna	Shaft	1
			Rib	Shaft	7
				Neck	1
Sternum			Body	1	
Thoracic Vertebra			Inferior Articular Facet	2	
Long Bone			Shaft	1	
Large Mammal		Flat Bone	Shaft	1	
		Limb Bone	Shaft	7	
		Long Bone	Shaft	26	
		Rib	Shaft	1	
		Shaft Fragment	Shaft	1	
Medium-Large Mammal		Long Bone	Shaft	1	

Cut Mark Type	Depth	Animal Type	Element	Part	Frequency
Slice	Medium	Unknown	Shaft Fragment	Shaft	1
	Deep (Visible on the bone surface and cuts noticeably into the bone)	Caribou	Distal Tarsal 2 and 3	Body	1
			Rib	Shaft	2
			Thoracic Vertebra	Inferior Articular Facet	1
		Large Mammal	Flat Bone	Shaft	5
			Irregular Bone	Body	1
			Limb Bone	Shaft	6
			Long Bone	Shaft	8
		Medium Mammal	Flat Bone	Shaft	1
			Limb Bone	Shaft	3
Unknown	Unknown	Shaft	1		
<b>Total Slice</b>					<b>142</b>
Scrape	Shallow	Large Mammal	Long Bone	Shaft	5
			Shaft Frag	Shaft	1
	Medium	Caribou	Cannon	Proximal Shaft	1
			Radius	Shaft	1
			Radio-Ulna	Shaft	1
	Large Mammal	Long Bone	Shaft	3	
<b>Total Scrape</b>					<b>12</b>
Chop	Shallow	Large Mammal	Long Bone	Shaft	1
	Medium	Caribou	Long Bone	Shaft	3
			Scapula	Glenoid Fossa	2
			Rib	Shaft	1
		Large Mammal	Flat Bone	Shaft	2
			Long Bone	Shaft	12
	Deep	Large Mammal	Crania	Body	1
			Limb Bone	Shaft	2
			Long Bone	Shaft	7
Unknown	Unknown	Fragment	Shaft	1	
<b>Total Chop</b>					<b>32</b>
Saw	Deep	Large Mammal	Long Bone	Shaft	1
<b>Total Saw</b>					<b>1</b>
<b>Total Cut Marks</b>					<b>187</b>

Bone grease also had the potential to be exploited by the Pre-Dorset. Bone grease is collected by boiling the broken epiphyses in water; the grease is then collected from the surface and consumed (Binford 1978: 157; Prince 2007: 4). There are two types of bone grease, white and yellow. The difference in the two types of bone grease is the amount of oleic acid it contains. White grease contains higher concentrations than yellow grease and is, therefore, more desirable. White grease is typically found in appendicular portion of the skeleton (i.e. the epiphyses of the long bones) while yellow grease is typically located in the axial skeleton (Binford 1978: 32; Prince 2007: 3). The process of marrow extraction and bone grease rendering creates highly fragmented assemblages (Prince 2007: 4). The lack of epiphyses at LdFa-1 Area 4 – as well as the LdFa-12, LdFa-13, and LdFa-14 – does not allow for an in-depth discussion of bone grease rendering from the epiphyses; therefore, the discussion of fracture patterns will focus on marrow extraction from shaft fragments.

The assemblage from LdFa-1 Area 4 contains high proportions of split bone. In total, there are 2,859 individual bones that exhibit evidence of splitting, splitting with impact scars, or splitting with associated bone cracks. This signifies that intensive marrow extraction occurred at the site. There are high frequencies of fore and hind cannons displaying fracture patterns; this is likely because they contain better, more desirable marrow.

Table 6.6. Total Fracture Pattern Frequency for LdFa-1 Area 4 (N=5344).

Fracture Pattern	Caribou	Fox or Wolf	Canine	Large Mammal	Medium-Large Mammal	Medium Mammal	Small Mammal	Unknown	Total
Broken	677	7	14	1137	158	76	6	30	<b>2105</b>
Split	174		2	1287	3	9		3	<b>1478</b>
Split/Scars	156			1197		4			<b>1357</b>
Split/Crack	4			41	1				<b>46</b>
Oblique	100		1	4					<b>105</b>
Spiral	78			3					<b>81</b>
Transverse	39			1					<b>40</b>
Splinter	2								<b>2</b>
Grooved	1								<b>1</b>
Epiphysis	33			1	1				<b>35</b>
Whole	92		1	1					<b>94</b>
<b>Total</b>	<b>1356</b>	<b>7</b>	<b>18</b>	<b>3672</b>	<b>163</b>	<b>89</b>	<b>6</b>	<b>33</b>	<b>5344</b>

Phalanges were also heavily exploited by the Pre-Dorset at LdFa-1 Area 4. Of the identifiable phalanges, 65% (N=252) show signs of intentional fracturing. This seems odd due to the difficulty in extracting marrow from such small elements; the exploitation of phalanges for their marrow is most often associated with resource scarcity (Jin and Mills 2011: 1799). However, Jin and Mills (2011) undertook an investigation into the use of marrow from inside phalanges. They found that marrow from the phalanges was exploited even in times of abundance due to the quality of the marrow, not the quantity (Jin and Mills 2011: 1807).

It makes sense that necessity, not resource scarcity, led the Pre-Dorset to exploit all the marrow that they could. The trek from the interior back to the coast would have been a long journey with potentially unpredictable resources available along the way. Bone marrow provides an easy food source to consume on such a long distance journey

since it packs easily and does not require extensive preparation methods for consumption. In the late summer and fall months, the Pre-Dorset likely subsisted largely on caribou meat and they may have supplemented the diet at that time with marrow since the nutrients it provides are not found in meat. Marrow would also have been an ideal food to consume on the migration back to the coast, and, perhaps most importantly, once they got there, marrow may have been eaten while waiting for the sea ice to form.

### *Burning*

The burning of bone can result from accidental or purposeful activities. Accidental burning occurs when bone is burnt during the cooking process. Purposeful activities include burning bones for fuel or burning them for disposal purposes. Bone can be burnt during cooking or by accidental contact with a hearth but the bone would not heat up enough to crack into the tiny pieces such as those found in the archaeological assemblages from Mingo Lake. In instances of accidental burning during cooking, the bone becomes discoloured but is never completely calcined (Stiner et al 1995: 235). Calcined bone is the greatest indicator that the burning of bone occurred at a site (Figure 6.5). Calcined bone can be either be white in colour, exhibit a greyish blue hue, or resemble charcoal. Calcined bone tends to feel chalky and quite often transfers its colour onto your hands. This is an effective way to distinguish sunbleached bone from white calcined bone. The proportion of fully calcined bone, to partially calcined bone, to charred bone indicates whether burning bone was purposeful or accidental. The higher the proportion of calcined remains, the higher the probability that burning bone was

purposeful (Mentzer 2009: 54; Stiner et al 1995: 234-235). Table 6.7 lists the frequency of burning that took place at LdFa-1 Area 4.



Figure 6.5. Examples of Burnt Bone from LdFa-1 Area 4.

Table 6.7. Number of Burnt and Not Burnt Remains from LdFa-1 Area 4 (N= 16,818).

Area	Burn Status	Identifiable Mammal	Unidentifiable Mammal	Bird	Fish	Totals
A-E	Burnt	47	932	0	0	979
	Not Burnt	2290	2206	43	4	5244
F-G	Burnt	247	4105	0	2	4354
	Not Burnt	1481	1293	24	1	2799
H-K	Burnt	13	13	0	0	68
	Not Burnt	1566	1762	44	15	3379
<b>Total Site</b>	<b>Burnt</b>	<b>307</b>	<b>5092</b>	<b>0</b>	<b>2</b>	<b>5401 (32%)</b>
	<b>Not Burnt</b>	<b>6037</b>	<b>5249</b>	<b>111</b>	<b>20</b>	<b>11417 (68%)</b>

In the case of LdFa-1 Area 4, it appears that bone was being purposefully burnt. There are 5401 burnt specimen out of a total of 16818 specimen (or 32%) found at LdFa-1 Area 4. The majority of the burnt bone was found in the units between grid letters F and

G (nine units total). Of the burnt bone from LdFa-1 Area 4, 94% (N=5401) is attributed to the unidentifiable mammal category. This indicates that the Pre-Dorset at LdFa-1 Area 4 were either using burning as a disposal method, or more likely bone was being used as a fuel source (Reitz and Wing 2008: 132). Since section F-G is located between the two stone circles it is possible that a bonfire existed in the area in order to dispose of bone. Burnt bone has a horrendous smell so it would make sense that burning bone would take place outside of potential habitation features. The burning of bone could also have been used as a smudge to keep the bugs away from the activity areas while also providing a source of fuel for the campfires since wood is scarce in the Arctic. Wood is needed to start a fire but once a fire has been lit, bone can be used to maintain the fire heat and flames of a fire (Théry-Parisot et al 2005: 53).

Bone can be used as a fuel source in either its complete state or in a fractured state. Whole elements provide longer lasting fires while fractured elements do not burn as long. Burning whole elements allows for the slow release of grease into the fire; bone grease is needed to keep a fire burning. Among fractured elements, marrow or grease is released faster into the fire and thus is consumed more rapidly as the fire burns. Because of this, fractured bones have to be added more regularly to maintain the fire. When complete elements are burned, the release of marrow or grease is slower thus the fire burns slower and longer (Théry-Parisot et al 2005: 54-55). Bone ends are preferred elements to burn as they contain more bone grease than shafts do (Théry-Parisot et al 2005: 55). As such, the lack of epiphyses at LdFa-1 Area 4 could be explained by using bone as a fuel source. Shafts are dominant in the non-burnt portion of the assemblage at LdFa-1 Area 4; as such the missing epiphyses can be explained by their use in the hearths

of the Pre-Dorset peoples. A future investigation is needed to determine the proportion of epiphyses to shafts within the burnt assemblage. Results of this would determine more definitively whether bone at LdFa-1 Area 4 was burnt as a fuel source or whether bone was burnt for disposal purposes, or perhaps both.

### Age and Sex Structure

There are instances of both juvenile and adult caribou present at all four sites. I discuss the results of the first mandibular molar measurements as well as the results of the analysis of epiphyseal fusion. Thereafter, I examine the sex of the assemblages by measuring the distal ends of the metapodials.

### *Age*

I was able to identify four mandibular first molars and 66 elements that permitted an examination of epiphyseal fusion data within the archaeological assemblage at LdFa-1 Area 4. Table 6.8 lists the results of the regression equations used in determine age at death using the mandibular first molar while Table 6.9 contains the results of the examination of epiphyseal fusion data.

Table 6.8. Age at Death based on Measurements of the Mandibular First Molar from LdFa-1 Area 4 (N=4).

Unit	Site Catalogue	Sub-Bag	Average Crown Height (mm)	Age at Death (in months)
F2	773	6	7.67	91.6
F3	815	1	6.85	100.9
D2	701	19	9.3	70.2
E4	750	3	4.68	128.2



Table 6.9. Epiphyseal Fusion Data for LdFa-1 Area 4 (N=66).

Element	Species	Age at Fusion	Frequency
Distal Cannon	Caribou	12-18 months	11
Caudal Vertebra	Caribou	Unknown	1
Vertebrae	Caribou	4-<14 years	7
Proximal Femur	Caribou	42-27 months	1
Fore Cannon (Shaft)	Caribou	Unknown	1
Hind Cannon (Distal)	Caribou	3 years of age, 18 months	11 (MNI of 7)
Hind Cannon (Shaft)	Caribou	Unknown	3
Medial Phalanx (Distal)	Caribou	Unknown	1
Medial Phalanx (Proximal)	Caribou	6-9 months	3
Pelvis (Acetabulum)	Caribou	6-18 months	2
Phalanx	Caribou	Unknown	3
Proximal Phalanx	Caribou	7-35 months	8
Radius (distal shaft)	Caribou	36-54 months	1
Radius (shaft)	Caribou	Unknown	1
Distal Radio-Ulna	Caribou	36-54 months	5 (MNI of 4)
Rib	Caribou	Unknown	2
Sternum	Caribou	<138 months	1
Distal Tibia	Caribou	1.5 years of age, 18-42 months	2
Proximal Ulna	Caribou	48-54 months	2

The age at death was determined for four separate individuals from LdFa-1 using mandibular teeth measurements. All four individuals were excavated from the area between the two stone ring features. The age range is from 70.2 months (six years) to 128.2 months (ten and a half years). Based on these four individuals it is suggested that the Pre-Dorset only exploited adult caribou, however, this is not entirely accurate. There are instances of deciduous teeth in the LdFa-1 Area 4 archaeological assemblage as well as an intact maxilla with visible permanent teeth pushing out the deciduous teeth. Unfortunately, there is no information on the eruption of maxillary teeth for caribou and it is very difficult to distinguish deciduous teeth when they are loose in the archaeological record. These two factors lead to an over representation of identified adult caribou.

To deal with this problem, I also examined the epiphyseal fusion data associated with caribou from LdFa-1. Of the 66 specimens that showed signs of unfused epiphyses, 55 were attributed to specific ages (Table 6.9). These elements indicate that the Pre-Dorset exploited young caribou as well as older adults. Based on epiphyseal fusion rates, the youngest member of the archaeological assemblage is less than six months old while the oldest individual is 11.5 years or older.

### *Sex*

Establishing the sex structure of an assemblage allows archaeologists to interpret seasonality and preferential exploitation of certain sexes. An attempt was made to determine the sex structure of LdFa-1 Area 4 by mirroring techniques used by Stenton (1989, 1991a). Figure 6.6 illustrates the distal condylar measurements of the fore cannons while Figure 6.7 depicts the distal condylar measurements of the hind cannons.

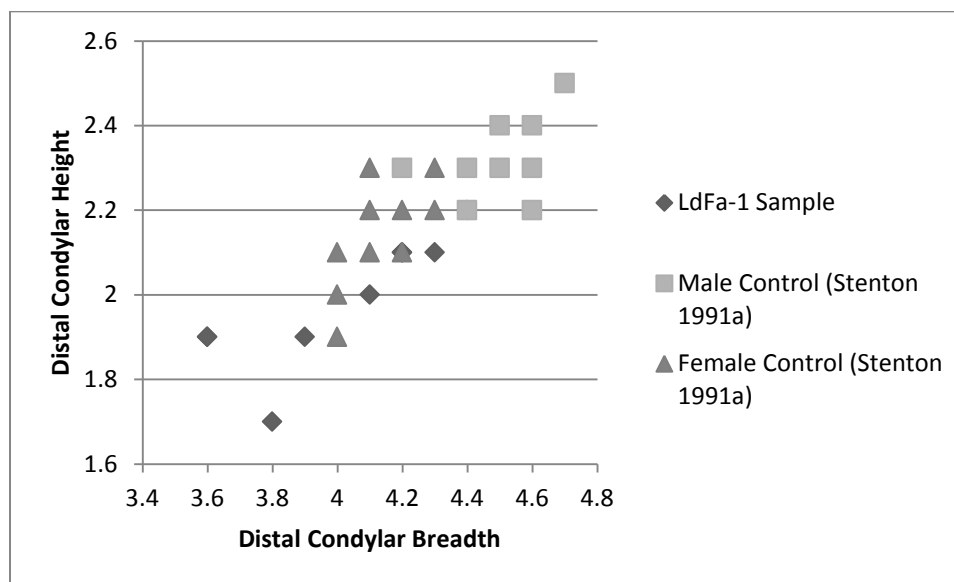


Figure 6.6. Scatterplot of Fore Cannon Distal Condylar Measurements.

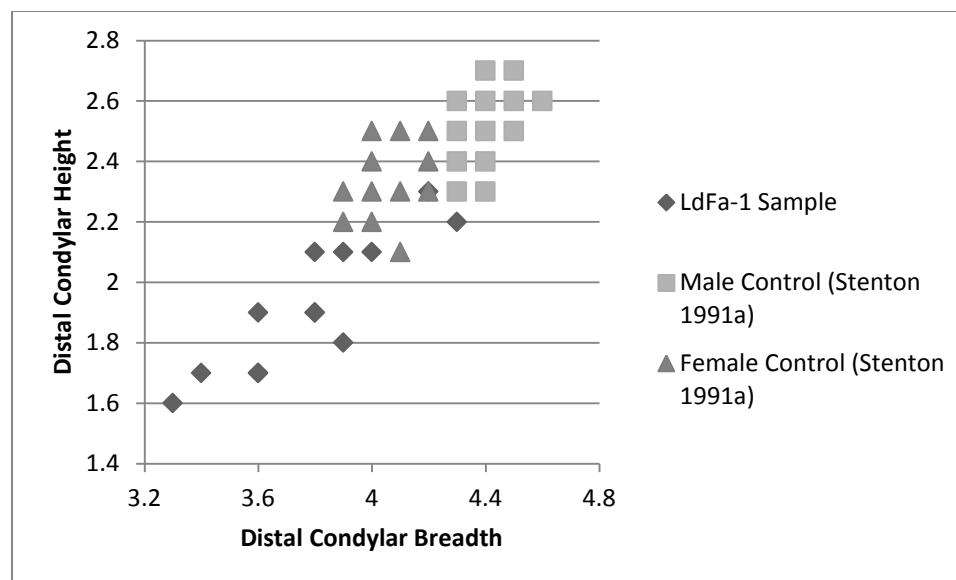


Figure 6.7 Scatterplot of Hind Cannon Distal Condylar Measurements.

Based on the distribution of both the fore cannon and hind cannon measurements on the scatterplots, the sex structure of the faunal assemblage is mainly female. The measurements on the LdFa-1 Area 4 assemblage depict cannons, specifically hind cannons that are smaller than the control population's cannons. There could be a variety of reasons for this distribution. One possibility is that the samples from LdFa-1 belong to younger cows whose bones have yet to reach their full size. This is plausible given the known herd structure from around Mingo Lake, which are dominated by cows and calves with bulls occupying other areas of the Large Lake Region (Milne 2005: 6)

### Interpretations

Based on the data presented for LdFa-1, I am able to make substantial interpretations on the Pre-Dorset use of LdFa-1. Based on class distribution and elemental frequency, combined with the results of MNI and NISP, I am able to determine

the function of the three sections (A-E, F-G, and H-K) within LdFa-1 Area 4. Section A-E was the section that was most intensively used. The MNI of 16 caribou and the NISP of 872 caribou fragments indicate that the stone tent ring was being used over a long period of time. Unsided shaft fragments are overly abundant in this section indicating that intensive marrow extraction was occurring in and around the stone tent ring. There was relatively little burnt bone within section A-E (less than 1000 specimen showed signs of burning), which is interesting given the large amount of bone recovered from the section. The reason for the lack of burnt bone in section A-E is most likely because the majority of the burnt bone from LdFa-1 is found in section F-G. This section is located between the two stone circles and is most likely where the main production activities took place. Bone would have been used as a fuel source to keep the fire going between the stone circles while also creating a smudge to keep the bugs away while outdoor work was happening. As an added bonus, fire breaks bone into tiny pieces which cuts down on the raw bone debris lying around the campsite. The amount of unidentified shaft fragments is also surprisingly high for such a small area. The majority of the caribou NISP are unsided shaft fragments that can be identified to the element but the lack of epiphyses prevents them from being sided. There is also a high proportion of large mammal long and limb bones found in section F-G; this signifies that intensive marrow harvesting was occurring in the area between the stone circles. It makes sense that in the summer months as much processing as possible was done outside; the fire pit of burnt bone could have helped keep the bugs away while the Pre-Dorset were working bone outside.

The final section (H-K) shows a different elemental distribution and frequency than the other two sections of LdFa-1 Area 4. There is no one element that is over-

represented in the assemblage from around the tight stone circle. There are a high number of unside phalanges but their presence can easily be explained alongside the MNI of five caribou calculated for the section. There is at least one complete fore quarter (humerus, radio-ulna, carpals, cannon, and phalanges) and one complete hind quarter (femur, tibia, fibula, patella, tarsals, cannons, and phalanges) represented in section H-K. However, if you were to remove the humerus and femur from the assemblage there would be a minimum of three hind quarters and a minimum of five fore quarters. All the aforementioned elements are represented in the other two areas, but not to the same degree, frequency, and consistency in relation to the MNI and NISP.

This patterning of bone is indicative of primary butchering at another location. Binford (1978) investigated Nunamiut butchering practices to help understand the patterning of faunal assemblages. He determined that caribou were primarily butchered into eight sections. The two sections that are of great interest to this study are the portioning of the limbs into front and hindquarters; this allowed for easier transportation to the habitation site from the butchering and/or cache location. Time constraints also led to the further break-down of the limbs by removing the humerus and femur (Binford 1978: 60). This type of butchering accounts for why the phalanx and cannon counts are so high at LdFa-1 Area 4 as a whole; these elements were tagging along with the high meat yield elements but were also utilized for their high quality marrow.

Marrow extraction was an important subsistence activity focus at LdFa-1 Area 4. There are signs of marrow extraction on 58% of all identifiable bone (minus teeth). The majority of the fractured bones are identified only by their shafts which indicates intensive marrow extraction. The Pre-Dorset were trying to exploit as much marrow as

they could, perhaps in preparation for their migration back to the coast. This is indicated by number of phalanges that show patterns of marrow extraction. It is extremely difficult and time consuming to try to fracture a small bone like a phalanx, especially since there is very little marrow inside.

The age at death of the specimens from LdFa-1 Area 4 indicate that the Pre-Dorset were exploiting caribou younger than six months of age. How often the Pre-Dorset were exploiting young caribou is debatable. Other fusion data point towards heavy exploitation of caribou younger than three years of age (based on hind cannon and proximal phalanx data). The lack of fusion on the ulnae elements confirms the data taken from mandibular molars (youngest age at death from mandibular first molar is six years old). As such it appears as if the Pre-Dorset were not selecting a specific age range to exploit. Adult caribou bones are more abundant within the assemblages but this makes sense due to taphonomic processes that would destroy the delicate juvenile bone. Sustainability practices could be another reason for the lack of juvenile caribou remains. The Pre-Dorset may not have taken younger caribou in the same quantities as older caribou in an attempt to maintain herd size.

The Pre-Dorset appeared to have preferentially exploited female caribou over male caribou at LdFa-1 Area 4. This is indicated by the distribution of data on distal condylar breadth and distal condylar height. Of the fore and hind cannon measurements there are only two potential males within the assemblage. However, since I do not know the absolute age of the individuals whose cannons were measured it is not possible to say if some of the cannons belonged to juvenile males. Even though I did not measure any unfused distal epiphyses, there is not an extreme difference between an unfused epiphysis

and a fused epiphysis in terms of size. Younger individuals could skew the sex structure towards female caribou when in fact the assemblage could be dominated by juvenile males. Both females and juvenile males are found around Mingo Lake and Amadjuak Lake so it could be possible to have both sexes present but be indistinguishable in the assemblage.

The seasonality of a site is determined in a variety of different ways. One way is to examine what species are present in the assemblage; migratory species are a great indicator of seasonality. The ethnographic record is used to establish seasonality of migratory species. If it is shown that resources are found in an area for long periods of time, then migration routes can be parsed out. When interpreting seasonality one must always keep in mind that food can be easily cached and returned to for later consumption, as such season of occupation should be determined using a variety of indicators, not only presence of migratory species (Morrison 1997: 33). Another way to determine seasonality is to examine the age structure of an assemblage. Certain indicators such as the eruption of specific teeth or the fusion of specific elements allows for an easy investigation of season at death. For example, the first mandibular molar begins erupting when a caribou calf is three months old and is fully erupted by five months of age (Miller 1973:16). Since calving occurs during May and June an erupting mandibular molar indicates a death between August and October. The other mandibular teeth erupt over such a wide length of time that it is almost impossible to secure a concrete season of death using any other eruption schedule besides the first mandibular molar. Thin sectioning can also occur on teeth to establish concrete ages of death; the age can then be tracked to the predictable calving season allowing for an estimation of seasonality.

Based on the resources available to determine the seasonality, a few different sources can be used to determine the seasonal of occupation at LdFa-1 Area 4. For example, the presence of migratory waterfowl (i.e. snow goose) in an assemblage points towards a season of occupation between May and September (Arnold 1981: 117; Milne and Donnelly 2004: 95; Morrison 1997: 33; Soper 1928: 92). Arctic char was fished in the fall using stone weirs but fishing can also occur in the early summer (Kemp 1984: 467). Caribou are a resource that is normally hunted in the late summer to early fall (Kemp 1984: 467; Morrison 1997: 33). They are especially abundant in the Large Lakes Region in the summer months due to the location of calving grounds (Boas 1974: 434; Milne and Donnelly 2004: 94; Soper 1928: 64; Stenton 1989: 96). Caribou would have been hunted when their hides were in peak condition since the hides were vital in producing winter clothing. The hides were in their peak condition between August and October (Stenton 1991b: 4).

The seasonality of LdFa-1 Area 4 is most likely a late summer to early fall occupation. The presence of a few snow geese indicates that they are either being opportunistically hunted or being brought in from another area. Caribou remains are abundant at the site. They are found inland year round but the Pre-Dorset most likely were on the coast in the winter in order to exploit marine resources. Toolstone also drew the Pre-Dorset into the interior. Provenance research to date indicates an absence of reliable stone sources along the coast of Baffin Island. There are, however, confirmed source areas in the Large Lakes region. These stone sources are most easily accessed in the summer (Milne 2003; Milne and Donnelly 2004: 103; Milne et al 2012: 275, 2013: 55). Therefore, it is highly probable that the Pre-Dorset occupied the interior in the



summer and early fall months. There are also cut marks, indicative of skinning, present on the caribou bones signifying that the Pre-Dorset were exploiting caribou hides that were at their peak in the fall. The presence of stone ring structures also suggests a summer occupation since use of these dwellings tends to occur in spring, summer, and fall when snow is not available to hold up the sides of the tent (Ramsden and Murray 1995: 110-115). Based on all the information presented above, LdFa-1 is a multi-occupation site. The primary goals during its use were to obtain subsistence and raw material from caribou in the late summer to early fall months.

### **LdFa-12: Results**

LdFa-12 has the smallest assemblage of the four Mingo Lake sites and includes a potential tent ring. The site has been excavated on two separate occasions and it has been more extensively excavated than both LdFa-13 and LdFa-14.

#### Species Representation

Only mammal remains are identified within the LdFa-12 assemblage. Table 6.10 lists the frequencies of identified and unidentified mammal bone. LdFa-12 contains a higher frequency of identified mammal bone than unidentified mammal bone. This means that the overall fragmentation rate at the site is relatively low. This is most likely skewed by the overall small size of the assemblage. The average weight of the unidentified mammal bone is 0.15 grams, which is the same average weight of the unidentified mammal bone from LdFa-1 Area 4 when the bulk soil samples were removed from the calculation.

Table 6.10. Separation of Animal Bone by Category for LdFa-12 (N=114).

Category	Frequency
Identified Mammal	64
Unidentified Mammal	50
Bird	0
Fish	0

The frequency of species and mammal size is presented in Table 6.11. Large mammal remains are the most frequent category present at LdFa-12. This speaks to high rates of fragmentation, which are indicative of intensive marrow extraction.

Table 6.11. Identification of Remains to Species or Animal Size for LdFa-12 (N=64).

Species or Size	Frequency
Caribou	13
Large Mammal	38
Herbivore	13

### Elemental Distribution

The elemental frequencies are higher than expected for a site with very few faunal remains; the frequencies are listed in Table 6.12. Hind Cannons are the most abundant caribou element (two shaft fragments and a proximal epiphysis) found at the site. Limb bones dominate the large mammal remains found at LdFa-12 indicating intensive marrow extraction patterns. Based on the presence of elements that belong to one hind quarter and one fore quarter, it is possible that this site was used as a brief camp site. The quarters could have been taken from a nearby cache and provided the sustenance for the duration of the stay at the camp.

Table 6.12. Elemental Frequencies of Identified Mammal Bone from LdFa-12 (N=64).

	Caribou	Large Mammal	Herbivore	<b>Total</b>
Crania	1			<b>1</b>
Mandible	2			<b>2</b>
Teeth	1		13	<b>14</b>
Pelvis	1			<b>1</b>
Humerus	1			<b>1</b>
Radius	1			<b>1</b>
Proximal Lateral Phalanx (Manus)	1			<b>1</b>
Hind Cannon	3			<b>3</b>
Proximal Phalanx (Ped)	1			<b>1</b>
Phalanx	1			<b>1</b>
Flat Bone		1		<b>1</b>
Irregular Bone		1		<b>1</b>
Limb Bone		22		<b>22</b>
Long Bone		14		<b>14</b>
<b>Total</b>	<b>13</b>	<b>38</b>	<b>13</b>	<b>64</b>

### Quantitative Measurements

Because LdFa-12 has the smallest faunal assemblage of all four sites, all NISP and MNI counts are extremely small. The NISP of caribou remains is 13. The MNI is one based on the presence of multiple elements all with a frequency of one. The small counts are indicative of a single occupation at LdFa-12.

### Bone Modifications

Patterns of butchering, fracture patterns, and burning were examined to determine site function.

### *Butchering*

The presence of cut marks at LdFa-12 is minimal due to the small size of the assemblage. In total, only six cut marks are recorded from LdFa-12 (Table 6.13). Slice marks are again the most common cut mark. Caribou hind cannons have the highest frequency of slice marks, which is consistent with the findings from LdFa-1.

Unfortunately not much can be derived from the LdFa-12 cut mark analysis as the few cut marks present do not allow for any substantial interpretations outside the fact that butchering occurred at the site.

Table 6.13. Butchering Mark Analysis from LdFa-12 (N=4).

Cut Mark Type	Depth	Animal Type	Element	Part	Frequency
Slice	Shallow	Large Mammal	Long Bone	Shaft	1
	Medium	Large Mammal	Long Bone	Shaft	1
		Caribou	Hind Cannon	Shaft	3
Scrape	Medium	Caribou	Humerus	Medial Shaft	1

Table 6.14. Fracture Patterns Distinguished at LdFa-12 (N=50).

Fracture Pattern	Caribou	Large Mammal	<b>Total</b>
Broken	7	12	<b>19</b>
Split	3	16	<b>19</b>
Split/Scars		9	<b>9</b>
Oblique	2		<b>2</b>
Spiral		1	<b>1</b>
<b>Total</b>	<b>12</b>	<b>38</b>	<b>50</b>

### *Fracturing*

Table 6.14 lists the results of the fracture pattern analysis from LdFa-12. There are indications of marrow extraction but the process is not as intense as it is at the other three sites.

### *Burning*

It appears that bone was not purposefully burnt at LdFa-12 (Table 6.15). The three burnt bones were most likely a by-product of cooking at the site.

Table 6.15. Number of Burnt and Not Burnt Faunal Remains from LdFa-12 (N=114).

	Identified Mammal	Unidentified Mammal	Bird	Fish	<b>Totals</b>
Burnt	1	2	0	0	<b>3</b>
Not Burnt	63	48	0	0	<b>111</b>

### Age and Sex Structure

The LdFa-12 assemblage includes one partially fused distal radius from a caribou. Based on the information presented in Table 5.1, this individual was six to nine months of age. This one individual does not provide an average age of the whole assemblage but it does allow for an estimation of time of death. Based on a calving season spanning May and June the individual with a partially fused distal radius was hunted before November.

None of the elements identified at LdFa-12 could be used to determine the average sex of the assemblage. Specifically, cannons were entirely absent and these are the only elements that can be used in sex determination.

### Interpretations

The analysis of the faunal remains from LdFa-12 can be used to make preliminary interpretations about the Pre-Dorset use of the site. LdFa-12 appears to be a single occupation camp site. It is difficult to determine a season of occupation since the only indicator present that can truly confirm when the Pre-Dorset used LdFa-12 is an unfused distal radius. The presence of this element indicates a season of death around November. LdFa-12 could have been used when hunters returned to their caches in the spring or during the fall migration when the Pre-Dorset began moving back to the coast. It could also have been occupied in the summer months. Summer migrations into the interior were an ideal time to visit and form ties with other groups of Pre-Dorset (Boas 1974). Based on the contemporaneous dates for LdFa-1 and LdFa-12, visiting Pre-Dorset peoples could have used LdFa-12 as their temporary campsite while visiting people at nearby LdFa-1.

### **LdFa-13: Results**

LdFa-13 yielded a larger faunal assemblage than that recovered from LdFa-12. LdFa-13 also contains a known tent ring that will aid in the determination of site function.

### Species Representation

Table 6.16 presents the information on class separation. Identified mammal remains again outnumber the unidentified mammal remains. Bird and fish species are also present at the site but not in the same abundance as mammal species. The fragmentation rate at the site is incredibly high. The average unidentified mammal bone

weighs 0.1 grams indicating intensive fracturing of the bone. Large mammal and caribou remains dominate the assemblage at LdFa-13 (Table 6.17) and due to their elemental size, natural taphonomic processes should not fracture bone to this degree.

Table 6.16. Separation of Animal Bone by Category for LdFa-13 (N=451).

Category	Frequency
Identified Mammal	221
Unidentified Mammal	209
Bird	20
Fish	1

Table 6.17. Identification of Remains to Species/Animal Size for LdFa-13 (N=242).

Species or Animal Size	Frequency
Caribou	63
Herbivore	15
Large Mammal	119
Medium-Large Mammal	10
Medium Mammal	6
Unknown Mammal	8
Snow Goose	3
Large Bird	2
Medium-Large Bird	2
Unknown Bird	13
Unknown Fish	1

Even though there is a high frequency of caribou and large mammal bones, there are relatively few herbivore remains present. This indicates that teeth, or the elements containing teeth were not being transported back to LdFa-13. There is also quite a large array of species utilized at the site. This most likely indicates that LdFa-13 was used as a seasonal camp, but it was not as intensively occupied as LdFa-1 Area 4. The small frequencies of bird and fish indicate that LdFa-13 was not used as a main hunting camp for either resource, instead a few specimen from each class were being transported into

the area as a dietary supplement perhaps during the caribou hunt. The noticeable presence of caribou and large mammal remains signifies that LdFa-13 was primarily used during the caribou hunting season.

### Elemental Distribution

The elemental distribution of identified mammal remains at LdFa-13 does not present any obvious patterns. Table 6.18 lists the elemental frequencies by mammal category. It appears that almost every butchering category (see Binford 1978) is present at LdFa-13. The crania, the ribs, the vertebra, and the fore and hind quarters are all present at the site. As such it is plausible that a caribou was killed nearby and then transported back to LdFa-13 for butchering. There are also instances of medium mammals at LdFa-13 indicating that the Pre-Dorset may have engaged in opportunistic hunting of foxes or wolves.

### Quantitative Measurements

NISP and MNI were calculated for LdFa-13 include only caribou remains. The NISP of caribou remains is 63. The MNI of LdFa-13 is two based on the identification of the neck, head, and tubercle of two right ribs.

### Bone Modifications

Instances of butchering, fracturing, and burning were recorded for LdFa-13. There are interesting patterns in the burnt remains as well as in the fracture patterns which could help infer site function.



Table 6.18. Elemental Distribution of Identified Mammal Bone from LdFa-13 (N=221).

	Caribou	Large Mammal	Herbivore	Medium-Large Mammal	Medium Mammal	Unknown	<b>Total</b>
Crania	4	3		3		2	<b>12</b>
Mandible	1						<b>1</b>
Teeth	9		15				<b>24</b>
Vertebra	3	1		2			<b>6</b>
Cervical Vertebra	1	1					<b>2</b>
Thoracic Vertebra	4						<b>4</b>
Lumbar Vertebra	1						<b>1</b>
Sternum	1						<b>1</b>
Scapula	1	1					<b>2</b>
Rib	9	2			1	6	<b>18</b>
Humerus	1						<b>1</b>
Radius	1						<b>1</b>
Radio-Ulna	4						<b>4</b>
Fore Cannon	1						<b>1</b>
Proximal Lateral Phalanx (Manus)	1						<b>1</b>
Medial Lateral Phalanx (Manus)	1						<b>1</b>
2 <sup>nd</sup> Proximal Phalanx (Manus)	1						<b>1</b>
Tibia	2						<b>2</b>
Fibula	1						<b>1</b>
Tarsal	1						<b>1</b>
Hind Cannon	7						<b>7</b>
Proximal Phalanx (Ped)	1						<b>1</b>
Metapodial	1						<b>1</b>
Phalanx	2						<b>2</b>
Proximal Phalanx	2						<b>2</b>
Flat Bone		8		4			<b>12</b>
Irregular Bone	2			1			<b>3</b>
Limb Bone		52			2		<b>54</b>
Long Bone		51			3		<b>54</b>
<b>Total</b>	<b>63</b>	<b>119</b>	<b>15</b>	<b>10</b>	<b>6</b>	<b>8</b>	<b>221</b>

### *Butchering*

LdFa-13 has more instances of butchering than LdFa-12. The majority of the butchered elements are shafts that can only be attributed to a mammal size category (Figure 6.19). Slice marks are once again the most common type of cut mark identified but there is also an instance of chopping indicating that disarticulation took place at the site. Butchering, as evidenced by the presence of cut marks on several shaft fragments indicating defleshing activities occurred thus facilitating marrow extraction and easier transportation of the meat.

Table 6.19. Frequency of Butchering Marks from LdFa-13 (N=7).

Cut Mark Type	Depth	Animal Type	Element	Part	Frequency
Slice	Shallow	Caribou	Radio-Ulna	Groove	1
		Large Mammal	Long Bone	Shaft	1
	Medium	Caribou	Rib	Shaft	1
		Medium-Large Mammal	Flat Bone	Shaft	1
	Deep	Large Mammal	Long Bone	Shaft	1
Scrape	Shallow	Large Mammal	Crania	Shaft	1
	Medium	Caribou	Sternum	Body	1
Chop	Deep	Large Mammal	Long Bone	Shaft	2

### *Fracturing*

There are indications that intensive marrow extraction was occurring at LdFa-13. Table 6.20 describes the fracture patterns present at the site. Over half of the remains are attributed to the large mammal category. This indicates that bone is being fractured to the

point where attributing a specimen to a specific species is near impossible. Phalanges are being exploited for their marrow at the site (five separate phalanges showed evidence of oblique fractures). The radio-ulna and tibia also show preferential signs of marrow extraction. These elements have been ranked as desirable elements due to the quality of marrow (Morin 2007: 71) so it makes sense that we find these same elements exploited for their marrow in the archaeological record. Based on the information on fracture patterns from LdFa-13 it appears that the Pre-Dorset were preferentially choosing to extract more desirable marrow. The lack of undesirable marrow elements (such as the femur) indicates that resource stress was not a reason for marrow extraction; instead it may be possible that the Pre-Dorset preferred the taste of marrow and commonly consumed it as another form of sustenance.

Table 6.20. Fracture Patterns Distinguished at LdFa-13 (N=197).

Fracture Pattern	Caribou	Large Mammal	Medium-Large Mammal	Medium Mammal	Unknown	<b>Total</b>
Broken	23	25	8	2	8	<b>66</b>
Split	13	56	1	4		<b>74</b>
Split/Scars	4	36				<b>40</b>
Split/Crack			1			<b>1</b>
Oblique	7					<b>7</b>
Spiral		2				<b>2</b>
Splinter	1					<b>1</b>
Stepped	1					<b>1</b>
Grooved	1					<b>1</b>
Whole	4					<b>4</b>
<b>Total</b>	<b>54</b>	<b>119</b>	<b>10</b>	<b>6</b>	<b>8</b>	<b>197</b>

### *Burning*

There are instances of burnt bone at LdFa-13 (Table 6.21). Based on the frequency of burnt bone, the act of burning bone was used as either a fuel source or as a disposal mechanism. All but one of the burnt specimens were found in one unit (2S 8E). This unit is most likely the hearth of the site, which would account for the high number of burnt bone within it. Based on the patterns identified at LdFa-1 Area 4, it is possible that this unit represents an outside hearth in proximity to a tent ring features. There is a possible tent ring located at LdFa-13, and unit 2S 8E is located roughly ten metres from it. The distance of the burn unit from the tent ring seems to support that inference since bones could have been burned for fuel, and indirectly for disposal, while also acting like a smudge to keep mosquitoes and other pests away from the camp.

Table 6.21. Number of Burnt and Not Burnt Remains from LdFa-13 (N=451).

	Identified Mammal	Unidentified Mammal	Bird	Fish	<b>Totals</b>
Burnt	4	39	2	0	<b>45</b>
Not Burnt	217	170	18	1	<b>406</b>

### Age and Sex Structure

The age at death and sex structure of the archaeological assemblage was investigated for LdFa-13. Sex could not be determined at this time. As for age, there is one mandible with an *in situ* third molar found in the assemblage. Unfortunately, the only information that was presented by this specimen is that there are adults in the faunal assemblage. The third molar is not a good indicator of age since it erupts over a wide range of time. The tooth in question had already erupted and was worn down meaning the

individual would be much older than the eruption date. Also, since only one molar is present for this individual, I am unable to undertake any calculations to determine age at death based on tooth wear.

There are two unfused specimens in the assemblage from LdFa-13 (listed in Table 6.22). The hind cannon is deemed to belong to an individual less than three years of age while the sternum is from an individual over 138 months of age (approximately 11.5 years of age). As such the assemblage contains a mixture of juvenile and adult caribou.

Table 6.22. Epiphyseal Fusion Data for LdFa-13 (N=2).

Element	Species	Age At Death	Frequency
Sternum	Caribou	Older than 138 months of age	1
Hind Cannon (Proximal)	Caribou	Less than 3 years of age	1

### Interpretations

Based on the results from the faunal analysis from LdFa-13, the site function was most likely a single occupation camp site. LdFa-13 was occupied longer than LdFa-12 but not as long, or as intensively, as LdFa-1 Area 4. There are indications of intensive burning at LdFa-13 and there is also the occurrence of a minimum of two caribou at the site. The elemental frequency for the site suggests that caribou were being hunted nearby. The carcasses were potentially floated down the shoreline of Mingo Lake from a caribou crossing closer to LdFa-1 in order to begin the butchering process. The presence of slice marks – indicative of defleshing – and the intensive marrow extraction further supports the interpretation that LdFa-13 was used as a butchering site. The presence of a stone

circle suggests that the site occupants camped in the area but further excavation is needed to determine the function of the tent ring.

I am able to make some inferences regarding the age of the assemblage. There are a total of two elements that could be used to describe the age of at least one individual. Based on the fusion rate of the hind cannon it is determined that one individual is under three years of age. The analysis of molar eruption was not useful since the only fully erupted tooth with associated mandible was a third molar. The third molar is fully erupted by 28 months (Miller 1974: 16). This tooth shows signs of wear indicating that it belongs to an individual who is much older than 2 years of age; therefore, it most likely does not belong to the same individual as the unfused hind cannon. As such, I can tentatively say that the Pre-Dorset at LdFa-13 exploited caribou of varying ages.

The presence of migratory waterfowl and fish, both in small quantities, suggests that these two classes were not being exploited at LdFa-13; instead they were likely brought in from other areas. The presence of caribou remains, as well as the presence of cut marks, indicates the site was occupied for a short period of time from the late summer into early fall.

#### **LdFa-14: Results**

LdFa-14 yielded the largest faunal assemblage of the three satellite sites (LdFa-12, LdFa-13, and LdFa-14) located on the northwest shore of Mingo Lake.

### Species Representation

LdFa-14 contains an assemblage dominated by unidentifiable mammal remains (Table 6.23); 78% (N=1326) of the total assemblage could only be identified to the mammal class level without any further information on specific species, mammal size or element garnered. The average weight of the unidentified remains from LdFa-14 is 0.05 grams. This once again points to an incredibly high fragmentation rate that is indicative of intensive marrow extraction.

Table 6.23. Separation of Animal Bone by Category for LdFa-14 (N=1326).

Category	Frequency
Identified Mammal	293
Unidentified Mammal	1020
Bird	13
Fish	0

Table 6.24. Identification of Remains to Species or Animal Size for LdFa-14 (N=306).

Species or Size	Frequency
Caribou	71
Large Mammal	103
Herbivore	101
Medium-Large Mammal	7
Medium Mammal	7
Unknown Mammal	4
Large Bird	2
Medium-Large Bird	1
Unknown Bird	10

The most abundant mammal remains at LdFa-14 are large mammal and herbivores (Table 6.24). Caribou are also found in the faunal assemblage but not in the same quantities as large mammals and herbivores. There are also instances of medium-

large and medium mammals at Ldfa-14 but they were not as important as caribou. Bird is also found at the site but could only be identified to a size category instead of to the species.

### Elemental Distribution

The elemental distribution of LdFa-14 does not favour any element over another (Table 6.25). There are a higher number of antlers and teeth attributed to caribou than any other element but this is most likely caused by their overrepresentation in the skeleton and favourable preservation conditions. The antler racks of caribou can be quite large accounting for the 16 antler fragments. Herbivores are the most abundant mammal category at LdFa-14 but this is due to the easy identification and preservation of teeth as well as the fact that the teeth are broken into small pieces. All three factors inflate the count of herbivore teeth. Large mammal bones are also abundant at the site but their numbers are fairly close to the number of identified caribou remains (i.e. 102 large mammal bones versus 71 caribou remains).

### Quantitative Measurements

NISP and MNI are calculated for the caribou remains. The NISP of caribou at the site is 71. The MNI for the caribou at the site is two based on the presence two left mandibular third molars and two right proximal radii.



Table 6.25. Frequencies of Identified Mammal Bone from LdFa-14 (N=293).

	Caribou	Large Mammal	Herbivore	Medium-Large Mammal	Medium Mammal	Unknown	Total
Antler	16						16
Crania	2				2		4
Mandible	1						1
Teeth	16		101				117
Vertebra	2						2
Pelvis	2						2
Clavicle	1						1
Scapula	1	1					2
Rib	9	2		2	1		14
Radius	2						2
Radio-Ulna	2						2
Fore Cannon	2						2
Proximal Phalanx (Manus)	1						1
Medial Phalanx (Manus)	1						1
Distal Phalanx (Manus)	1						1
Tibia	1						1
Hind Cannon	4						4
2 <sup>nd</sup> Proximal Phalanx (Ped)	1						1
Phalanx		1					1
Medial Phalanx	1						1
Proximal Phalanx	1						1
Flat Bone		4					4
Irregular Bone	1	2					3
Limb Bone	1	39		1		3	44
Long Bone	2	52		4	4	1	63
Shaft Frag		2					2
<b>Total</b>	<b>71</b>	<b>103</b>	<b>101</b>	<b>7</b>	<b>7</b>	<b>4</b>	<b>293</b>

## Bone Modifications

### *Butchering*

Based on the frequency of cut marks (Figure 6.26), it does not appear that butchering was the main activity at LdFa-14. Of the three smaller sites, LdFa-14 has the highest bone count but does not contain many elements with visible cut marks. Only six cut marks were identified at the site with one mark located on the shaft of a bird bone. The slice marks on the shafts indicate defleshing activities but this would be common in the preparation of meals. The majority of the elements at LdFa-14 were either processed at another site or were being removed from the site for further processing (i.e. disarticulation and meat removal). It is also possible that the Pre-Dorset who occupied LdFa-14 were very skilled at butchering, meaning they did not leave any errant marks on the bone; hitting the bone is believed to dull stone tools (Braun et al 2008).

Table 6.26. Frequency of Butchering Marks from LdFa-14 (N=5).

Cut Mark Type	Depth	Animal Type	Element	Part	Frequency
Slice	Shallow	Caribou	Rib	Shaft	1
		Large Mammal	Limb Bone	Shaft	1
	Medium	Large Mammal	Long Bone	Shaft	1
	Deep	Bird	Unknown	Shaft	1
		Large Mammal	Long Bone	Shaft	2

### *Fracturing*

LdFa-14 also contains fracture patterns consistent with intensive marrow extraction (Table 6.27). The majority of the split bones are attributed to the large mammal category which is indicative of intensive marrow exploitation; the shafts have been obliterated and the epiphyses are almost non-existent. Of the fractured caribou bones, phalanges dominate the assemblage. Radii and cannons also show signs of preferential marrow extraction.

Table 6.27. Fracture Patterns Distinguished at LdFa-14 (N=176).

Fracture Pattern	Caribou	Large Mammal	Medium-Large Mammal	Medium Mammal	Unknown	<b>Total</b>
Broken	30	13	2	3		<b>48</b>
Split	15	65	4	3	3	<b>90</b>
Split/Scars	5	25	1	1	1	<b>33</b>
Oblique	4					<b>4</b>
Whole	1					<b>1</b>
<b>Total</b>	<b>55</b>	<b>103</b>	<b>7</b>	<b>7</b>	<b>4</b>	<b>176</b>

### *Burning*

LdFa-14 was the location of major bone burning (Table 6.28). Over one-third of the bone recovered from LdFa-14 was burnt. Of the burnt bone, 97% (N=341) was attributed to the unidentifiable mammal category because the bone was too fragmented to permit more precise identifications. The high fragmentation of the burnt bone suggests that the Pre-Dorset were attempting to use bone as a fuel source or they were trying to dispose of excess bone by burning it, or perhaps both. There is no one unit from LdFa-14 that shows preferential use as a hearth; there is evidence of burnt bone in all the units.

Given the entire absence of any discernible patterning in the burnt bone remains, it appears as though LdFa-14 was used principally as a disposal site.

Table 6.28. Total Number of Burnt and Not Burnt Bone from LdFa-14 (N=1326).

	Identified Mammal	Unidentified mammal	Bird	Fish	Totals
Burnt	7	333	1	0	341
Not Burnt	286	687	12	0	985

### Age and Sex Structure

Age was determined at LdFa-14 by using epiphyseal fusion data (Table 6.29); however, the sex structure of the caribou assemblage is unknown. The age structure can be distinguished by one element, a hind cannon which estimates that one individual is less than three years of age. There is also the unfused proximal epiphysis of a fore cannon present in the assemblage but no comparative data exist for when this element fully fuses. There were no useable teeth found at LdFa-14 to use as an indicator of age at death.

Table 6.29. Epiphyseal Fusion Data from LdFa-14.

Element	Species	Age of Fusion	Frequency
Fore Cannon (Proximal)	Caribou	Unknown	1
Hind Cannon	Caribou	3 years of age	1

### Interpretations

Based on the lack of patterning amongst the units at LdFa-14, it appears to be a disposal site. Its close proximity to LdFa-13 leads me to believe that any butchering

activities associated with that site – as well as LdFa-15 – could have occurred at LdFa-14. It could also have been a strategic place to leave waste so that scavengers did not encroach on the main campsite. If LdFa-14 is truly a disposal site then it was most likely utilized during the late summer and fall caribou hunt.

Given the absence of identifiable mandibular teeth, it was not possible to distinguish age based on eruption patterns or the measurement of crown height. Instead, epiphyseal fusion data were used to estimate age. That said, only two identifiable remains yielded information relevant to epiphyseal fusion. The hind cannon is completely fused by three years of age and the LdFa-14 assemblage contains one hind cannon that is not fused meaning one individual is less than three years of age.

### **Overall Interpretations**

The four Mingo Lake sites were most likely occupied during the summer and fall months. It makes sense that the Pre-Dorset would congregate around the Large Lakes Region during this time. There was an abundance of migratory subsistence resources in the area and the area is warmer than coastal areas (Jacobs and Grondin: 212). Even though the Pre-Dorset were adapted to the cold climate, they would have surely welcomed a reprieve from the colder, coastal weather (Milne et al 2013: 57).

LdFa-1 was primarily used as a multi-occupation habitation site. The two stone circles as well as the abundance and distribution of caribou remains strongly suggests this area was occupied multiple times over multiple years. LdFa-12 is most likely a single occupation campsite that was used once and briefly, while LdFa-13 was also single occupation campsite that served as both a habitation and butchering location. Based on

the lack of consistency between the units at LdFa-14, this section of land between LdFa-12 and LdFa-13 appears to have served as a disposal site for the Pre-Dorset. Primary butchering could have occurred at this area (e.g. evisceration). Localizing this kind of messy work at this location may have prevented scavengers from entering the three nearby campsites. Furthermore, intensive burning at LdFa-14 would dissuade pests from hanging around. The burn unit from LdFa-13 is located along the edge of the site closest to LdFa-14; this unit could have been burned to provide a smudge to keep the bugs away while the butchering of caribou took place.

There are high degrees of fragmentation at all four sites. Average weights were taken for all of the unidentified mammal bone to determine the fragmentation patterns at the Mingo Lake Sites. The average bone weights at LdFa-1 are 0.09 grams with bulk soil samples included and 0.15 grams with the bulk soil samples removed. LdFa-12 also has an average unidentified mammal bone weight of 0.15 grams. LdFa-13 has a high rate of fragmentation with the average unidentifiable bone fragment weighing 0.10 grams. Finally, LdFa-14 has the highest rate of fragmentation of all the sites. The average weight of an unidentified mammal bone is 0.05 grams. All of the weights are extremely small considering the main subsistence resource exploited in the area was caribou. Caribou are larger mammals and, therefore, have heavier bones. For such remains to be so highly fragmented, human agents, as well as taphonomic processes, must be at work at all four sites. There is evidence of trampling by caribou at all four sites. The trampling coupled with the annual freeze-thaw cycle would affect the fragmentation and preservation of the mammal bone. However, human agents are the more likely cause of the high fragmentation rates. The Pre-Dorset decision to intensively exploit bone marrow as well

as their intentional burning of the bone indicates these activities were the main cause behind the high degree of fragmentation.

## Chapter 7 – Discussion

This chapter evaluates the three hypotheses presented in Chapter Four in light of the data generated from the zooarchaeological analysis of the four Mingo Lake faunal assemblages. Based on this evaluation, I discuss the reasons why the Pre-Dorset traveled to the deep interior of southern Baffin Island. Finally, I discuss some of the methodological problems encountered during my analysis and propose ways to avoid similar experiences in future analyses.

### **Revisiting the Hypotheses**

Based on the data acquired from my analysis, I can reject Hypothesis one. The four Pre-Dorset sites on Mingo Lake did not yield patterns consistent with what was expected for a winter season of occupation. Moreover, only one of the four sites, LdFa-1 Area 4, was used repeatedly. The remaining three sites (LdFa-12, LdFa-13, LdFa-14) are all ephemeral, single occupation sites. The lack of seal remains – the main subsistence resource exploited in the winter – combined with the intensive marrow extraction occurring at all four sites further supports the rejection of hypothesis one. The ethnographic record indicates that caribou hunting occurred around the Large Lakes region in the summer and fall months, and with the onset of winter, the Inuit would have returned to the coast in preparation for hunting seals on the sea ice. It seems probable that the Pre-Dorset followed a similar seasonal round (Milne 2003) and thus likely did not overwinter in the interior; rather, they too would have spent it on the coast or on the sea ice.



Hypothesis two states that all four sites were occupied in the summer and fall, and they were used as multi-occupation and single occupation habitation sites and/or multi-occupation and single occupation butchering sites. The third hypothesis states that all four sites were occupied during the warmer months but LdFa-1 is a multi-occupation campsite while LdFa-12, LdFa-13, and LdFa-14 were solely single occupation butchering sites. The seasonality determined for all four sites is summer and early fall, which confirms at least the first part of Hypotheses two and three as accurate. However, based on the skeletal frequencies, elemental frequencies, NISP, and MNI of the four sites, I am rejecting the Hypothesis three in favour of Hypothesis two.

The lack of faunal remains from LdFa-12 (MNI of 1), LdFa-13 (MNI of 2), and LdFa-14 (MNI of 2) indicates these three sites were not occupied for long or repeatedly over time; rather, they were most likely used as single occupation campsites. These three sites also contain evidence of primary butchering. It would have been easy for the Pre-Dorset to kill caribou upstream and float them down Mingo Lake shoreline to butcher at the three satellite sites (Milne, personal communication). Butchering the caribou away from LdFa-1, the site that has been deemed a multi-occupation site, would have served a variety of purposes. For starters, it could have kept predators such as wolves and polar bears away from the primary habitation area. The large amounts of viscera and blood would have attracted carnivores to the butchering areas therefore keeping them away from the large amounts of meat at LdFa-1. Binford (1978: 48) mentions that evisceration, skinning, and dismemberment all occur at the primary butchering site. Secondly, the ethnographic record states that it was disrespectful to butcher caribou on the north shore of a river crossing (Stewart et al 2004: 198). As such, it would make sense that the Pre-

Dorset would float the caribou further down the lake so as to avoid negatively affecting future hunts.

The sheer size of the features and faunal assemblages at LdFa-1 versus LdFa-12, LdFa-13, and LdFa-14 should lead me to reject Hypothesis two and accept Hypothesis three. There are clear signs of at least one tent ring at LdFa-1 Area 4 with a second unidentified stone ring located a few metres away. There are also potential stone tent rings at LdFa-12 and LdFa-13. LdFa-14 is lacking a tent ring but more investigation is needed at all three satellite sites to determine more precisely actual site function. The same elements are also present at all four sites. If there was indeed a distinction between the activities at LdFa-1, LdFa-12, LdFa-13, and LdFa-14, then the elemental frequencies would differ. The three satellite sites could contain more low yield elements while also showing intensive signs of marrow extraction. LdFa-1 on the other hand would consist of high yield elements which showed minimal signs of marrow extraction. However, this is not the case since all four sites contain similar elemental distributions (mainly low yield elements), and they also all show signs of intensive marrow extraction. As such, I have decided to name the three satellite sites single occupation sites where both habitation and butchering activities occurred. This interpretation may, however, change if the sites are more extensively excavated in the future.

Based on the results of the data I collected I have deemed LdFa-1 Area 4 a long-term, multi-occupation site utilized by the Pre-Dorset in the summer and fall months. LdFa-12, LdFa-13, and LdFa-14 were single occupations by the Pre-Dorset in the summer and fall months. The main functions of the sites were short-term camping and primary butchering (e.g. evisceration) as well as disposal of garbage such as burnt bones

which is identified by the lack of patterned findings of burnt bones at LdFa-14. In conclusion, I accept Hypothesis two and reject Hypotheses 1 and 3.

### **Pre-Dorset Use of the Large Lake Region**

The Pre-Dorset were not only exploiting caribou, nesting waterfowl, and fish in the interior of Baffin Island; all three classes are available on the coast so something else must have brought the Pre-Dorset into the interior. It appears that they were also travelling into the area to access toolstone. There are no known locally available sources of toolstone along the coast so in order to replenish their toolkits, the Pre-Dorset would have travelled inland to access the chert near Mingo, Amadjuak, and Nettilling Lakes (Milne et al 2011: 122-123; Milne et al 2013: 56). The archaeological sites on Mingo Lake are littered with an abundance of lithic debitage. There has not been any formal analysis conducted on the Pre-Dorset lithic assemblages from LdFa-1 Area 4, LdFa-12, LdFa-13, and LdFa-14 but from information obtained from the permit reports (Milne 2005, 2008; Park 2009), as well as personal experience organizing the collections, lithic procurement was just as important an activity as harvesting caribou. Caribou could still be found on the coast in the winter months but the sources of stone were fixed and restricted geologically in their distribution meaning the Pre-Dorset had to travel to them. The lithic analyses of the assemblages from Mosquito Ridge (MaDv-11) and Sandy Point (LIDv-10) indicate that lithic raw material was heavily exploited in the areas surrounding the Large Lakes Region (Milne 2003).

The Pre-Dorset also appeared to access resources in specific areas of the Large Lake Region. Mosquito Ridge along the coast of Burwash Bay seems to be the main

place used by the Pre-Dorset to exploit snow geese. The area around Mosquito Ridge is marshy and not ideal for calving (Milne and Donnelly 2004: 2007). Caribou remains are found in the assemblage but not in the same quantities as those found in sites near Mingo Lake and Amadjuak Lake. Mingo Lake and Amadjuak Lake seem to be the two areas where caribou were abundantly hunted. The known assemblages from these two lakes are littered with caribou remains and contain relatively few bird remains. Arctic char and other fish remains are difficult to find in the archaeological record due to preservation conditions. However, the ethnographic record, as well as wildlife management records, indicates that Arctic char are exploited in the area and are commonly found in Nettilling Lake. That said, there is no mention of the Arctic char populations in Mingo Lake or Amadjuak Lake or the Inuit exploitation of them, as they exist (Soper 1928).

### **Discussion of Methods**

The following section will discuss the methodological problems I encountered when conducting the analysis on the faunal assemblages from Mingo Lake. My use of VZAP is presented first followed by description of my experiences with the methods available to age and sex faunal assemblages that are dominated by caribou remains.

#### VZAP

VZAP (Virtual Zooarchaeology of the Arctic Project) was a useful website especially when I became more adept at identifying bones during the course of my analysis. VZAP provides a comparative collection for most mammalian, avian, and fish species that inhabit the Arctic (Betts et al 2011: 755). The website is free to access and

easy to use once a researcher becomes adjusted to the layout and programming. A researcher is able to choose the species they wish to look at and then choose the element(s). VZAP also allows for the cross comparison of elements across species. VZAP provides a 2D picture of a bone on a web page and allows for the option to view all the possible orientations of that bone (i.e. distal, proximal, medial, and lateral). One is also able to download a 3D .pdf of an element. The 3D model allows for a 360<sup>0</sup> view of a bone while also providing a 3D measuring tool which allows for easy comparison of bone size to better aid in the determination of species (Betts et al., 2011, p. 756). VZAP also eliminates the need for institutions to acquire expensive, hard to obtain skeletal materials; only four relatively complete Arctic faunal collections exist in North America (Betts et al., 2011, p. 756).

The online database was useful but I did find some downfalls with VZAP. First, I found the nomenclature used for identifying certain bones troubling. The carpals, tarsals, metapodials, and phalanx had different identifiers than the published faunal manuals I consulted. The fore and hind metapodials were labelled as cannons while the phalanx had a few names that I had not come across in my studies such as the medial lateral phalanx. I was also unaware that caribou have five sets of phalanx in each hoof. The carpal and tarsal nomenclature was also confusing since only a few had names (hamate and lunate) while others were just referred to by their anatomical position (distal carpal 2 and 3 and distal tarsal 2 and 3). I mirrored the nomenclature of my thesis to reflect the nomenclature used by VZAP to make everything more cohesive. The change in nomenclature is just a very minor problem that is easily corrected once the learning curve is over.

Betts et al. (2011: 757) aimed to obtain male and female skeletons as well as juveniles for the most represented species in the archaeological record (such as caribou and seal) while also providing multiple specimens of avian and fish skeletons. Unfortunately, this had not been fully completed while I was conducting my research. The only caribou skeleton available through VZAP was an adult female skeleton and there was no access to a juvenile skeleton; this limited my ability to identify certain elements that were not fully fused. However, most avian and fish species I needed to access had multiple individuals to examine.

VZAP is not designed to replace a real osteological collection (Betts et al., 2011: 762) but is an effective tool to use when it is not possible to have full access to faunal remains. I have and will continue to recommend VZAP to my colleagues.

### Age and Sex Methods

The age at death and the sex structure of an assemblage are crucial pieces in any investigation of faunal remains. Unfortunately for three of the four sites I examined, I was unable to determine these key elements. Sample size is one reason why I was unable to determine age and sex at LdFa-12, LdFa-13, and LdFa-14. All three sites produced relatively few faunal remains and what was present was highly fragmented. The methods that are used to age and sex caribou remains are not developed enough to be accurate in highly fractured assemblages.

Mandibles, key element in both the ageing and sexing of an assemblage, were not intact enough, at any of the Mingo Lake sites, to provide useful data. In order to properly estimate the sex using a mandible, the diastema (long space of bone in between the

canine and the first premolar) needs to be complete, or at least partially complete.

Unfortunately, the diastema is the most fragile portion of the mandible; it is rarely found intact in the archaeological record.

There is also a complete lack of information relating to the eruption patterns of the maxillary teeth. I uncovered a few maxillary teeth that were either deciduous or newly erupted in the assemblage from LdFa-1 Area 4. As such it would have been handy to have some data to compare the eruption patterns. One particularly interesting maxillary find (Figure 7.1) proved to be irrelevant since there was no data on eruption patterns. The right maxilla of a caribou was identified and it contains two deciduous molars and clearly shows the formation of two permanent teeth. All I can say about this find is that there is a juvenile represented in the assemblage but I could not give an accurate age even though the maxilla belongs to a young calf. I would assume that the maxillary eruptions are on par with the mandibular eruption of permanent teeth. As such I would deduce that the calf was younger than eight months of age but without any concrete data my assumptions are speculative.



Figure 7.1. Photograph of the Right Maxilla of a Juvenile Caribou.

A valid attempt was made to determine the age structure of the archaeological assemblage based on epiphyseal fusion. Unfortunately, there is not enough information available on caribou to concretely determine the age structure based on epiphyseal fusion. There is information on the fusion rates of Bison (*Bison bison*) and White-tailed deer *Odocoileus* but they are not similar enough to caribou nor do they live in the same environment making me hesitant to use their fusion rates as comparative data. More research needs to be conducted on caribou fusion rates. It has been shown that caribou were an important resource in the archaeological past and they remain an important resource for the Inuit today. In order to really grasp an understanding of past uses of caribou more research needs to be conducted on proper ways to age and sex an assemblage dominated by caribou remains.



## Chapter 8 – Conclusion

### Summary of Study

The interior of southern Baffin Island is an ideal location to procure both subsistence and lithic resources. It is also a strategic place for distant coastal populations to meet for social interactions and information exchange (Milne et al. 2013; Stenton 1989). As such it would make sense that the Palaeo-Eskimo, more specifically the Pre-Dorset, would have utilized the inland regions of Nettilling Lake, Amadjuak Lake, and Mingo Lake to their benefit. Besides works completed by Stenton (1989, 1991b), Milne (2005, 2008) and Park (2009) little archaeological work has been conducted in the interior of Baffin Island. Stenton (1989) examines the Thule faunal assemblages from the interior as well as a few Palaeo-Eskimo occupations while Milne and Donnelly (2004) investigated a snow goose assemblage from Burwash Bay; these two works are the extent of the published faunal analyses from the interior of Baffin Island. There have been a few studies undertaken in the interior of Greenland at sites attributed to the Saqqaq (e.g. Gotfredsen 1996) but unfortunately the information they present was not directly useful to this study. The only comparative sites I could find for the Pre-Dorset were located on the coast, and of these, few contained caribou remains. As such I was left to consult the ethnographic record in order to aid in my interpretations of the four Mingo Lake sites.

The findings from the faunal analysis indicate a summer and fall occupation of all four sites. LdFa-1 was intensively occupied over multiple occasions while LdFa-12 was a single-occupation campsite. LdFa-13 was used more extensively than LdFa-12 and is most likely a habitation site that also doubled as a butchering location. LdFa-14 appears to be a disposal area where the primary butchering of the caribou occurred. Within LdFa-

1 Area 4, there are three distinct sections that were each individually examined. The first section (A-E) contained a stone tent ring and was most likely the actual living quarters of the area. The second section (F-G) was an outdoor activity area where intensive marrow extraction occurred as exhibited by the high degree of element fragmentation. There was also a high proportion of burnt remains found in this section. This indicates the presence of an open-air hearth (once again signifying a summer to fall occupation). The hearth appears to have been fueled by bone and bone grease and provided a method for disposing of large amounts of bone. The smudge created by the burnt bone would have kept the summer bugs away from the activity area. The final section (H-K) from LdFa-1 Area 4 contains a stone circle with an undetermined use. Based on the fairly even elemental distribution it makes sense that it is some type of cache feature that was used to store caribou remains that were butchered into quarters. The quarters would have been stored in the stone feature before defleshing and marrow extraction activities began.

### **Implications for Arctic Research**

The archaeological record of the Palaeo-Eskimo peoples in the Arctic is noticeably lacking in interior sites with published faunal data. As such, my study is the first, large-scale analysis of a Pre-Dorset faunal assemblage originating from a distant interior with a predominant focus on caribou as a subsistence resource. The data resulting from this analysis will make a significant contribution to the missing dimension to the dual economy model: the terrestrial component.

The ethnographic record, with the use of analogy and a proper interpretive framework, can be useful when examining Palaeo-Eskimo adaptation strategies. The

Arctic environment presents certain challenges that remain consistent throughout time: pronounced seasonality and a limited resource base (both flora and fauna). All human populations living in this region had to deal with these challenges to successfully adapt. And, all of them made extensive use of the terrestrial landscape where essential resources like caribou, migrating waterfowl, and toolstone could be reliably acquired. Caribou hides would have been exploited throughout Palaeo-Eskimo times as a raw material resource just as the Thule Inuit exploited caribou as a raw material resource for hides (Stenton 1989, 1991b). Given these consistencies over time, the ethnographic record provides a unique and valuable resource for archaeologists from which to draw interpretive inferences when examining Arctic populations and their respective lifeways.

### **Future Considerations**

A basic faunal analysis was conducted on four assemblages from Mingo Lake. As such, there is still more work that can be done. A study focusing on bone refitting would make a valuable contribution to the data already obtained since the majority of the assemblages that were studied are either unsided caribou elements or shaft fragments from the long bones of caribou. As such, most of the interpretive value is lost in terms of elemental frequencies and quantitative strategies. This process would be time consuming but it could provide useful results. I made an attempt to refit a few bones from various bags and was successful on a number of occasions. Since I was successful in my limited attempt at refitting, a project could be undertaken to refit small areas of the assemblage to garner more accurate numbers.

Bone refitting will provide a means to quantify the entire caribou assemblage. At the moment, there appear to be comparatively few caribou exploited around the Mingo Lake area during the Pre-Dorset occupation of the area. However, if the shaft fragments could be identified, by either refitting or another comparable method, a more accurate quantification of the caribou remains could be undertaken. An attempt to quantify all the caribou remains at LdFa-1, LdFa-12, LdFa-13, and LdFa-14 will provide insights on how intensively caribou were harvested in the area. Moreover, it would provide a more accurate understanding of which elements are present at all four sites. A more accurate representation of the elements and quantity of each element will lead to a more precise description of site function and duration of occupation.

A second project that could be undertaken is an extensive survey and excavation of LdFa-12, LdFa-13 and LdFa-14. These sites, along with LdFa-15, are all in close proximity to one another and most likely contain more information that would be vital to understand the uses of each site. Their relationship with LdFa-1 would also be better understood with a more intensive examination of the site. Furthermore, there have been hunting blinds, drive lanes, and caches found in the areas around the four sites I examined (Milne 2005; Stenton 1991c). A more intensive examination of the features could also be undertaken to truly understand how the Palaeo-Eskimo and Neo-Eskimo utilized the area surrounding Mingo Lake.

A third project that would help validate the results of this study would be to undertake a similar analysis of the Dorset faunal remains from LdFa-1. Research has already been conducted on the Dorset lithic assemblage from LdFa-1 Area 1 (Landry 2013). If the same patterns of butchering and marrow extraction are found within the

other areas of LdFa-1, they would provide further evidence of continuity in site function and land use strategies among the Pre-Dorset and Dorset in the deep interior of southern Baffin Island (see Milne et al. 2012, 2013) .

Another project that can be conducted on the faunal remains from the sites around Mingo Lake relates to the burning of bone at LdFa-1, LdFa-13, and LdFa-14. These three sites show purposeful burning (calcined remains and relatively high frequencies of burnt bone to unburnt bone) but the exact purpose of burning bone remains to be absolutely determined. The burnt bones should be examined in greater detail to determine why bones were being burnt. If bone was being used as a fuel source there would be a higher proportion of cancellous bone (epiphyses) as cancellous bone releases bone grease slowly into a fire (Mentzer 2009; Stiner et al 1995; Théry-Parisot et al 2005). A higher proportion of cortical bone (shaft fragments) would indicate that bone was being used as a disposal method. Since the Pre-Dorset were exploiting bone marrow from the shafts of the long bone, there would be very little left over to fuel a productive fire. To conclude, a higher proportion of epiphyses would signal burning bone as a fuel source while a higher proportion of shaft fragments would signify fire as disposal method for bone.

Finally, a project can be undertaken to determine how Inuit elders would interpret the data. The results from this thesis can be presented to the elders for further insight. Based on their own experiences of living in the area, they would likely provide additional evidence to augment the findings of this study. Elders maintain the oral histories of a population and their knowledge must be shared with future generations so as to preserve our understanding of important places, traditions, and stories of the past.

## **Final Thoughts**

The research presented in this thesis also has implications outside of archaeology. The Arctic is currently feeling the effects of climate change, glaciers are melting leading to rising sea levels, winter sea ice is shrinking, and permafrost is melting, which directly impacts the frozen archaeological record. As the Arctic opens up and becomes more accessible, Polar nations like Greenland are experiencing pressure from industry to allow resource exploitation in pristine environments (Nuttall 2013: 372). Greenland is relying on non-renewable resources like oil and mineral ores to achieve complete separation from the Danish government. As such companies that specialize in the extraction of resources are flooding into Nuuk, the capital of Greenland in an attempt to begin the development process (Nuttall 2012, 2013). The government of Greenland is on board for this process to happen because they have sold Greenland as a place at the edge of the world, a wilderness that needs to be explored, a new frontier. By labelling the newly ice free areas of Greenland a frontier, the government and industry are saying that there is no history in the area (Nuttall 2012: 113). It is empty land that has yet to be explored (Nuttall 2012: 119). Industry has attempted to erase the oral traditions in certain areas of Greenland in its attempt to portray the mining areas as empty of information. Place names, migration patterns, and hunting stories are all important components of the Greenlandic oral traditions but industry and the government are placing an emphasis on technological knowledge, which does not exist in the area due to differences in what is deemed important knowledge of the environment (Nuttall 2013: 375). By attributing the mining areas as empty, public consultation is pushed to the side and mining licenses are handed out with few considerations given to the impact these massive extractive processes will

have on the environment or the communities and land surrounding the mines (Nuttall 2012: 114).

In reality, there is no such thing as empty spaces with no history (i.e. frontiers). Frontiers are socially constructed by Western cultures to combat modernity (Cronon 1995: 77-78). The concept of frontiers and the associated wilderness was also used to remove First Nations and Inuit from their territorial land as no one should be living in the wilderness until the Europeans tamed the wilderness (Cronon 1995: 79). By placing humankind outside the realm of the wilderness, we are denying our existence as a species in North America for over 10,000+ years. An untouched wilderness invites exploration and denies that past peoples ever lived in the area; no area is truly untouched (Cronon 1995: 81).

The ideas of untouched land and an emphasis on resource extraction are also present in Arctic Canada (Dahl 2012: 267-268). The interiors of the islands in the Arctic Archipelago could potentially be viewed as empty spaces with no history. If the islands contain desirable ores then we may begin to see the same events occurring in Arctic Canada that are occurring in Greenland. There is more of an emphasis on public consultation in Canada since the Inuit and First Nations have worked hard to gain a say in what occurs on their traditional lands but if it can be proven that there is no history in an area past the 1800's then mining companies can come in to disrupt the landscape. The research that has been described in this thesis allows for land claims to be made back at least 4000 years in the interior of southern Baffin Island. People have occupied the interior of Baffin Island since time immemorial and as such the Inuit must have a say in how resources are exploited in the traditional territories. Policy development, in relation

to the extraction of minerals, in the Arctic will hopefully drive more scholars to examine the interior of the islands of the Arctic Archipelago. Archaeologists have an ethical duty to prove that the landscape is not vacant and empty; instead people have occupied the area exploiting resources for thousands of years. The Arctic is not a wilderness frontier.



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## Appendix A: Identified Faunal Remains from Four Pre-Dorset Mingo Lake Sites

Appendix A contains the elemental distributions of all identified mammal, bird, and fish specimens from LdFa-1, LdFa-12, LdFa-13, and LdFa-14. The information in this table is divided into element, element portion, and side. The table coincides with the data presented in the quantification sections of chapter six. Since there was too much information to place in the actual chapter, it made sense to combine all the data into one comprehensive table. This allows for quick comparisons with other faunal assemblages.

	LdFa-1					LdFa-12				LdFa-13				LdFa-14				
	Right	Left	Both	Axial	Unsidied	Right	Left	Axial	Unsidied	Right	Left	Axial	Unsidied	Right	Left	Both	Axial	Unsidied
<b>Caribou</b>																		
Antler – Pedicle																		2
Antler – Tine					17													14
Crania – Miscellaneous Fragments					9							3						
Crania – Auditory Canal					9			1										
Crania – Temporal Bone	1				1													
Crania – Eye orbits					2							1						
Crania – Parietals					1										1			
Crania – Zygomatic, Maxilla, Lacrimal																		1
Crania – Frontal Bone			9		2													
Crania – Occipital Condyle	2																	
Crania – Nasals			1															
Crania – Cranial Vault					6													
Crania – Sinus					1													
Crania – Occipital Bone					1													
Crania – Palatine	1																	
Crania – Tooth Socket					16													
Crania - Maxilla	1	2			2													
Maxillary Second Premolar	2	5													1			
Maxillary Third Premolar	7	2																
Maxillary First Molar	1	2							1						1			
Maxillary Second Molar	3	5																
Maxillary Third Molar		5													1			
Maxillary Premolar	9	7			3													
Maxillary Molar	10	13			11				1					1	1			
Maxillary Tooth	1	1			16													
Mandible – Gonial Angle	1	3				1								1				

	LdFa-1					LdFa-12				LdFa-13				LdFa-14				
	Right	Left	Both	Axial	Unsided	Right	Left	Axial	Unsided	Right	Left	Axial	Unsided	Right	Left	Both	Axial	Unsided
Mandible – Tooth Socket		1			2	1												
Mandible – Body	5	1			12													
Mandible – Body and Ramus					1													
Mandible – Condyle		2																
Mandible – Diastema	3	6																
Mandible – Diastema and Tooth Socket	1	2																
Mandible – Diastema and First Premolar		1																
Mandible – Ramus	2	3			1													
Mandible – Ramus and Condyle	1	5																
Mandible – Ramus, Condyle, and Gonial Angle	1	1																
Mandible – Ramus and Gonial Angle	2																	
Mandible – Body and First Premolar		1																
Mandible – Body, Premolars, and First Molar		1																
Mandible – Body and molars	2	1																
Mandible – Body and Third Molar	1	1							1									
Mandible – Body, Second Molar, Third Molar		3																
Mandible – Body, Ramus, Second Molar, and Third Molar	2																	
Mandible – Body and Three molars	1	1																
Mandible – Body and Unidentified Teeth	1																	

	LdFa-1					LdFa-12				LdFa-13				LdFa-14				
	Right	Left	Both	Axial	Unsidied	Right	Left	Axial	Unsidied	Right	Left	Axial	Unsidied	Right	Left	Both	Axial	Unsidied
First Incisor	1																	
Second Incisor	1	1																
Third Incisor		1																
Incisor	2	4			2													
Canine		1																
Mandibular First Premolar	8	13			1													
Mandibular Second Premolar	5	6																
Mandibular Third Premolar	9	10							1									
Mandibular Second Molar													1					
Mandibular Third Molar	9	9			2	1				1			1	2				
Mandibular Premolar	5	8			6													
Mandibular Molar	22	23			30				1	1			2					3
Mandibular Tooth					12							1						1
Tooth					32							2						1
Vertebra – Body				5							2						1	
Vertebra – Lamina				3							1							
Vertebra – Articular Facets				1													1	
Vertebra – Articular Surface				2														
Vertebra – Caudal Articulation				1														
Vertebra - Epiphysis				3														
Vertebra – Spinous Process				3														
Atlas				1														
Axis				1														
Cervical Vertebra – Lamina											1							
Cervical Vertebra – Body				2														
Cervical Vertebra – Cranial Articulation				3														
Cervical Vertebra – Spinous Process				2														



	LdFa-1				LdFa-12				LdFa-13				LdFa-14					
	Right	Left	Both	Axial	Unsided	Right	Left	Axial	Unsided	Right	Left	Axial	Unsided	Right	Left	Both	Axial	Unsided
Cervical Vertebra – Inferior Articular Facet				1														
Cervical Vertebra – Articular Facet				1														
Cervical Vertebra – Transverse Process				1														
Cervical Vertebra – Transverse Foramen				1														
Cervical Vertebra – Cranial Transverse Foramen				1														
Cervical or Thoracic Vertebra - Body				1														
Thoracic Vertebra – Spinous Process				8							2							
Thoracic Vertebra – Cranial Articulation				1														
Thoracic Vertebra – Body				8														
Thoracic Vertebra – Neural Spine											1							
Thoracic Vertebra – Inferior Articular Facet				6							1							
Thoracic Vertebra – Articular Facet				3														
Thoracic Vertebra – Lamina				2														
Thoracic Vertebra – Body and Superior Articular Facet				1														
Thoracic or Lumbar Vertebra – Body				1														
Lumbar Vertebra – Lamina				1														
Lumbar Vertebra – Body				2							1							

	LdFa-1					LdFa-12				LdFa-13				LdFa-14				
	Right	Left	Both	Axial	Unsidied	Right	Left	Axial	Unsidied	Right	Left	Axial	Unsidied	Right	Left	Both	Axial	Unsidied
Lumbar Vertebra – Superior Articular Facets				2														
Sacrum – Cranial Articulation				1														
Sacrum – Spinous Process				1														
Caudal Vertebra – Body				2														
Sternum – Body				2								1						
Sternum – Xyphoid Process				2														
Stylohyoid – Head	1																	
Stylohyoid – Shaft	1	1																
Stylohyoid – Sternal End		1																
Rib – Head, Neck, Tubercle	11	5		1					2					1				
Rib – Shaft	4	6		134					1	2		3	1					5
Rib – Sternal End	2	1		9								1						2
Rib - Whole		1																
Scapula – Glenoid Fossa	1	3																
Scapula – Blade				12								1	1					
Clavicle – Shaft				1														1
Humerus – Proximal		1		2						1								
Humerus – Shaft				1														
Humerus –Distal	2	1				1												
Radius – Proximal	11	9		2					1					2				
Radius – Shaft		1		2														
Radius – Distal	4	1				1												
Radio-Ulna – Shaft	3	1		50								4						2
Radio-Ulna – Distal	10	3																
Ulna – Proximal	1																	
Ulna – Olecranon Process	6	4		2														
Ulna –Shaft				1														
Ulna – Distal		1																

	LdFa-1					LdFa-12				LdFa-13				LdFa-14				
	Right	Left	Both	Axial	Unsidied	Right	Left	Axial	Unsidied	Right	Left	Axial	Unsidied	Right	Left	Both	Axial	Unsidied
Distal Carpal 2 and 3	9	6																
Scaphoid	6	5																
Lunate	10	7			1													
Hamate	7	8			2													
Triquetrum	8	5																
Fore Cannon – Proximal	6	5			1										1			
Fore Cannon – Shaft					17													1
Fore Cannon – Distal	5	8			3							1						
Metacarpal 2					1													
Proximal Phalanx (Manus) – Proximal	3	5			10													1
Proximal Phalanx (Manus) – Distal	4																	
Proximal Phalanx (Manus) – Whole		1																
Proximal Lateral Phalanx (Manus) – Proximal	2	3				1												
Proximal Lateral Phalanx (Manus) – Distal										1								
Medial Phalanx (Manus) – Proximal		1			1													1
Medial Phalanx (Manus) – Distal					2													
Medial Lateral Phalanx (Manus) - Whole	1									1								
Second Proximal Phalanx (Manus) - Whole												1						
Distal Phalanx (Manus) – Proximal																		1
Pelvis – Acetabulum	12	4			2		1							1				

	LdFa-1					LdFa-12				LdFa-13				LdFa-14				
	Right	Left	Both	Axial	Unsid ed	Right	Left	Axial	Unsid ed	Right	Left	Axial	Unsid ed	Right	Left	Both	Axial	Unsid ed
Pelvis - Shaft					12													1
Pelvis – Auricular Surface					3													
Pelvis – Pubis/Ischium					1													
Femur – Head		2			1													
Femur – Shaft					1													
Femur - Distal		1																
Patella	2																	
Tibia – Proximal		1			1													
Tibia – Shaft	1				1													
Tibia – Distal Shaft																		1
Tibia - Distal	9	5			2				1			1						
Fibula	3									1								
Calcaneus – Proximal	6	3																
Calcaneus – Shaft	1																	
Calcaneus – Body	1	1																
Calcaneus – Distal	1				1													
Calcaneus – Whole		1																
Talus - Whole	9	2							1									
Talus - Body	3	2			2													
Talus – Posterior	1	1																
Distal Tarsal 2 and 3	3	4			2													
Navicular	8	12																
Hind Cannon – Proximal	17	12			5			1	1			1						1
Hind Cannon – Shaft	4	2			146			2				5						2
Hind Cannon – Distal Shaft																		1
Hind Cannon – Distal	23	4			9													
Proximal Phalanx (Ped) – Proximal	7	5			7	1												
Proximal Phalanx (Ped) – Distal	1	1			4					1								

	LdFa-1					LdFa-12				LdFa-13				LdFa-14				
	Right	Left	Both	Axial	Unsidied	Right	Left	Axial	Unsidied	Right	Left	Axial	Unsidied	Right	Left	Both	Axial	Unsidied
Proximal Phalanx (Ped) – Whole		1																
Proximal Lateral Phalanx (Ped) – Proximal	4	4			1													
Proximal Lateral Phalanx (Ped) – Distal		1																
Medial Phalanx (Ped) - Proximal					1													
Medial Phalanx (Ped) – Distal	1																	
Second Proximal Phalanx (Ped) - Whole		1																1
Cannon – Proximal					5													
Cannon – Shaft					4													
Cannon – Distal					35													
Phalanx – Proximal					1							2						
Phalanx – Shaft					3													
Phalanx – Distal					16			1				2						
Phalanx - Whole					1													
Proximal Phalanx – Proximal					33													1
Proximal Phalanx – Shaft					3													
Proximal Phalanx - Distal	1				38													
Proximal Lateral Phalanx – Proximal	1																	
Medial Phalanx – Proximal					49													1
Medial Phalanx – Distal					15													
Second Phalanx - Shaft					1													
Second Phalanx – Whole					1													
Second Proximal Phalanx - Proximal					2													
Second Proximal Phalanx – Whole					2													

	LdFa-1					LdFa-12				LdFa-13				LdFa-14				
	Right	Left	Both	Axial	Unsidied	Right	Left	Axial	Unsidied	Right	Left	Axial	Unsidied	Right	Left	Both	Axial	Unsidied
Second or Fifth Medial Phalanx - Whole					3													
Distal Phalanx – Proximal					2													
Fifth Distal Phalanx – Distal					1													
Fifth Distal Phalanx –Whole					1													
Metapodial					2							1						
Irregular Bone					20							2						1
Limb Bone – Shafts					2													1
Long Bone - Shafts					25													2
<b>Fox</b>																		
Thoracic Vertebra – Lamina				1														
Rib – Head, Neck, Tubercle					1													
Rib – Sternal End					3													
Pelvis – Pubis	1																	
<b>Wolf</b>																		
Lumbar Vertebra – Lamina				1														
<b>Canine</b>																		
Incisor					1													
First Premolar					1													
Vertebra – Lamina				1														
Vertebra – Body				1														
Cervical Vertebra – Body				1														
Cervical Vertebra – Transverse Process				1														
Thoracic Vertebra – Spinous Process				1														
Lumbar Vertebra – Lamina				1														
Lumbar Vertebra – Body				1														
Epiphyoid					1													

	LdFa-1				LdFa-12				LdFa-13				LdFa-14					
	Right	Left	Both	Axial	Unsidcd	Right	Left	Axial	Unsidcd	Right	Left	Axial	Unsidcd	Right	Left	Both	Axial	Unsidcd
Rib – Head, Neck, Tubercle		1																
Rib - Shaft					1													
Pelvis – Pubis	1				2													
Pelvis - Shaft					1													
Femur – Distal					1													
Fibula					1													
Phalanx – Distal					1													
Proximal Phalanx					1													
<b>Large Mammal</b>																		
Crania – Miscellaneous Fragments					44							3						
Crania - Sinus					1													
Crania – Tooth Socket					2													
Scapula – Blade												1						1
Vertebra – Body				1								1						
Vertebra – Lamina				2														
Cervical Vertebra – Transverse Foramen												1						
Rib – Shafts					8							2						2
Pelvis – Shaft												1						
Phalanx – Proximal					1													1
Phalanx – Shaft					1													
Phalanx –Distal					1													
Flat Bone					383			1				7						4
Irregular Bone					41			1										2
Limb Bone – Articulation					35							1						4
Limb Bone – Shafts					1770			22				51						35
Limb Bone - Epiphysis					1													
Long Bone - Articulations					47							1						2
Long Bone- Shafts					1316			14				50						50

	LdFa-1					LdFa-12				LdFa-13				LdFa-14				
	Right	Left	Both	Axial	Unsidied	Right	Left	Axial	Unsidied	Right	Left	Axial	Unsidied	Right	Left	Both	Axial	Unsidied
Miscellaneous Shaft Fragments					18													2
<b>Herbivore</b>																		
Tooth					672				3				15					101
<b>Medium-Large Mammal</b>																		
Crania – Miscellaneous Fragments					41								3					
Mandible – Tooth Socket					1													
Vertebra – Body				2														
Vertebra – Epiphysis				2														
Vertebra – Lamina												2						
Vertebra – Articular Surface				1														
Rib - Shaft					1													2
Pelvis – Auricular surface					2													
Flat Bone					74								4					
Irregular Bone					4								1					
Limb Bone - Articulations					18													
Limb Bone – Shaft					11													1
Long Bone - Articulation					1													
Long Bone - Shafts					3													4
Epiphysis					2													
<b>Medium Mammal</b>																		
Crania – Miscellaneous Fragments					2													2
Vertebra – Lamina				2														
Vertebra – Articular Facet				1														
Vertebra – Body				3														
Rib – Head, Neck, Tubercle		1			2						1							
Rib – Shaft					7													1
Pelvis					1													
Phalanx – Distal					1													
Flat Bone –Articulation					2													



	LdFa-1				LdFa-12				LdFa-13				LdFa-14					
	Right	Left	Both	Axial	Unsid ed	Right	Left	Axial	Unsid ed	Right	Left	Axial	Unsid ed	Right	Left	Both	Axial	Unsid ed
Flat Bone – Shaft					18													
Irregular Bone					5													
Limb Bone – Articulation					11													
Limb Bone – Shaft					19							2						
Long Bone – Shaft					14							3						4
<b>Small Mammal</b>																		
Mandible – Tooth Socket					1													
Vertebra - Body				1														
Limb Bone					1													
Long Bone					3													
<b>Unknown Mammal</b>																		
Crania – Miscellaneous Fragments					5							1						
Crania –Parietal Bone												1						
Tooth								10										
Rib - Shafts					1							6						
Flat Bone					11													
Irregular Bone					1													
Limb Bone																		3
Long Bone					1													1
Shaft Fragments					14													
<b>Snow Goose</b>																		
Crania -Beak				1														
Crania – Cranial Vault		1																
Mandible - Body									1									
Synsacrum				1														
Rib – Shaft					6													
Rib – Sternal End	2				1													
Rib -Whole	2	1																
Coracoid – Shaft	1				1													

	LdFa-1				LdFa-12				LdFa-13				LdFa-14					
	Right	Left	Both	Axial	Unsidied	Right	Left	Axial	Unsidied	Right	Left	Axial	Unsidied	Right	Left	Both	Axial	Unsidied
Humerus – Proximal		1																
Humerus – Distal	1																	
Radius – Distal	1	1																
Ulna – Shaft					2													
Carpometacarpus – Shaft		1								1								
Femur		1																
Tibiotarsus - Shaft	1									1								
Tarsometatarsus – Shaft		2																
Digit 2		1																
Digit					1													
Phalanx					1													
Limb Bone					1													
Long Bone – Articulation					2													
<b>Large Bird</b>																		
Sternum					1													
Rib – Shaft					1													
Long Bone					4													
Shaft Fragment					7							2						2
<b>Medium-Large Bird</b>																		
Crania					1													
Rib – Head, Neck, Tubercle					1													
Rib – Shaft					1													
Limb Bone					2													
Long Bone					16													
Shaft Fragment					11							2						1
<b>Medium Bird</b>																		
Radius – Shaft					1													
Flat Bone					1													
Limb Bone					2													

	LdFa-1				LdFa-12				LdFa-13				LdFa-14					
	Right	Left	Both	Axial	Unsidied	Right	Left	Axial	Unsidied	Right	Left	Axial	Unsidied	Right	Left	Both	Axial	Unsidied
Long Bone					6													
Unknown Fragments					3													
<b>Unknown Bird</b>																		
Crania – Eye Orbit												1						
Rib – Shaft												1						
Irregular Bone												1						
Shaft Fragments					19							10						10
<b>Arctic Char</b>																		
Parasphenoid					1													
Maxilla	1	1																
Vertebra				1														
Thoracic Vertebra				1														
Caudal Vertebra				2														
Certhyal				1														
Branchiostegal Ray				1														
<b>Unknown Fish</b>																		
Crania				1														
Vertebra – Body				1								1						
Unknown Fragments				11														