A TAPHONOMIC TREATMENT OF THULE ZOOARCHAEOLOGICAL MATERIALS FROM DIANA BAY, NUNAVIK (ARCTIC QUEBEC)

by

Susan E. Lofthouse

Department of Anthropology

McGill University, Montréal

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Abstract

This thesis presents a taphonomic analysis of a zooarchaeological assemblage excavated from JfEl-10, a Thule site located near modern Quaqtaq in Nunavik. Little is known of the Thule occupation of Nunavik, and even less concerning Thule subsistence activities here. As a result, this is one of the first detailed zooarchaeological analyses performed on Thule archaeofaunas from the Ungava region. Because of the poor preservation that characterized the assemblage, a taphonomic study was undertaken in order to determine the "representativeness" of the faunal remains. Food utility indices are compared to bone density indices, in order to establish the effects of density-mediated attrition upon the faunal remains.

A moderate correlation was found between bone density and the identified animal bones. This indicated that, while density-mediated attrition had altered the zooarchaeological assemblage, bone density alone did not provide a sufficient explanation for the observed element distributions. Other taphonomic agents, such as those related to the degree of butchering and the potential effects of cryoturbation upon remains, also need to be taken into consideration.

Resumé

Cette thèse présente l'analyse taphonomique d'un assemblage zooarchéologique de la fouille du site JfEl-10 près de Quaqtaq à Nunavik. L'occupation Thule au Nunavik est très mal connue, et le mode de vie Thule en Nunavik est encore moins bien connu. Le présent travail est l'une des premières analyses zooarchéologiques detaillées éffectuées sur l'archéofaune Thule de la region d'Ungava. À cause de la piètre préservation qui charactérise l'assemblage, une étude taphonomique a été entreprise pour déterminer ce que les ossements fauniques représentent. Les indices d'utilité alimentaire sont comparés aux indices de la densité des ossements, dans le but de déterminer les effets sur l'assemblage de l'attrition modifiée selon la densité des restes.

Une corrélation spatiale modérée a pu être établie entre la densité des ossements et la proportion d'ossements identifiés. Ceci indique que, même si l'attrition modifiée selon la densité a changé l'assemblage archéologique, la densité des ossements ne suffit pas à elle seule à expliquer les elements de distribution observés. D'autres agents taphonomiques, comme par example ceux reliés au degré de dépeçage et des effets potentiels de cryoturbation sur les ossements, doivent aussi être considérés.

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Dedication:

This is for my grandmothers – Frieda and Margaret.

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Chapter 1

INTRODUCTION

Zooarchaeological research in the Canadian Arctic has often touted the exceptional organic preservation that is characteristic of the circumpolar zone, providing a unique opportunity to develop relatively unconstrained subsistence interpretations. Organic materials that have been firmly encased in permafrost for centuries, even millenia, often emerge in a condition rarely seen further south. The most southerly reaches of the Canadian Arctic, however, experience a permafrost layer that lies deeper in the substrate, and archaeological materials are therefore more commonly subject to destructive freeze/thaw cycles (cryoturbation). Subsistence interpretations developed from faunal materials must of necessity exercise caution, maintaining a persistent awareness of the range of taphonomic factors that may have altered the deposited assemblage.

Taphonomy is the area of study concerned with the "laws of burial" (Efremov 1940) and was initially defined with reference to palaeontology. The subfield of vertebrate taphonomy is of particular concern to archaeologists, since this considers the natural processes acting upon animal remains through the transition from the biosphere to the final fossil assemblage. Since zooarchaeologists are ultimately interested in interpreting human behaviour from faunal debris, the study of vertebrate taphonomy provides a valuable set of guidelines by supplying a means of establishing the representativeness of the analysed assemblage. By identifying the natural formation processes that have been active upon a zooarchaeological assemblage, the analyst is better able to evaluate the security of inferences made concerning cultural formation processes

(Schiffer 1987): "The accurate identification of agents and causal mechanisms is the critical basis for modeling taphonomic systems. Without the ability to take this first step, all subsequent analyses and resulting cultural and environmental reconstructions should be viewed with caution" (Bonnichsen 1989: 1).

The present study considers a zooarchaeological assemblage that was excavated from a Thule site near modern Quaqtaq in Nunavik (Figure 1.1). The site, JfEl-10 (DIA-10), is located on Illutalialuk (Igloo Island) in the base of Diana Bay along Hudson's Strait. Archaeological research at JfEl-10 was conducted in two phases. The first excavation phase occurred during the 1970's through the Tuvaaluk Project of the Laboratoire d'Archèologie at the Université de Québec à Montréal. The second phase took place in 2002 with the collaboration of McGill University, Université Laval, and Avataq Cultural Institute through the Community-University Research Alliance project (CURA) "Des Tuniit aux Inuits". The small zooarchaeological assemblage yielded through the activities of both projects was analysed by the author, and displayed a significant amount of evidence for disturbance from a suite of taphonomic factors.

This thesis is divided into seven chapters. Following this introduction, a historical overview of studies relating to formation processes is presented in Chapter 2. Chapter 3 provides a more detailed discussion of the history of taphonomic theory, and describes the methodologies that are applied in this thesis. Chapter 4 presents the background on the geography of the Labrador-Ungava peninsula, a history of the archaeological and ethnohistorical research conducted here, and a discussion of the subsistence cycle that had traditionally been practised by Inuit of the Diana Bay region. Information on the relationship between the analysed and deposited assemblages is then sought through the

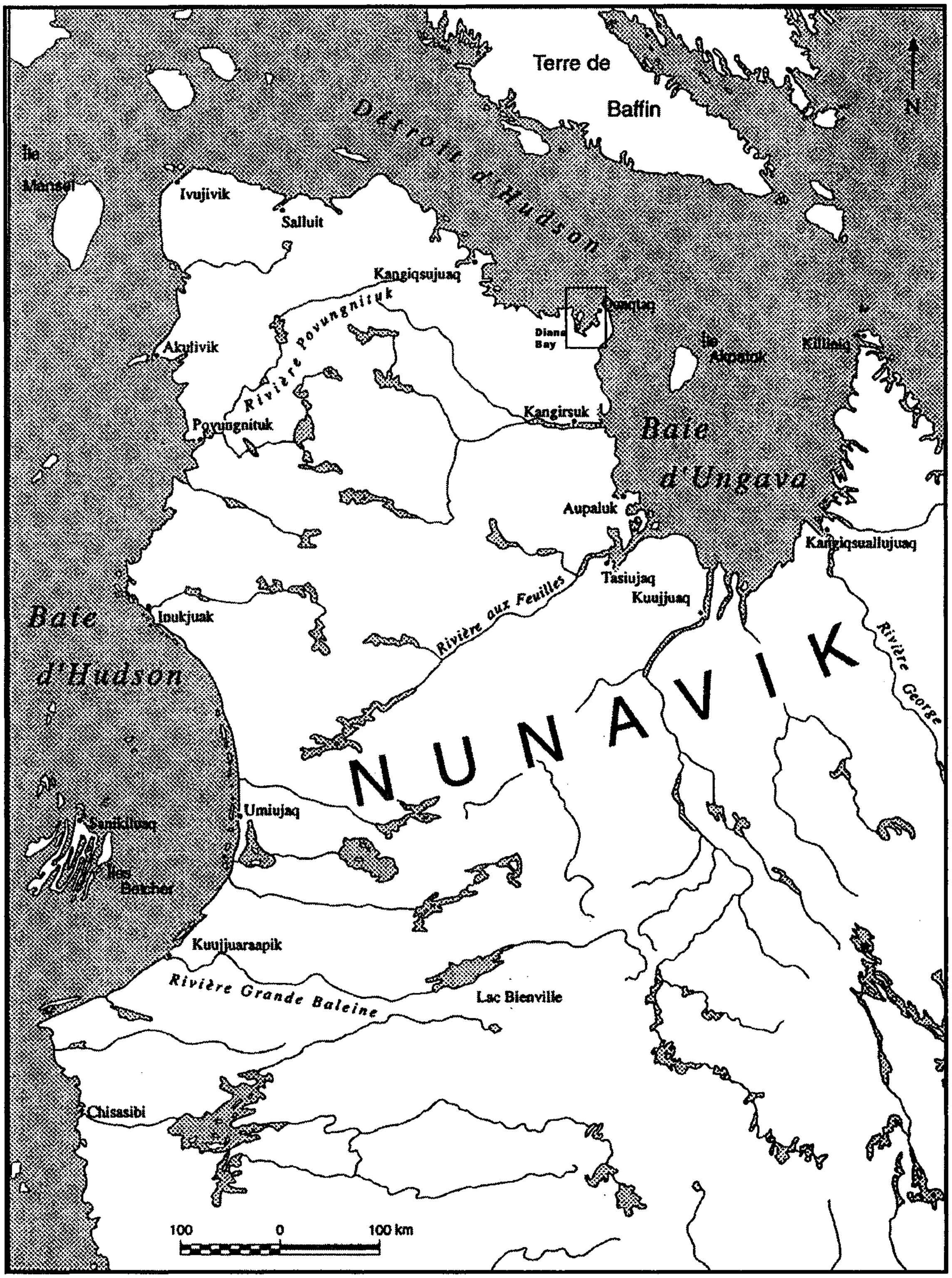

Figure 1.1 : Map of Nunavik indicating location of Diana Bay.

application of food utility and bone density indices to the identified zooarchaeological materials in Chapters 5 and 6. Food utility indices are applied to the assemblage in order to identify potential butchery and transport strategies, while bone density indices enable the identification of potential differential preservation. The faunal analysis is presented in Chapter 5, including a discussion of the site seasonality, species and element distributions, and presentation of the food utility data. Chapter 6 presents the bone density data, which is compared to the faunal data, and considers the taphonomic history of the site. Finally, the conclusions are presented in Chapter 7.

Chapter 2

A HISTORICAL REVIEW OF STUDIES ON FORMATION PROCESSES

The last four decades have witnessed an intensified awareness among archaeologists of the range of processes affecting the formation of the archaeological record. Although reference had been made before this time to potential natural sources of site alteration (i.e.: Darwin 1896; Atkinson 1957), it was not until the 1960s and 1970s that the importance of both natural and cultural forms of archaeological site disturbance was considered. Previous analyses that had been based upon an uncritical acceptance of the 'patterns' seen in the material record were brought into question, and the call was put out for a revision of uncensored interpretations of material culture. Behavioural archaeologists of the 1970s (i.e.: Reid, Schiffer and Rathje 1975; Schiffer 1972, 1976) drew upon works stemming from the previous decade (Ascher 1961a, 1961b, 1962, 1968; Clarke 1968, 1973) to develop a body of thought that emphasized "the importance of identifying formation processes *before* behavioural or environmental inferences are attempted" (Schiffer 1983: 697; 1987: 303, emphasis in originals). At the same time, middle-range theory was proposed (Binford 1977a, 1981b) with the similar goal of understanding the range of processes that shape the archaeological record in order to develop laws that may be used to explain the visible patterns.

Early Treatments of Formation Processes

Charles Darwin was possibly the earliest researcher to point out the potential transformative effect of natural processes upon archaeological sites. First published in 1881, *The Formation of Vegetable Mould through the Action of Worms with Observations* *on Their Habits* (Darwin 1896) included specific reference to the impacts of worm activity upon archaeological remains in Britain. Over 75 years later, Darwin's work was drawn to the attention of archaeologists when *Worms and Weathering* (Atkinson 1957) highlighted the significance of the post-depositional "processes of formation" (ibid.: 219) acting upon archaeological deposits. In this article Atkinson detailed the particular alterations effected by various earthworm species, to which he attributed increased burial rates of archaeological materials and accelerated weathering processes of rocks and sediments. Atkinson made the important observation that "the assumption of a static state in archaeological sites is false, even dangerous" (ibid.: 219).

The term "Pompeii premise" was coined by Robert Ascher (1961a: 324) to describe the presumption of the frozen condition of archaeological information referred to by Atkinson. This recognition led Ascher (1962, 1968) to undertake a pioneering series of ethnoarchaeological studies, in an attempt to identify some of the factors responsible for the "disorganization path" (Ascher 1968: 51) conditioning the material record of a Seri Indian community. Ascher's statement that "the recognition of man's purposeful arrangements depends on *distinguishing between* the action of natural agents and the action of human agents" (ibid.: 47, emphasis in original), along with his descriptions of *smearing* and *blending* (in which behavioural information found in refuse is obscured by aeolian sand and chemical decomposition), and *cycling* (involving the recycling of scarce materials)(ibid.: 50), provided early considerations of cultural and natural formation processes that would later inspire behavioural archaeologists in the 1970s. Ascher set the stage for future ethnoarchaeological research with his description of the archaeological importance of 'time's arrow', which progressively reduces the quality and quantity of surviving evidence:

> "in time, every community will become a 'ghost town', then a cube below ground. The problem of the prehistorian is to reconstruct the community from the cube. Since the connection between the archaeological present and the ethnographic past lies along the route of increasing disorder, the advancement of interpretation depends on knowing what happens along that route" (Ascher 1968: 52).

Behavioural Archaeology

Behavioural archaeology proposed that "the subject matter of archaeology is the relationships between human behaviour and material culture in all times and places" (Schiffer 1976: 4). The emphasis in this statement upon material culture incorporates the premise that before any higher-level inferences can be made from archaeological data, the effects of natural and cultural agents must first be identified and distinguished between. Schiffer (1972: 156) accused previous generations of archaeologists of accepting the spatial patterning of archaeological remains as fully representative of the spatial patterning of past activities, with particular criticism of Lewis Binford's reference to the " 'fossil' record of the actual operation of an extinct society" (Binford 1964: 425).

Schiffer developed a series of flow charts (Figure 2.1) representing the life cycle of an element through the *systemic* (while participating in a behavioural system), and *archaeological* (deposited in the archaeological record after having passed through the behavioural system) contexts (Schiffer 1972: 159-163). Gaps separating the stages of procurement, manufacture, use, discard, and refuse, represent points of opportunity for removal of elements from the chain through storage or transport, thereby preventing their final deposition within the archaeological context. In this article he introduced categories for refuse disposal patterns: *primary* refuse refers to material discarded at its location of use (i.e., through loss), *secondary* refuse is discarded away from its location of use (i.e., in a refuse heap), and *de facto* refuse is deposited without deliberate discard behaviour (i.e., upon abandonment of a site).

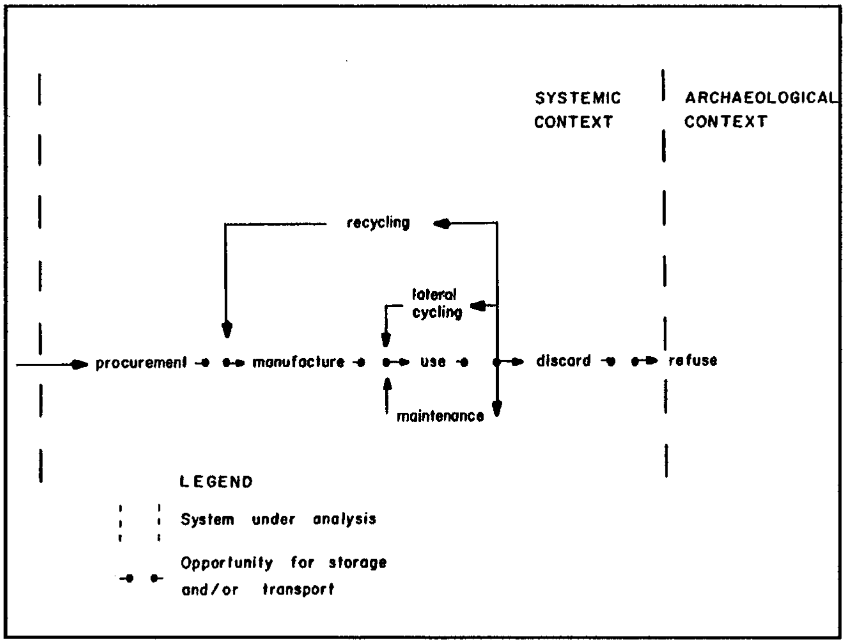

Figure 2.1: Flow chart demonstrating life cycle of durable elements. (Schiffer 1972: 159)

Schiffer's flow charts resembled an amplified segment of David Clarke's systems model for archaeological processes (Clarke 1968: 73) (Figure 2.2). Based upon systems theory, this schematic model suggested that "archaeological entities, at several levels, change as special kinds of dynamic systems coupled with environing or contextual systems" (ibid.). These 'environing' and 'contextual' systems resemble Schiffer's natural and cultural formation processes, later labelled c-transforms and n-transforms (Schiffer 1976). David Clarke (1973: 16-17) also proffered a body of archaeological theory that considered all factors active in the stages of predeposition and deposition, postdeposition, retrieval, analysis, and interpretation. This group of theories was concerned with all relationships between material objects and the range of factors that affect them: from their position within a culture system to their retrieval through excavation, submission to the analytical process, and eventual incorporation within a general theory.

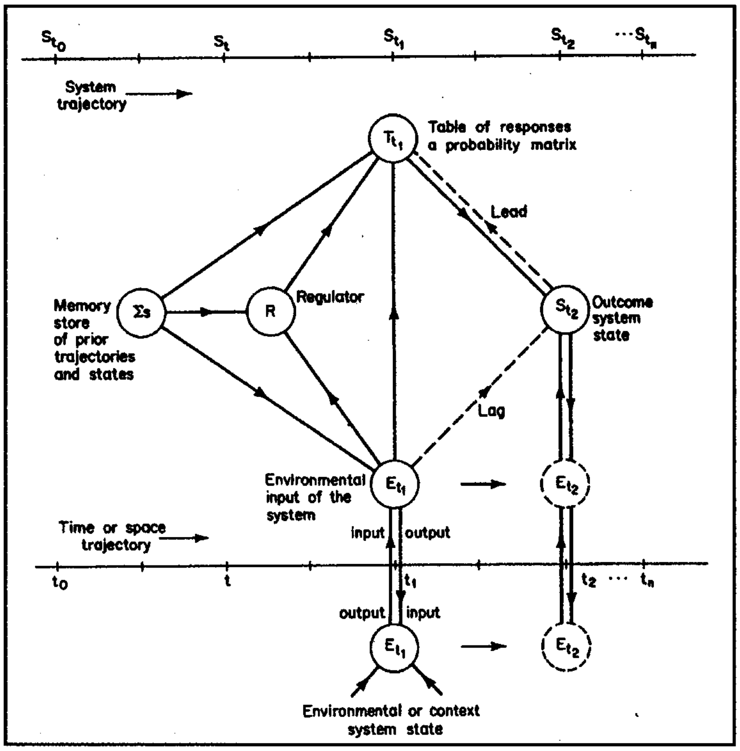

Figure 2.2: A model for archaeological processes – suggests change as dynamic systems meet with environing or contextual systems. (Clarke 1968: 73)

Behavioral Archeology (Schiffer 1976) introduced the terms *c-transforms* and *n-transforms* to describe cultural and natural formation processes. Schiffer proposed the *synthetic model* (Figure 2.3) that built upon three basic properties of archaeological data (ibid.: 12):

1. data consist of materials in static spatial relationships: archaeological *correlates*
2. data represent output from a cultural system: [subject to] *c-transforms*
3. data have been subjected to noncultural processes: *n-transforms.*

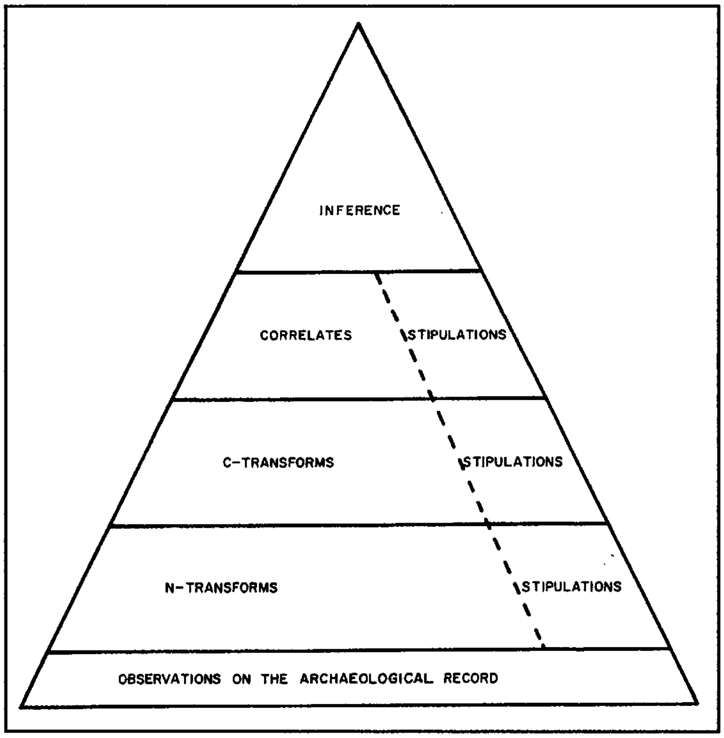

Figure 2.3: The synthetic model (Schiffer 1976: 12)

The most important type of correlate connects behavioural variables to the material record. In applying the synthetic model, stipulations must be stated and tested when considering each of these three properties. Schiffer suggested that through continually stating and testing assumptions being made at each stage of analysis, a process referred to as "inference justification" (ibid.: 12), considering the effects of c-transforms and n-transforms upon the material data and establishing expected archaeological correlates, archaeological laws may be more confidently established. This proposition was not dissimilar to Clarke's (1973) chain of predepositional and depositional, postdepositional, retrieval, analytical, and interpretive theories.

Returning to his systemic and archaeological contexts (Schiffer 1972), Schiffer (1976: 28-41) developed a framework of cultural formation processes in which he distinguished four categories: S-A, A-S, A-A, and S-S processes. These codes simply refer to the movement of objects from one context to another. Thus, S-A indicated the transformation of materials from the systemic context to the archaeological context, such as through the actions of discard, burial, loss, and abandonment. A-S processes involve the transformation from archaeological context to systemic context: this may occur through such activities as scavenging, looting or excavation. A-A processes (archaeological to archaeological context) may be induced through land-modification activities like ploughing, mining, dam-building, etc. Finally, S-S processes (systemic to systemic context) might be seen through recycling, secondary usage (involving a change in form and function), internal cycling (changing hands), or conservation (with a change in function but not form). These processes all represent significant sources of variability in the archaeological record. The recognition of this variability is essential, since "to note that a formation process has a biasing effect is also to acknowledge that it has predictable consequences – which can be described by laws" (Schiffer 1987: 10). While true, the identification of laws that govern an almost infinitely varying combination of formation processes is far more difficult – as taphonomic researchers continue to discover.

Middle-Range Theory

Middle-range theory, defined as "research that emphasizes the study of extant systems in which both processes and the results of processes can be observed" (Nash and Petraglia 1987: 194), was proposed by Binford (1977a, 1981b) as a means of utilizing a knowledge of the effects of formation processes to discern broader patterns, with the goal of establishing laws that may be more widely applicable. The objective of middle-range theory, then, is to identify the dynamics responsible for the static patterns perceived in the archaeological record (Binford 1977a: 6-7). In other words, "we are looking for 'Rosetta stones' that permit the accurate conversion from observation on statics to statement about dynamics" (Binford 1981b: 25). Despite choosing a new term to describe it, Binford (ibid.) recognized that his middle-range theory was essentially the same as David Clarke's interpretive theory, and was probably similar to the intentions purported for behavioural archaeology, although he ridiculed the latter for providing no more than low-level "empirical generalizations" (Binford 1977a: 5).

The primary concern of *Behavioral Archeology* lay with cultural formation processes; natural formation processes received only cursory mention. Binford (1981a), in response to Schiffer's (1972: 156; 1976: 11) use of him as a 'straw man', objected to the concept that cultural formation processes could create bias within the archaeological record. He reasoned that behavioural dynamics acting within a cultural system are a normal function of that system, and could not therefore be viewed as distorting the system's material record. For example, the cleaning of a hearth and subsequent deposition of the debris at another location as secondary refuse, is simply a regular behavioural act. "The archaeological record can only be considered a distortion relative to some *a priori* set of expectations; certainly it is not a distortion of its own reality" (Binford 1981a: 200).

Binford also critiqued Schiffer's application of his synthetic model to the archaeological data of the Joint site (Schiffer 1976: 79-178), accusing the behavioural archaeologist of adherence to the 'Pompeii premise' in his assumption that a single occupation phase explained the house floor assemblages. Schiffer's failure to consider the possibility of *successional* use (Binford 1981a: 204) overlooked another important formation process: repeated visits to the same spots on a landscape can generate concentrated patches of refuse that may be mistaken for a continuous occupation sequence (Isaac 1981: 152). Binford (1981a: 204) pointed out the possibility of post-abandonment use of house ruins by hunting parties, and stressed that the importance of palimpsests in the development of the archaeological record could not be ignored. Curiously, in his response to Binford's critique, Schiffer countered by accusing his mentors, the New Archaeologists, of encouraging the treatment of house-floor assemblages as fossilized inventories, unmodified by formation processes (Schiffer 1985: 41).

Binford's objections were centred upon the c-transforms involved in S-A processes: those relating to discard, loss, disposal of the dead, and abandonment. For the purposes of his argument, he ignored the relevance of A-S, S-S, and A-A processes. In fact, his ethnoarchaeological studies among the Nunamiut of northern Alaska resulted in a number of significant observations pertinant to both cultural and natural transformation processes (Binford and Bertram 1977; Binford 1977a, 1977b, 1978a, 1978b, 1979, 1981a). Binford detailed the dynamics of curation and recycling (1977b, 1979), and lateral cycling in the form of reuse of what he termed "site furniture" (1979: 263). Site furniture referred to the items remaining on a re-visited site that may subsequently be used: serving the same function within a different context. "Size effect" (Baker 1978), in which larger items are found to remain closer to the surface through a combination of natural formation processes, such as sedimentation and erosion, and an increased likelihood of being reused or scavenged, due to their heightened visibility, means that site furniture generally consists of larger objects that may be continually pulled up out of the matrix and reused (Binford 1979: 264). The result is that the use of site furniture progressively increases the distance between the artifact and the level it was initially affiliated with.

Binford (1978a, 1978b) also contributed ethnoarchaeological information regarding the cultural formation processes that affect the material record of a hunting stand, in which he conducted a detailed analysis of the organization of space. Binford observed that the distribution of debris from eating and craft-/tool-making in relation to the locations of the hearths, with smaller items located in a "drop-zone" (Binford 1978a: 339) and larger items found farther away in a "toss zone" (ibid.), could be used to predict seating plans and even prevailing wind direction. The coarse-grained assemblages of more functionally specific sites such as hunting stands mean that they can be more difficult to identify. Binford pointed out that a careful consideration of formation processes might permit the identification of differences in site function within a single culture system (ibid.: 357). The recognition of differences in site function, he subsequently suggested, may advance an understanding of the relationships between subsistence strategies and settlement patterns (Binford 1980).

Soil disturbance processes

Schiffer (1983: 696) stated that "the first order of business for the archaeologist is to identify the nature of the cultural and noncultural formation processes that created a given deposit or set of deposits". Since sediment comprises the most obvious, and often most abundant component of a deposit (ibid.: 697), the formation processes effective upon it need careful consideration. Raymond Wood and Donald Johnson (1978) returned to the ideas first tendered by Darwin (1896) and Atkinson (1957), when they pointed out the importance of considering the dynamic nature of soil when attempting interpretations of the static archaeological record: "we feel that it is just as important for us to be aware of the factors and processes that *disturb* soil horizons and their contents as it is to know the factors and processes leading to artifact *deposition* in natural or cultural deposits" (Wood and Johnson 1978: 317, emphasis in original). Their comprehensive work outlines the nine forms of *pedoturbation* – or soil-mixing – processes that may create distortion in the archaeological assemblage. *Faunalturbation* (ibid.: 318-328) refers to disturbance caused by burrowing animals, such as earthworms, rodents, foxes, some insects, etc. *Floralturbation* (ibid.: 329-333) concerns the mixing of soils through plant root activity and decay. Disturbance caused by freeze-thaw cycles, or *cryoturbation* (ibid.: 333-346) was initially documented in 1901 by Charles Darwin's son, Horace, when during his attempts to measure the degree of movement of stones by worms he found that frost action and thawing was responsible for far more dramatic movements through the soil than could be attributed to earthworms (Darwin 1901: 253).

Graviturbation (Wood and Johnson 1978: 346-352), or mass wasting, involves mixing of soil and rock debris as it moves downslope under the influence of gravity. The effect of mass wasting upon water-saturated soils is referred to as solifluction: when this occurs in permafrost areas it is described as gelifluction. Gelifluction is often associated with frost creep, in which frost heaving accompanies the down slope movement. *Argilliturbation* (ibid.: 352-359) occurs in soils with high clay contents, in which seasonal swelling and shrinking of clay particles causes soil mixing. *Aeroturbation* (ibid.: 358-359) is disturbance of soil through soil gas and wind: this occurs most frequently in deserts. Soil disturbance through artesian or cryostatic water pressure is referred to as *aquaturbation* (ibid.: 359-362); hence, a number of cryoturbatory processes are actually aquaturbatory when they take place in unfrozen soil. *Crystalturbation* (ibid.: 362-365) involves disturbance through the growth and wasting of crystals in soil: this is common in subhumid regions. Finally, *seismiturbation* (ibid.: 366-369) refers to the significant movements of soils that can result from seismic activity. Wood and Johnson's litany of processes expected to distort and sometimes destroy parts of the archaeological record ended on a more optimistic note, however, when they noted that a site affected by a range of these processes might still retain sufficient contextual and stratigraphic integrity to permit confident interpretations. Their objective was to urge that archaeologists develop an ability to recognize each of these processes and their effects upon archaeological materials (ibid.: 370).

Formation processes in Arctic contexts

Arctic climatic conditions for the most part favour a degree of preservation less commonly found south of the tree line. An exceptionally well-preserved archaeological record, however, should not be confused for a "frozen slice of the cultural past" (Hassan 1987: 2). The following discussion demonstrates that archaeological assemblages in the Arctic are often subjected to a wide array of potential forms of disturbance.

Early excavations conducted by Denmark’s Fifth Thule Expedition, 1921-1924, discovered an astonishing variety of preserved organic materials, including wood, hair, skin, and even dog excrement (Clark 1939: 75). The presence of these organic materials encourages the growth of vegetation, which have been used as a rough estimate of relative age: Clark noted from Therkel Mathiassen's reports that more recent Greenlandic ruins were covered in grass, while the oldest remains displayed little or no vegetation (Clark 1939: 39). Plant activity stimulates soil production, which, in turn, attracts burrowing animals such as lemmings, ground squirrels, mustelids, and foxes to the site. Grizzly bears may contribute an even greater degree of disturbance, through digging up archaeological sites in pursuit of these burrowing animals (Hall 1990: 403). The implications for distortion of archaeological materials through faunalturbation are obvious.

Cryoturbation and gelifluction are the most disruptive pedoturbatory processes affecting archaeological assemblages in the arctic and subarctic regions. Wood and Johnson (1978: 333-346) found that cryoturbation resulted in a wide range of soil alterations, including frost wedging, frost heaving, mass displacement and involutions, ice wedges, frost cracking, frost sorting, patterned ground (sorting stones into forms such as rings, circles, nets, steps, and stripes), and stone pavements. All of these processes, with the exception of frost wedging, may be expected to have an effect upon archaeological materials. They found that frost heaving (upfreezing) in particular could cause substantial displacement, often vertically reorienting an artifact within the soil matrix. Frost cracking opens up ground, permitting the downward movement of artifacts. Ice wedges may form in these cracks, and upon melting may sometimes be replaced by sand or soil, resulting in ice wedge casts. The significance of these processes is that relative dating through the principle of stratigraphic superposition may often be rendered invalid. The identification of ice wedge casts could provide an important source of information on postdepositional disturbance.

Mass displacement, which moves large bodies of soil both upwardly and laterally within the matrix through frost action, and involution, involving the aimless distortion of soil beds, may also be expected to significantly alter the appearance of the archaeological record. Frost action has been found experimentally to sort materials: as the freezing front moves through soil finer materials will migrate ahead of the front while coarser materials remain above it. It should be noted, however, that these experiments were based upon the premise that freezing occurs from the surface down, which clearly does not apply in permafrost regions. Patterned ground and stone pavements, caused by vertical sorting and upfreezing of stones, may be confused for archaeological features by the untrained eye. An important factor to remember in considering the effects of cryoturbatory processes, is that these are all conditioned heavily by the presence of water, and may therefore be expected to have a far more significant effect in low, wet tundra, such as that found in the subarctic regions, than would be anticipated in the high, dry tundra found throughout most of the Arctic. Gelifluction and frost creep also pose a significant threat to arctic archaeological sites, particularly since these are often located on the slopes of former beach ridges and coastal bluffs.

Hall (1990: 407) outlined the range of post-depositional disturbance believed to have affected the Utqiagvik site in northern Alaska, demonstrating the potential for substantial distortion in the archaeological record of Arctic sites. The most significant alterations appear to have resulted from erosion, site re-use (both modern and prehistoric), and scavenging of both "site furniture" (Binford 1979: 263) and construction elements. The Utqiagvik site, located on a ten metre high bluff, was believed to have eroded back at least twenty-one metres over the previous seventy years. This destruction was due largely to wave and wind action, which can drive large floes of heavy pack ice up onto the land – a process held responsible for crushing a Neoeskimo structure (along with its inhabitants) at Utqiagvik (Hall 1990: 402). Stenton and Park (1994: 412-413) pointed out that the paucity of faunal data in the Utqiagvik house assemblage, preserved *in situ* through this catastrophe, suggests that the accumulated debris had recently been removed through maintenance and deposited elsewhere as secondary refuse. This implies that the copious quantities of faunal materials frequently recovered from other Thule house floors represented either the absence or relaxation of house maintenance, possibly just prior to abandonment (Schiffer 1987: 97), or that other factors (potentially post-depositional) were responsible for the formation of faunal assemblages (Stenton and Park 1994: 412).

James Savelle (1984; 1987b) conducted an analysis of natural formation processes associated with snow-melt – a form of disturbance essential to considerations of arctic archaeological assemblages that was not included in Wood and Johnson's (1978) review. His approach undertook an ethnoarchaeological study of the artifact and debris scatter that remained following the complete disintegration of two snow dwellings. The snow house is a historically well-documented form of winter abode and likely one that was made significant use of by the prehistoric inhabitants of the Canadian Arctic (Savelle 1984: 508). Since winter camps consisting of these house types were generally built upon the sea ice, their remains are completely unrecoverable. Snow houses have also been constructed upon beach gravel, however, and Savelle's study found that through recording the spatial distributions of artifacts and faunal remains at such a beach site, employing a consideration of slope, prevailing winds, and associated rate of progression of melt-water, he was able to approximate the size and shapes of the former snow dwellings.

Site re-use and human scavenging (A-S processes, Schiffer 1976: 34) have been significant agents of distortion both historically and, it is believed, prehistorically (Stenton and Park 1994). Perhaps the most visible evidence for scavenging derives from the removal of bowhead whale bone from prehistoric Thule winter houses, which incorporated bowhead skulls, mandibles and ribs in the construction of house roofs. Whale bone served as an important resource in an environment where driftwood was the only form of wood available. Secondary uses for whale bone house rafters involve new house construction, sled shoes, sled runners (old bone proving more effective than green bone)(McCartney 1979a: 307), potential tool material blanks, and later for modern art carving (McCartney 1979a: 303, 307; 1979b). The explosion in demand for Inuit art during the 1960s/1970s led to a dramatic intensification of whale bone scavenging, which had such an impact upon the Canadian Arctic's prehistoric archaeological record that Thule winter houses are rarely, if ever, found architecturally intact (McCartney 1979a: 302; 1979b).

Collection of archaeological artifacts for sale to collectors/explorers disturbed a substantial number of archaeological assemblages during the early 20th century (Hall 1990: 404). The discovery of artifacts in Thule assemblages attributable to the earlier Dorset culture have led to the suggestion that prehistoric groups also engaged in 'antiquarianism' (Park 1993: 222) or, alternatively, simply made use of still-functional salvaged tools (ibid.: 223). Park (1993: 221-222) suggested that the comparative study of variations in patination and degree of weathering on artifacts might enable the identification of salvage behaviour (Schiffer 1987: 104).

Secondary modification of structures through interior wall construction has been recorded (McCartney 1979a: 303); reoccupation may also have occurred without structural modification, making identification of this form of distortion difficult, if not impossible to identify (Stenton and Park 1994: 414). Retrieval of flat stones used to construct Thule house floors and sleeping platforms is another post-depositional disturbance process that may be expected to disrupt stratigraphical integrity (Stenton and Park 1994: 414).

In addition to alterations of archaeological features caused by Inuit reoccupation of Thule sites, and probable Thule reoccupation of earlier Thule houses, disruption of the Palaeoeskimo archaeological record through the excavation of Thule semi-subterranean houses into Dorset ruins also poses interpretive problems (e.g. Plumet 1979). Since organic materials preserved in archaeological assemblages may encourage plant activity and soil formation, as mentioned earlier, abandoned structures often develop a conspicuous covering of sod on landscapes where soil and vegetation is sparse. This sod provided a source of construction material to the Thule, and Neoeskimo sod roofs are often found to contain Palaeoeskimo artifacts, indicating their removal from the place of primary deposition (Hall 1990: 404). Other post-depositional alterations of Thule houses include their use as food caches, temporary autumn dwellings, refuse pits, and hearths (Stenton and Park 1994: 414). Hall (1990: 404) has described the quarrying of oil-drenched soil (*pitch*) for fuel, thereby distorting the assemblage not only by removing information but also potentially increasing the decomposition rate of the newly-exposed underlying materials.

The potential effect of symbolic behaviour upon the archaeological record also needs careful consideration. Schiffer (1987) propounded that in order to demonstrate symbolic causality, the behaviour must first depart from expectations generated by functional considerations, and secondly, that a role be shown to exist for symbolically mediated behaviour in the greater social system (1987: 75). Recently, Stenton (2001) observed the presence of these conditions in the ideological treatment of caribou bone debris in prehistoric Thule (widely accepted as ancestral to the Inuit) assemblages, by applying a direct historical (Trigger 1995) comparison with traditional Inuit practices. He found that the historical Inuit practice of concealing processed caribou remains from non-human carnivores in natural and artificial stone features, done as a mark of respect to the caribou and with the intention of ensuring the herd's survival and subsequent return, closely mirrored the distributions of butchered and cracked elements viewed in excavated Thule features, thereby providing a potential correlate for symbolic behaviour.

Less optimistic prospects for the archaeological detection of ideological treatment of faunal remains, however, resulted from an ethnoarchaeological study of a subarctic Cree winter camp (Gordon 1980). Gordon observed the spatial distribution of bone refuse following processing and learned that species were separated and differentially disposed of in ways that rendered the debris inaccessible to predators. Some species and elements were selected for burning, and others were suspended from tree branches. Only the burned bone may be expected to survive archaeologically, although few of these hearths were associated with structures and therefore could easily remain undetected. These examples clearly illustrate the difficulties inherent in the detection of ideological behaviour, particularly in cases where the interpretation of patterns through the direct historical approach is impossible.

Excavation based upon a careful delineation of stratigraphic divisions must be an essential component of archaeological research in the Arctic if information is to be confidently retrieved from disturbed sites. Allen McCartney observed in 1979 that "our understanding of subsistence adaptation, settlement patterns, migration routes, material flow, and symbolic constructs[...]depend on our ability to interpret the sequential stages of Thule house existence and the attendant meaning these have to Inuit" (McCartney 1979a: 309), yet fifteen year later Stenton and Park (1994) were still able to accuse Thule researchers of an inadequate consideration of the site formation processes operative on faunal assemblages when attempting ecological explanations of Thule behaviour (Stenton and Park 1994: 417). Habu and Savelle's call for more published stratigraphic information from individual house structures (1994: 15), with the ultimate goal of a suite of comparative literature on Thule site formation processes, has yet to be realized.

In his 1973 article *Archaeology: The Loss of Innocence*, Clarke (1973: 16) observed that the body of archaeological models and theories he was proposing were merely an elaboration of those already intuitively applied by archaeologists. The range of formation processes affecting Arctic archaeological assemblages, Neoeskimo assemblages in particular, has been used as an excuse to call into dispute many of the interpretations of Thule subsistence-settlement practices that have been based upon these artifactual and faunal assemblages (McGhee 1982: 74; Stenton and Park 1994). This highlights the need for a careful consideration of the taphonomic history of an assemblage as an essential component of any subsistence analysis.

Chapter 3

APPROACHES TO TAPHONOMIC ANALYSIS

A historical review of taphonomic studies

The fields of vertebrate taphonomy and geoarchaeology have provided significant contributions to archaeologists' understanding of natural formation processes (Schiffer 1983: 675). The earliest taphonomic research took place within the field of palaeontology (e.g., Efremov 1940), as attempts were made to determine the degree of confidence with which fossil assemblages could be expected to represent their respective living communities. Taphonomy, the science of the laws of embedding, was initially defined by the Russian palaeontologist I.A. Efremov in a 1940 article, in which he described this branch of science as "the study of the transition (in all its details) of animal remains from the biosphere to the lithosphere, i.e., the study of a process in the upshot of which the organisms pass out of the different parts of the biosphere and, being fossilized, become part of the lithosphere" (Efremov 1940: 85). Because this transition occurs under the influence of a variety of geological and biological processes, Efremov pointed out that these bodies of phenomena – both geological and biological – should be assigned an equal degree of consideration (ibid.).

German palaeontologists in the 1920's were already discussing what Efremov was to describe as *taphonomy*, however they referred to this body of palaeontology as *actuopaleontology*: encompassing "the science of the destruction of animals and of the embedding of their remains" (Efremov 1940: 84). Actuopaleontology was subdivided into three areas: *tanatology*, investigating the causes of death and its immediate results; *comidology*, concerned with the transportation of animal remains; *biostratonomy*, the science of embedding, and *necrology*, analysing the decay of animal remains down to diagenesis (Efremov 1940: 84). Efremov's 1940 article played an important role in introducing the concepts being addressed by German palaeontologists to the English-speaking world (Gifford 1981: 370). His own research was concerned with the development of laws governing the preservation of sediments and their embedded organic remains, making it of direct relevance to archaeologists: his "observations and analytic methods, and his careful taxonomy of fossil-bearing deposits, still merit study" (Gifford 1981: 370).

Grahame Clark (1939) provided an early consideration of the effects of taphonomic processes upon the archaeological record. He addressed the differential rates of preservation between organic and inorganic remains (ibid.: 50-52), and discussed the importance of climatic and pedological factors in degree of preservation (ibid.: 52-82). Interest in the study of vertebrate taphonomy, however, did not receive any significant attention from archaeologists until the late 1950's, following R.A. Dart's (1957) purported evidence for australopithecine hunting practices. Dart's hypothesis was based largely upon his supposition that spiral fracture patterns could only be the result of a crack-and-twist marrow extraction technique. This led to an intensified interest in the taphonomy of archaeofaunas, as the hunting vs. scavenging debate heated up and researchers became interested in either proving, or (more often) disproving Dart's hypothesis: "Dart's ideas were provocative and served as a major catalyst for the development of explicit taphonomic research in the service of archaeology" (Lyman 1994: 21).

The most important response to Dart's allegations was proferred by C.K. Brain. Drawing from a series of methodological studies conducted in the 1960's and 1970's, "Brain established that a number of Dart's assumptions about the determinants of fracture and element frequency were incorrect" (Gifford 1981: 378), finding that the patterns observed in the Makapan assemblage could have very possibly been produced through non-human agents. This discovery was published most comprehensively in the 1981 volume *The Hunters or the Hunted.* In this important work, Brain observed that "the consistent absence of certain skeletal parts from the Sterkfontein valley fossil assemblages could well be related to their original delicacy and inability to survive destructive influences" (Brain 1981: 11). Conducting an extensive survey of the range of taphonomic factors that may have affected the prehistoric South African assemblages, he noted that "direct observation suggested that some skeletal parts were more robust than others" (ibid.), however this robusticity could only be assessed through experimentation.

Brain undertook a range of ethnoarchaeological studies of the effects of butchering upon animal bone in Hottentot villages, and observed the behaviour of modern carnivores and other bone-altering species such as porcupines – in order to develop a clearer idea of the diagnostic indicators for various agents of modification. Brain's chief goal was to solve the debate concerning Dart's creative analysis of "australopithecine"-generated assemblages from Sterkfontein, Swartkrans, and Kromdraai, "in order to decide how these bones may have found their way into the caves and to draw conclusions about the behavior of the hominids and other animals that interacted with them" (Brain 1981: 7). His detailed investigation provided substantial evidence that the assemblages were more likely attributable to non-human taphonomic agents. It also led to the important observation that the specific gravity of a bone played an important role in determining the 'survivability' of that bone in the archaeological record (Brain 1981).

Advances made in the field of taphonomic research were finding that assemblages are subject to a wide range of factors that may all be held responsible for reducing the size and representativeness of the assemblages through attrition at each of the various stages of its taphonomic life-history, as is illustrated in Figure 3.1.

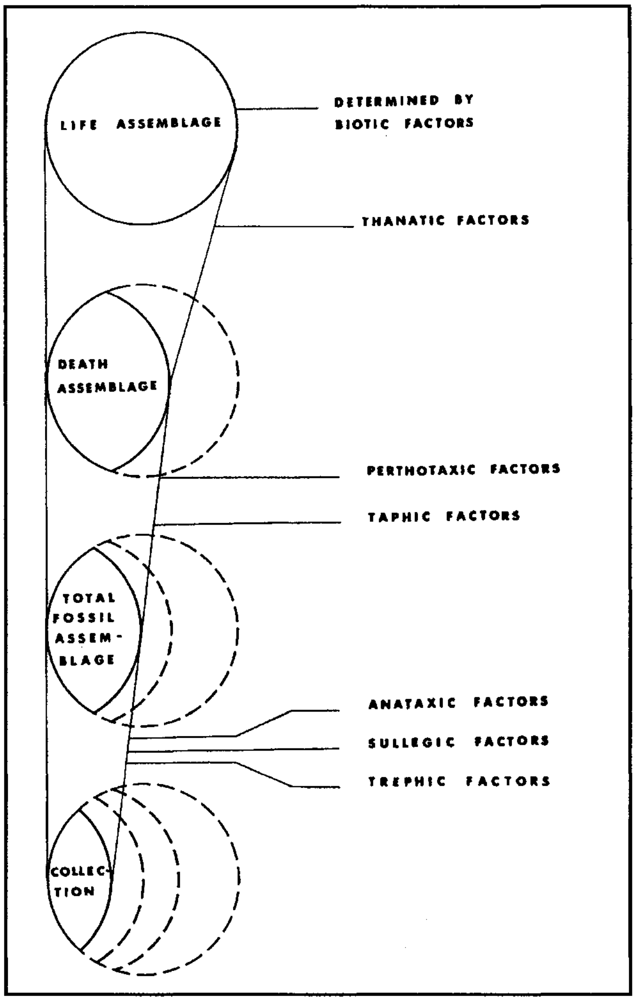

Figure 3.1: Modelled taphonomic history of a life assemblage (Clark and Kietzke 1967: 117).

Clark and Kietzke (1967) defined six stages of a taphonomic life-history. The first stage is governed by *biotic* processes, which involve "those characteristics of the natural environment and of the human cultural milieu which influence the presence and numbers of animals at a site at a particular time" (O'Connor 2000: 20). *Thanatic* factors are those surrounding the death and deposition of animal remains. The third stage relates to *perthotaxic* processes, which control the movement and destruction of bones before their final burial. The most important variables involved at this stage are climate and exposure (Clark and Kietzke 1967: 117). Stage four considers the *taphic* factors: those related to burial of the fossil remains. They include the suite of "physical and chemical agents which act upon bones after burial and thus include much of what is commonly intended by narrow use of the term 'taphonomy'" (O'Connor 2000: 20). *Anataxic* factors concerns the recycling process, i.e., exposure by erosion or in situ weathering, through which buried bones are re-exposed to attritional processes. The sixth stage involves *sullegic*, or collecting factors. This stage relates to such factors as sampling decisions, which may result in the deliberate selection of some bones rather than others.

Hesse and Wapnish (1985: 19) added a seventh category to this series of potential forms of bias. *Trephic* processes are those generated through the analysis/report stage, at which point curatorial decisions related to the sorting, recording and publication of animal bone data might further contribute to information loss. In addition, they emphasized the reduction of assemblages through the replacement of cultural behaviour with natural influences (see Figure 3.2). This was not a variable considered in Clark and Kietzke's survey of taphonomic processes, since their concern lay solely with palaeontological materials. Hesse and Wapnish's flowchart is therefore of more direct relevance to zooarchaeologists seeking to relate fossil animal bone remains to human activity: "In archaeology, the context of concern is generally human behavior, and while archaeological assemblages of animal remains may well be biased with regards to that behavior, this does not mean humans are not taphonomic agents" (Lyman 1994: 33).

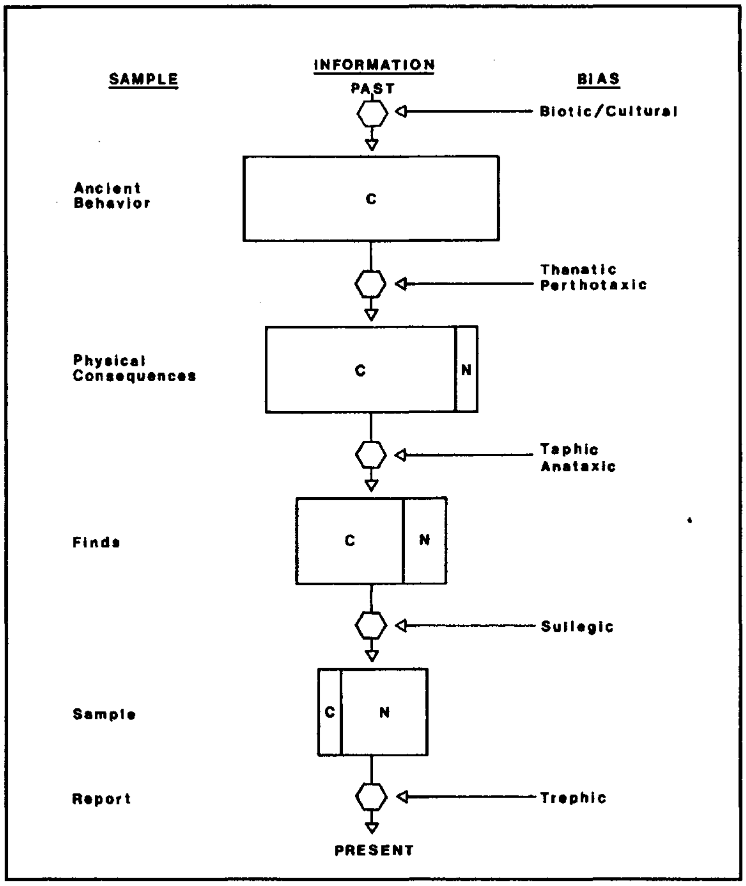

Figure 3.2: Modelled taphonomic history of a zooarchaeological assemblage (from life to analysis) (Hesse and Wapnish 1985: 19).

Binford and Bertram (1977) confronted the issue of attrition in archaeological assemblages, and provided a detailed study of the differential preservation of faunal remains. They protested to what was described as the general acceptance by archaeologists that faunal remains provide "an accurate reflection of the bones actually abandoned by men at the location" (ibid.: 78). Using data on dog-feeding practices collected by Binford from studies in north Alaska and on a Navajo reservation, the authors noted differential survival probabilities for ungulate anatomical parts following carnivore activity. This had significant implications for inferences regarding hunting and butchery patterns and site functions based upon element frequencies. Another important contribution of this work was the observation that the 'survivability' of a bone, based upon its density, is age-dependent – and should therefore be expected to vary across age-categories within a given taxon. They also applied their results to the South African Makapansgat assemblage, purported by Dart to provide evidence for australopithecine hunting and cannibalistic practices, and similarly found that the faunal remains revealed no conclusive evidence for hominid behaviour (ibid.: 148).

These ideas were expanded upon in *Nunamiut Ethnoarchaeology* (Binford 1978b), an ethnoarchaeological investigation of culling practices, selective use of body parts as dog-food, differences in element densities, and variations in butchery dependent upon prospective storage, meat drying, or immediate consumption. The objective of the study was to provide statistical formulas that could be used to explain the formation processes operative upon faunal assemblages.

Complementing this important contribution to zooarchaeological analysis, Binford published *Bones: Ancient Men and Modern Myths* (1981b), which supplied a more extensive study of the cultural and natural formation processes affecting osteological materials. This volume provided detailed analysis of the range of cultural and natural processes that can modify bone. Diagnostic markers for such processes as butchering, carnivore gnawing and plant root activity were clearly described and illustrated.

Food Utility Indices

The statistical formulas developed by Binford in *Nunamiut Ethnoarchaeology* are a series of utility indices that rank the respective contribution of each ungulate skeletal element in terms of grease, meat, and marrow. The application of these indices provides the analyst with a means of identifying and explaining various culling strategies. It was suggested that higher-utility body parts are most likely to be transported from a kill site to a residential base, while lower-utility body parts experience a greater likelihood of being left at the kill site. Binford then merged these indices into a General Utility Index (GUI), which was adjusted in order to account for the effect of 'riders'. 'Riders' are low utility elements that may remain attached to high utility elements (e.g., patellae to distal femurs) following butchery and therefore should receive a higher ranking. The revised index was named the Modified General Utility Index (MGUI). The mathematical callisthenics involved in the application of this index, however, rendered it relatively inaccessible. To remedy this, Metcalfe and Jones (1988) developed a simplified version of the MGUI referred to as the Food Utility Index (FUI). When the elements of an archaeological assemblage are represented by Minimal Animal Units (MAU) and plotted against %MGUI or FUI, a positive relationship may be observed where an assemblage is dominated by high utility elements (dubbed a "gourmet" strategy by Binford) (Figure 3.3) and a negative relationship becomes apparent where lower utility elements predominate (a "reverse utility strategy")(Grayson 1989: 644) (Figure 3.4).

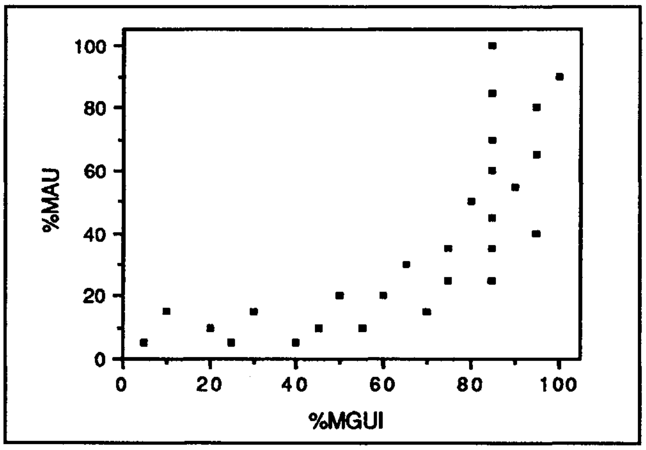

Figure 3.3: A gourmet utility strategy (Lyman 1994: 228)

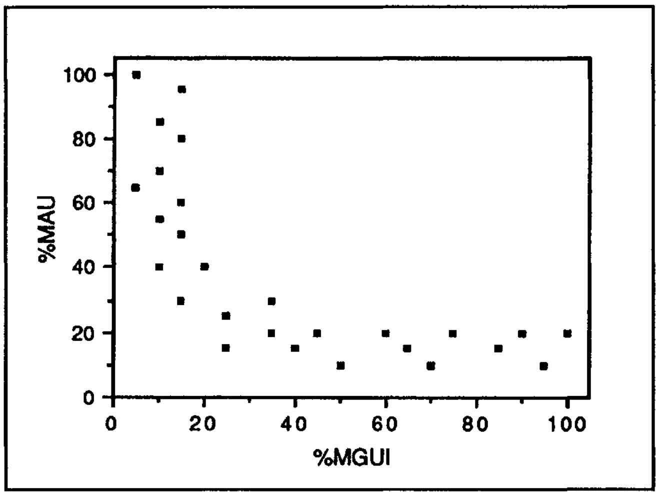

Figure 3.4: Reverse utility strategy (Lyman 1994: 228)

The application of utility indices was quickly adopted as a means of inferring hunting and butchery patterns from the zooarchaeological record. Meat utility indices and modified meat utility indices have since been developed for a variety of animals, including harbour porpoise (Savelle and Friesen 1996), harp seal (Lyman et al. 1992a), ringed seal (Diab 1998) and sea lion (Savelle et al. 1996). The latter is applied to walrus in this study, since sea lion provides the closest comparative data for walrus calculations. A recent article also redressed the drying utility index for caribou supplied by Binford (1978), and provided a more workable means of evaluating an element distribution resulting from caribou meat drying activities (Friesen 2001). The modified meat utility index considers the more practical aspects of butchery practices, by accounting for the fact that butchery units are rarely tidy little units in which all elements are conveniently separated. As a result, correlations between minimum animal units and MMUI tend to be stronger: for this reason, only MMUIs are employed in JfEl-10's faunal analysis.

Marean and Frey (1997) suggested that reverse utility curves may also be connected to a dependence upon the ends of long bones in MNE (minimum number of elements) calculations, rather than the mid-shaft fragments. The latter are often more common in an assemblage, but are less-likely to contain diagnostic features. This criticism is more appropriate for assemblages containing a variety of similar-sized ungulates – in which inter-taxonomic variation is harder to recognize from shaft fragments. This situation does not apply to Arctic ecozones, in which the two extant ungulates, caribou and musk-ox, are significantly different in both size and morphologies. In addition, Arctic zooarchaeological assemblages are often more heavily dominated by pinniped remains. Shaft portions of pinniped long bones are generally easily identifiable, therefore Marean and Frey's concerns are inapplicable to the present study.

Bone Density Indices

Lyman pointed out that faunal utility indices, rather than providing direct information on human behaviour, may often be the product of "some combination of variables that includes irrelevant, obfuscating and biasing factors such as the probability that a bone will survive attritional agents" (1992: 20). He observed a correlation between utility and density, with low-utility elements often exhibiting greater bone density (1984). As a result, a reverse utility curve may be caused by the greater survivability of low-utility elements, rather than selective butchery practices. Grayson found a significant and positive correlation between bone density and the relative contribution of an element to the zooarchaeological assemblage, which is measured through ranking by MAU (1989). This correlation illustrates the risks inherent in accepting utility indices simply at face value.

As a means of rectifying this problem, Lyman developed a series of bone density measurements that permit the analyst to test for the impact of density-mediated attrition upon a faunal assemblage. Using photon densitometry, Lyman measured the bone mineral density of selected scan sites on the elements of a skeleton. This technique was applied to a number of species of varying sizes and forms of locomotion that are frequently recovered from New World archaeological sites, including seal (Lyman 1994), marmot (Lyman et al. 1992b), deer (Lyman 1984), and bison (Kreutzer 1992). These indices provide the faunal analyst with a means of assessing the impact of taphonomic factors upon zooarchaeological materials.

Due to the inter-taxonomic variation in both bone density and food utility, these values should be treated on an ordinal scale (Lyman 1994: 252). Therefore, the non-parametric Spearman's rank order correlation coefficient provides the most appropriate means of comparing bone density and utility indices. The present study will test the reliability of subsistence interpretations through the application of bone density indices to faunal materials recovered from JfEl-10 in Diana Bay, Nunavik. For this study, seal bone density values derived from small seal were applied to all pinniped bones. No values are presently available for caribou, therefore deer bone density values were applied to caribou elements.

Chapter 4

NEOESKIMOS IN LABRADOR-UNGAVA

> “En 1964, William Taylor supposait que la culture thuléene ne s’était pas étendue au Québec – Labrador avant le milieu du XIVéme siécle. Depuis, trés peu de recherches ont été effectuées sur des sites thuléens au Nouveau-Québec et notre conaissance de l’implantation thuléenne dans cette region n’a guère progressé” (Plumet 1979: 111).

In the twenty-four years following Plumet's statement, our knowledge of the Thule inhabitants of Nunavik and Labrador has seen little improvement. Although numerous archaeological remains attributed to the Thule culture have been located by survey in this region, the excavation of Thule sites on the Arctic mainland east of Hudson Bay has been rare. Archaeological excavations here have focused predominantly upon Palaeoeskimo sites, while Neoeskimo sites have received scant attention – confined largely to the occasional test-pit. At present, the primary source of information on the Neoeskimo presence in northern Quebec relies heavily upon analogues drawn from the ethnohistoric record, and requires the assumption of a direct historical connection. This chapter provides a summary of the information available to date on the prehistoric and early historic inhabitants of the Ungava and Labrador peninsulas.

Geography

The majority of the Labrador-Ungava peninsula lies above the treeline, and is characterized by continuous permafrost that prevents tree roots from penetrating the ground. It consists of a tundra ecozone, typified by creeping shrubs, grasses, lichens and mosses (Balikci 1964a: 6). Although the region lies below the Arctic circle, it is above the 10° C isotherm (Maxwell 1985). This fact, in combination with the tundra ecological zone, long cold winters and short cool summers, means that the Labrador-Ungava area is classified as an arctic environment. "The navigation of Ungava Bay and Hudson Strait is rendered dangerous to sailing craft by the strong currents and exceedingly high tides, the latter having a mean rise in Ungava Bay of nearly forty feet, and at exceptional spring-tides they have been known to rise sixty feet" (Low 1896: 21). The interior of the landmass is "covered with myriads of lakes, that occupy, at a moderate estimate, at least one-fourth of the total area" (Low 1896: 23). Post-glacial uplift is irregular around the coastline, and along the southern and western margins was at least three times greater than along the northern and eastern coasts, "where 200 feet appears to be the limit of raised marine terraces and beaches" (Low 1896: 311). Open leads exist off the Payne, George and Koksoak Rivers. Times for ice break-up varies temporally and spatially. The general break-up of Hudson Strait occurs in June, with ice remaining in Ungava Bay into July (Findlay 1955: 26-7).

The soils covering the majority of the peninsulas result from the Archaean formations, made up mainly of gneisses and schists, and consist predominantly of glacial till mixed with boulders. The till is composed of mainly sand mixed with some clay. In the areas consisting of Cambrian rocks, the soils are composed of debris from the limestone, shales, argillites, sandstones and other intrusive or volcanic rocks – providing less support for the growth of vegetation than in the Archaean regions (Low 1896: 30, 196). The tree line follows the southern shore of Ungava Bay and turns south-south-east upon reaching the mouth of the George River. It then skirts the western foot-hills of the Atlantic coastal range southward to the Hebron area (Low 1896: 31).

Nunavik prehistory

The earliest northern migrants into the Ungava and Labrador peninsulas are believed to have arrived from Baffin Island between 2500 and 1000 B.C. (Taylor 1964), crossing over the western end of Hudson Strait via the Mill, Salisbury, and Nottingham Islands. This migration would almost certainly have required the use of boats (Taylor 1964: 195), although no evidence has been discovered to date for Pre-Dorset boat-use. From these eastern Pre-Dorset origins the Dorset culture appears to have emerged and eventually spread further north and west. The 1957 excavations of the Arnapik and Tyara sites (Taylor 1968a), along the southern shore of Hudson Strait, led to the suggestion by William Taylor that Dorset populations were direct descendents of Pre-Dorset peoples, dispelling a previous theory that Dorset peoples derived from Archaic Indian origins to the south (see Taylor 1964). The apparent concentration of Dorset sites in the Hudson Strait – Foxe Basin region seems to reinforce the idea of a Dorset homeland emerging here from Pre-Dorset origins (Taylor 1968b: 6).

The Thule culture was initially defined by Therkel Matthiasen in 1927. Drawing upon data collected during the Danish "Fifth Thule Expedition" across Greenland and the Canadian Arctic, he developed a view of coastal-adapted populations emerging from an Alaskan homeland and travelling rapidly across the Canadian Arctic in a succession of waves. This culture was typified by semi-subterranean houses composed of stones, sod, and either wood or whale bone (dependent upon availability), and a particular adaptation to the hunting of whales and large sea mammals (Matthiasen 1927: 182). The presence of the umiak and cone-shaped tent suggested that the Thule origins had developed in an area with an abundance of wood (i.e., the western Arctic).

The arrival of Thule Inuit groups to the Hudson Strait region is believed to have occurred c. 1350 A.D., also from Baffin Island (Taylor 1964: 203; Barré 1970: 20). The Button Islands, Resolution Island, and the Knight Islands off the northern tip of the Labrador peninsula, have been proposed as 'stepping stones' for these migrations from the north (Kaplan 1983: 17). Based upon a single radiocarbon date from a Thule site in Diana Bay, Plumet (1979: 115) pushed this occupation back by at least a couple of hundred years, dating the earliest known Thule presence to 810 ± 80 b.p. This date (of dubious provenience) provided a convenient overlap with dates for the Dorset presence in Nunavik, leading Plumet to propose the inevitability of Dorset-Thule interaction (he even suggested a hypothetical Dorset-Thule mixed marriage based upon the presence of mixed architectural traits within a structure observed at a Dorset site on Diana Island)(Plumet 1979: 115). Highly adapted to coastal life, and armed with a tremendous toolkit that included large skin boats, dog sleds and nets (for which no Dorset evidence is available to date), the Thule groups would likely have had no problem out-competing Dorset peoples for resources – possibly establishing control of optimal niches and forcing Dorset groups to relocate to less resource-rich areas. Alternatively, as Plumet appears to suggest, Dorset people may have been absorbed into the new societies. William Fitzhugh addressed the issue of the elaborated subsistence adaptations of the Thule: "In terms of the breadth of Eskimo marine economies it might be tempting to see the Thule economy as being more stable than that of Dorset because of their use of whales. However, there is insufficient data on hand to support this view. The lack of whale hunting obviously was not a limiting factor in Dorset and pre-Dorset culture as their 3000 years occupation of the eastern Arctic demonstrates. It may, however, have been a factor in their competition with Thule culture around A.D. 1000" (Fitzhugh 1972: 191).

Susan Kaplan suggested a Thule expansion into northern Labrador at some time during the 15th century (1983: 29), favouring Peter Schledermann's (1971) proposal that a combination of climatic factors and the appearance of Europeans to the south may have drawn Thule groups southwards (Kaplan 1983: 23). A cooling period between 1600-1730 would have caused a southerly movement of bowhead whale populations, drawing Thule whale-hunters with them, and European trade goods may also have provided an impetus. William Fitzhugh also suggested the arrival of the contact era Thule Inuit in Groswater Bay, known here as Ivuktoke Eskimo, occurred after 1500 A.D. following a rapid expansion down the Labrador coast (Fitzhugh 1972: 128). Junius Bird's (1945) excavations in the Hopedale area of northern Labrador sought information on the prehistoric Inuit occupation of this area, however no pre-contact houses were located. All sites excavated and reported in southern Labrador have yielded evidence for European contact.

Early descriptions of Labrador-Ungava Inuit

The first recorded account of a European visitor to the Labrador-Ungava region took place in 1576, during Martin Frobisher's first voyage. Frobisher mentioned an abandoned village that appears to have been seen along the southern shore of Hudson Strait (in Farid 1999: 16). In 1610, Henry Hudson's ship the 'Discovery' followed the coastline of Hudson Strait and sailed down the east shore of Hudson Bay, where a team of his crew were reportedly massacred on Digges Island near Ivujivik (Vézinet 1982: 17). The next encounter between Europeans and Inuit groups took place in 1746, as detailed in Henry Ellis's accounts of the ships Galley and California visit along Hudson Strait (in Farid 1999: 17). Captain W. Coates travelled along the shores of Hudson's Bay and

Hudson's Strait for close to thirty years, and purportedly referred to the "Eskimos swarming on these islands" (in Manning 1946: 202). Following his 1892-1895 explorations of the region, A.P. Low reported that approximately 120,000 mi.^{2} along Hudson Strait remained "totally unknown to anyone except the wandering bands of Eskimo who occasionally penetrate inland from the coast" (Low 1896: 20). Low's surveys of the region's river systems served as the main basis for maps of Labrador until the 1940's, when wartime requirements and the development of aerial photography led to a suite of more detailed maps of the peninsulas (Williams 1963: lxxix).

The earliest detailed ethnographic study of the Ungava Inuit was undertaken by Lucien Turner (2001) during his stay in Fort Chimo from 1882-1884, under the auspices of the Smithsonian Institution. The resulting publication, *Ethnology of the Ungava District, Hudson Bay Territory*, gives a comprehensive description of Inuit and Indian groups around Fort Chimo in the late 19th century. Drawing from his informants in the Fort Chimo area, Turner defined four Ungava Inuit groups. The *Suhinimyut (siqinirmiut)* "those who dwell at or in the sun" occupied the Atlantic coast of Labrador and shores of Ungava Bay west to Baie aux Feuilles. The *Tahagmyut (tarramiut)* "dwellers in the shade" (referred to as "Northerners" by the Hudson's Bay Company people) lived along the west coast of Ungava Bay, southern Hudson Strait, and between Hopes Advance Bay and Cape Smith along the east coast of Hudson Bay. The *Itivimyut (itivimiut)* "dwellers on the other side" occupied the east coast of Hudson Bay from Cape Smith to the entrance of James Bay. Finally, the *Kigiktagmyut (qikirmiut)* "island people", referred to by traders and missionaries as different in language and customs from their neighbours the Itivimiut along the coast, resided on the outer islands of Hudson Bay (Low 1896: 52; Saladin d'Anglure 1984: 476-7; Turner 2001:176-80). Although Turner's distinctions appear to have been roughly correct, the terms used are meaningful only in the Fort Chimo area, where his informants would have originated (Saladin d'Anglure 1984: 477).

In *The Labrador Eskimo*, E.W. Hawkes employed the European definition of Labrador as applied to the whole Labrador-Ungava peninsula, and grouped all Inuit occupying this region as 'Labrador Eskimos' "unjustifiably obscuring the important differences among them" (Saladin d'Anglure 1984: 477). In this volume, Hawkes also described some additional terms for more precisely-defined Inuit groups: *Killinunmiut* – "land's end people" of Cape Chidley; *Kanilualukcuamiut* – "long, narrow bay people" of George River; *Koksoakmiut* – "big river people" of Koksoak (Fort Chimo); *Ungavamiut* – "farthest northerners" of Hopes Advance; and *Nuvugmiut* – "people at the point" of Cape Wolstenholme (Hawkes 1916:23).

In addition to the Ungava Inuit groups described by Turner and Hawkes, the *Nunamiut* inhabited the interior of Labrador-Ungava. A prehistoric presence of inland Inuit in the Ungava interior has been a subject of debate (Balikci 1964a): Frank Speck (in Rogers 1964: 218) suggested that evidence from old maps indicated an interior presence, although E.S. Rogers argued that eye-witness accounts of this region weren't available until the arrival of Anglican and Moravian missionaries in the 1800s, and that early map makers often fabricated information in order to fill in blank spaces on their maps (Rogers 1964: 218). Jacques Rousseau stated emphatically that, contrary to Speck's suggestion, Inuit had never occupied the interior of Ungava. He was, however, less certain of the nature of Inuit habitation in the Labrador interior (Rousseau 1964: 75). Saladin d'Anglure reported that several Inuit alive in the 1970s described growing up in the Ungava interior, and asserted an ancestral link to permanent residents of the interior (Saladin d'Anglure 1984: 479). Vézinet (1980, 1982) also favours the concept of a traditional occupation of the interior. However, according to Saladin d'Anglure, inland Inuit populations were probably of relatively low density in Ungava, and were integrated into coastal groups by 1930 (1984: 479). In contrast, Balikci suggested that an interior occupation may have been a post-contact development linked to decreased coastal populations of caribou following the introduction of the repeating rifle, although he acknowledged that the traditional use of caribou skin tents and kayaks implied a traditional inland adaptation (Balikci 1964b: 92). It has been suggested that an exclusively interior-oriented subsistence adaptation places excessive stress upon a population's survivability: "cultures with predominantly interior adaptations are subject to severe ecological control. Interior cultures with proportionately greater dependence on marine resources, or with less specialized interior economies should be subject to less ecological and climatic limitation" (Fitzhugh 1972: 197).

Due to the logistical difficulties involved in locating and excavating inland sites, compared to the relative ease of working in coastal regions where modern communities are concentrated, archaeological evidence for the ancestral Nunamiut is sparse. Saladin d'Anglure cites the Nantais, Klotz, and Payne lakes and the Povungnituk, Kogaluc, and aux Feuilles rivers as the main areas of inland Inuit occupation (1984: 479). Payne Lake provides the most substantial archaeological evidence for a prehistoric inland presence, however the Thule evidence here is minimal and is limited to the discovery of a few artifacts at the Dorset Cartier site, and a Thule-era date (555 ± 80 b.p.) from an apparently intrusive hearth at the nearby Dorset Black Spruce site (Lee 1979).

Archaeological investigations

East Coast Hudson Bay

While the earliest excavations of Thule sites in Nunavik took place along the eastern coast of Hudson Bay, the subsequent archaeological exploration of the region was comparatively sparse. The first excavation was undertaken by Thomas Manning (1951) on Smith Island, where test pits yielded a mixed Dorset-Thule assemblage from a site consisting of tent rings and caches: this site was tentatively identified as JeGn-3 by Avataq (1992), which conducted further tests in 1991. In the most south-easterly region of the bay, Claude Desgoffe excavated sites on the Belcher Islands and the more northerly off-shore islands (HcGs-1, HdGt-12, HeGt-3, GkGt-2) in 1954 (Benmouyal 1978), recovering a smattering of artifacts. Elmer Harp also excavated Thule sites on the Belcher Islands (HdGt-12) in 1974 and 1975 (Aménatech 1984), and additional sites on and near Castle Peninsula along the southeastern shore of the bay (HaGd-1, -2) in 1967 and 1972.

In the Inukjuak area, sampling was undertaken at two mainland sites, IcGm-3 and IdGo-14, by Avataq in 1987 and 1991, respectively (Avataq 1987a, 1993). On the offshore Hopewell Islands, Weetaluktuk identified numerous Thule sites via survey, and test-pits were undertaken on Drayton Island (IbGk-3) by Avataq (1996), as well as the Kogaluk River region on the mainland (IjGh-5) (Avataq 1992). Further north, on Povungnituk Bay, Matthew Wallrath undertook extensive sampling of JaGf-1 and –2; however Avataq's 1987 survey of the site found the remains of only two of the original thirteen semi-subterranean structures described by Wallrath, as a result of extensive construction activity. Finally, in the most north-eastern portion of the bay, the partial excavation of semi-subterranean dwellings at JlGu-3 on Mansel Island and test-pits at JlGu-4 were undertaken by William Taylor in 1958 (Taylor 1968a).

Hudson Strait

The Thule presence along Hudson Strait began to receive archaeological attention in 1968, when Georges Barré excavated the large mixed Dorset, Thule and historic Inuit site on Ukiivik Island (JiEv-4), in Joy Bay (Barré 1970). Yves Labrèche later undertook archaeological work here in the late 1980's (Labrèche 1987, 1989, 1990). Barré identified five groups of features at JiEv-4 that were later given separate Borden designations through Aménatech (1984), who distinguished JiEv-1, -3, -4, and -7 (although there is some confusion in relating these designations to Barré's groups). The most substantial site on Ukiivik is Group 5, consisting of fourteen semi-subterranean dwelling aligned along the shoreline. Labrèche's excavations here yielded numerous stone artifacts and a wealth of faunal material that included seal and walrus bones. A sample of burnt fat yielded a C-14 date of c. 500 b.p. (Labrèche 1987, 1989, 1990). Group 5 also yielded one of the only two Thule potsherds ever recovered from Nunavik. Further test-pits undertaken by Labrèche on the nearby mainland at JjEw-1 yielded the second potsherd. Excavations of two semi-subterranean structures at JjEw-1 in 2002 through the CURA 2002 project (Avataq Cultural Institute, Université Laval, and McGill University) found a severely disturbed stratigraphy and an assemblage consisting exclusively of Dorset and historic Inuit artifacts.

Also on Joy Bay, JhEv-3 on Assuukaaq Island was partially excavated through Avataq in 1997 (Corriveau 1998; Farid 1999). The assemblages recovered from the two semi-subterranean houses were of mixed Dorset, Thule and historic Inuit affiliation, leading to the suggestion that the Thule houses had been dug into underlying Dorset structures (Corriveau 1998; Farid 1999). According to Maxwell (1985), thick layers of sod used in the construction of Thule roofs appear to often have been removed from

Dorset middens. Also, since historic Inuit were known to have built upon old ruins (Mathiassen 1928: 209), a direct historical approach suggests that Thule Inuit may have done the same. A small sample of bones recovered from one structure was analyzed by Farid (1999), and is clearly dominated by small seal. Charcoal recovered from the alcove of the entrance tunnel yielded a C-14 date of 545 ± 120 B.P. The second structure yielded three blue glass beads attributed to a 17th century Basque origin, and a slightly larger faunal assemblage that remains un-analyzed. One test-pit in a tent ring at nearby JhEv-47 yielded only bone fragments and a rifle cartridge; however the presence of a sleeping platform in the tent ring has led to the suggestion of a mixed Thule and historic Inuit affiliation (Avataq 1998a).

The Tuvaaluk project, undertaken through UQAM's Laboratoire d'Archéologie, conducted excavations through the mid- to late-1970's in the Diana Bay region (Figure 4.1), near modern Quaqtaq. JfEl-10 on Igloo Island (Illutalialuk) was partially excavated through the project in 1974, with additional test-pits undertaken in 1976 for the purpose of recovering datable charcoal (Salaün 1975; Plumet 1979, 1994). Further excavations of JfEl-10 were conducted in 2002 through the CURA 2002 project. The discovery of a mixed Dorset/Thule context at JfEl-10, not only in the assemblage recovered from the 2002 season's excavation but also in the curated assemblage from the 1974 excavation, confirmed the likely use of sod recovered from Dorset remains in the construction of Thule houses. This find was in stark contrast to Plumet's suggestion that sites along the west coast of Ungava Bay are *never* of mixed context:

> "A la différence de la côte est, nous n'avons jamais rencontré de sites mixtes. Nulle part les structures thuléennes ou plus tardives ne recouvrent des structures dorsétiennes. A une exception près, sure laquelle nous reviendrons, nous n'avons jamais trouvé d'objet thuléen sur un site dorsétien" (Plumet 1979: 111).

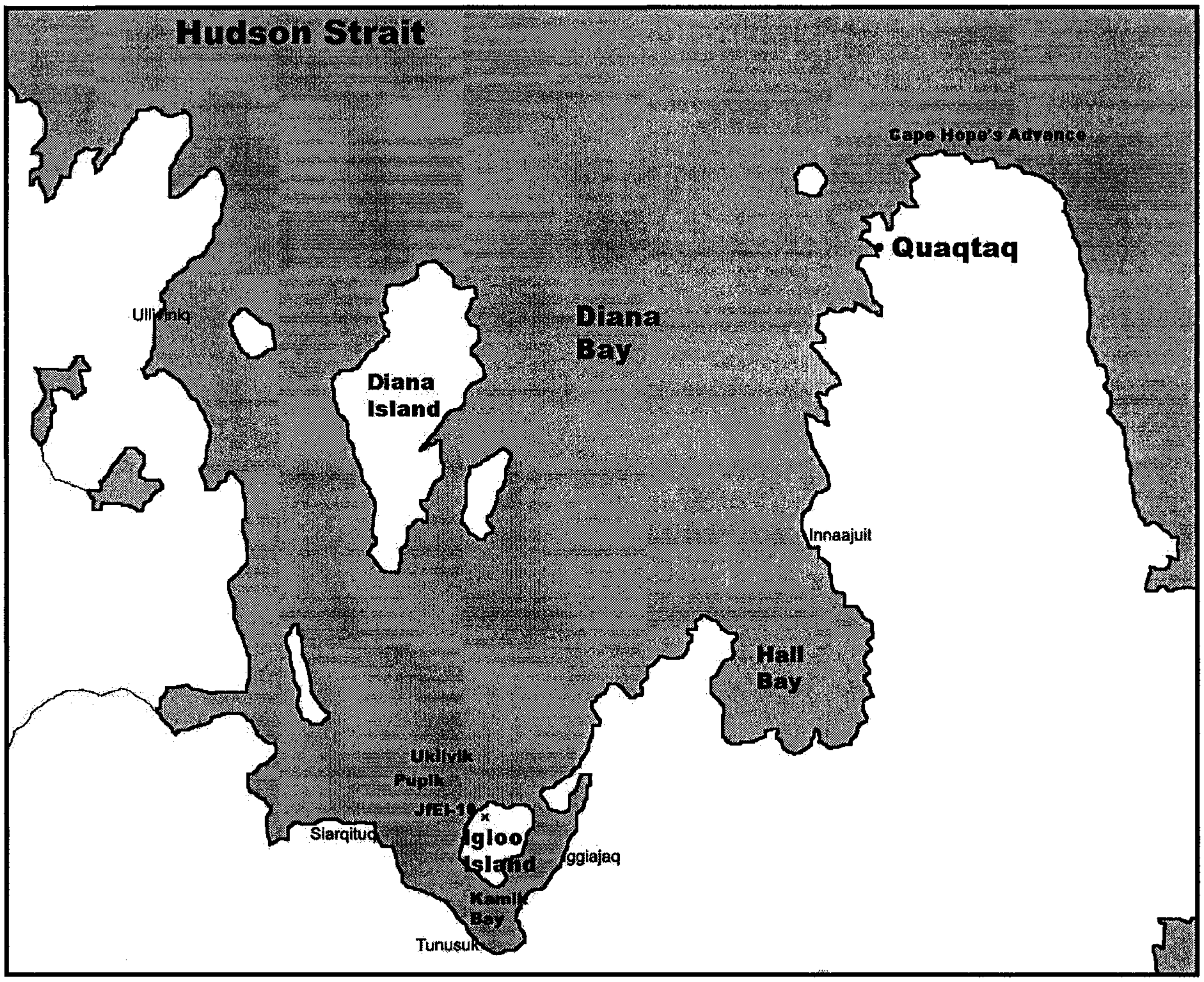

Figure 4.1: Map of Diana Bay showing location of JfEl-10 and ethnographically-documented hunting camps.

A C-14 date of 810 ± 80 b.p. was recovered from an external kitchen hearth in a 1976 test-pit. Excavation of this same hearth during the CURA 2002 project found a mixed Dorset and Thule assemblage, suggesting that Structure D had been either built on top of an underlying Dorset feature, or had employed sod excavated from a nearby feature. Therefore this date may easily be attributed to an underlying or adjacent Dorset occupation. Subsequent C-14 dates for JfEl-10 have been retrieved from charcoal and wood recovered during the 2002 excavation, and are shown in Table 2. They display a variety of dates ranging from as early as 690 B.P. (when considering the maximum standard of deviation for House D-SE1), or as late as 330 B.P. (when considering the maximum standard deviation for House H-SE7). Since the relatively small artifact and faunal assemblages imply a short-term occupation of the site, this suggests a mixed context. The date retrieved from the same hearth area (House D-SW7) as the Tuvaaluk project's early date is significantly later: at 510 ± 45 BP. The charcoal and wood samples described as 'large' in Table 1 were of sufficient size to permit full pre-treatment. Dates retrieved from the CURA 2002 excavation were processed in the Brock University Earth Sciences Radiocarbon Lab.

Table 4.1: C-14 dates recovered from DIA-10/JfEl-10

Lab #	*Unit*	*Material*	*C-14 date*	*Excavation*
GIF 4209	House D–TP 7	Charcoal	810 ± 80 BP	Tuvaaluk 1976
BGS 2449	House E–SW1	Charcoal (small)	660 ± 70 BP	CURA 2002
BGS 2447	House H–TP 2	Wood (small)	520 ± 70 BP	CURA 2002
BGS 2448	House H–SE 7	Charcoal (small)	410 ± 90 BP	CURA 2002
BGS 2450	House E–SE 5	Charcoal (large)	590 ± 40 BP	CURA 2002
BGS 2451	House D–SE 1	Charcoal (large)	650 ± 40 BP	CURA 2002
BGS 2452	House D–SW 7	Charcoal & wood (large)	510 ± 45 BP	CURA 2002

Dates from CURA 2002 excavation following C13 isotope correction and calibration.

At the Dorset site JfEl-4 on nearby Diana Island, architectural traits of suggested Thule affiliation were observed in one structure, which also yielded a Thule era C-14 date of 470 ± 90 b.p. Plumet attributed this date to a Dorset occupation, and suggested that these two contentious dates in Diana Bay provided evidence for a temporal overlap between Dorset and Thule populations, and therefore supported his belief in the likelihood of Dorset-Thule interaction.

Also in Diana Bay, semi-subterranean houses at JfEl-3 on the south-eastern shore was sampled through the Tuvaaluk Project in 1976, yielding a very small artifact assemblage that suggested the presence of both Dorset and Thule structures (Aménatech 1984). On nearby Pupik Island, semi-subterranean houses were sampled by Laboratoire d'Archéologie (UQAM) in 1973. Although this assemblage was purported to indicate a mixed Thule and historic Inuit affiliation, observations made by Claude Pinard (personal communication, 2002) during the CURA 2002 survey suggested that JfEl-9 was attributable solely to an historic occupation.

In addition to these excavations along Hudson Strait, it is worth mentioning Barry Matthews surface investigations at Deception Bay, located 60 km east of modern Salluit. Cracked animal bones recovered from the house walls and crevices at KaFh-2 were identified as walrus, caribou, polar bear, arctic hare and "elk". A dubious C-14 date of 620 ± 80 b.p. was derived from caribou and arctic hare bones, leading Matthews to propose a Thule affiliation for the site. Using palaeo-botanical and palynological evidence, he proposed a warmer climate c. 500 – 700 b.p., and suggested that this would explain the presence of elk (referred to as probably wapiti). While this identification seems unlikely, particularly since the faunal evidence is confined to two distal tibiae, it should be noted that in more recent years a moose was in fact observed in the Salluit region (Claude Pinard, personal communication, 2002). A musk-ox affiliation is also unlikely, as the presence of musk-ox in Ungava is unheard of prior to their introduction during the last century: "there is no evidence to show that the musk ox was ever found in Labrador" (Low 1896: 320). Unless, of course, the tibiae are intrusive. Matthews analysis clearly shows the dangers involved in drawing inferences without proper consideration of the site formation history.

West Coast Ungava Bay

High tides and a precipitous coastline, the result of lower rates of uplift than in other regions of the Labrador-Ungava peninsula, have made settlement and survey along the shoreline of Ungava Bay difficult (Avataq 1992). The archaeological investigation of the western shore has been spartan, and is confined to the activities of the Tuvaaluk project during the 1970's. On Iqalupillik Lake, off Roziére Bay, a tent ring at JeEl-5 was excavated through the project in 1977 (Aménatech 1984). Also in 1977, the large mixed site of JeEj-7 was investigated, yielding C-14 dates that range from approximately A.D. 200 – 1600 (Aménatech 1984). On Akpatok Island, in the north-central portion of Ungava Bay, sampling was undertaken at JbEc-1, a large site consisting of semi-subterranean houses and tent rings of exclusively Thule affiliation (Aménatech 1984; Salaün 1975). Further inland at Robert's Lake, the Tuvaaluk Project excavated a Thule semi-subterranean house at the mixed Dorset and Thule site JcEo-1 in 1978, yielding a small artifact assemblage (Aménatech 1984).

Ungava Interior

The only suggestion of a Thule presence in the interior comes from Robert Lee's excavations at the Black Spruce site on Payne Lake (Lee 1979; Vézinet 1980). Lee proposed that a Thule origin was more likely than the traditionally-proposed Dorset affiliation for the site, basing this interpretation upon architectural features and one slate flake extracted from a test pit in a tri-lobed feature. He also suggested the presence of

Thule artifacts recovered from the nearby Dorset Cartier site might be attributed to a brief visit by local Thule. A charcoal C-14 date of 555 ± 80 b.p. was retrieved at the Cartier site from an apparently intrusive hearth.

East Coast Ungava Bay

Archaeological interest in the eastern shore of Ungava Bay has fared slightly better than the western shore. Along the southern coastline, extensive sampling by Avataq at IfDk-2 on the Korok River indicated a mixed Dorset and Thule occupation (Avataq 1992). Further sampling by Avataq during the same 1991 field season at IgDj-1 on the Baudoncourt River found a similar mixed occupation, as did IhDk-1 on Keglo Bay. In addition, test-pits were undertaken in tent rings at IhDk-2, a small mixed Thule and historic Inuit site on Cape Kattaktoc (Avataq 1992). At Cape Qarmait, the large mixed Dorset, Thule, historic and modern Inuit site IdDi-1 was initially sampled by Plumet in 1967 (Plumet and Gangloff 1991) and further investigated by Avataq in 1991 (Avataq 1992). Artifact assemblages at all five of these sites are relatively small. Although no excavation was undertaken at nearby IdDi-1, Cape Qarmait, surface finds of a lamp and a cooking pot confirmed a Thule presence at the site.

Labrador

On the northern tip of the Labrador peninsula, by McLelan Strait, the large mixed site of Nunaingok (JcDe-1) spans the entire history of occupation phases for northern Labrador: from Pre-Dorset to modern Inuit. Initially excavated by Leechman in 1935, it was later sampled by Fitzhugh in 1977 and more extensively through the Nunaingok Archaeological project in 1978 (Aménatech 1984; Plumet and Gangloff 1991). The 1978 excavations yielded large quantities of lithic and organic artifacts, and a substantial (given the poor organic preservation generally characteristic of archaeological sites in Labrador-Ungava) faunal assemblage that was analyzed by James Woollett (1991). On adjacent Killinik Island, JcDe-6 was also sampled by Fitzhugh in 1977 and through the Torngat Archaeology project in 1978. JeDd-2 on the Button Islands was sampled by Laboratoire d'Archéologie (UQAM) in 1967. Further down the Labrador coastline, JaDb-2 on Staffe Island received extensive archaeological investigations, initially sampled by Laboratoire d'Archéologie in 1967, but most extensively excavated from 1977 to 1980 through the Torngat Archaeology Project (Fitzhugh 1994; Kaplan 1983), with additional test-pits undertaken by Fitzhugh in 1989 (Fitzhugh 1994). A small faunal assemblage was gathered consisting predominantly of walrus, with bearded seal a secondary component (ibid.: 252). Finally, Schledermann's excavations on Rose Island at Ikkusik yielded a mixed Thule and historic Inuit assemblage, likely the result of the superposition of historic structures upon earlier Thule structures. A C-14 date of 430 ± 90 b.p. was recovered, however the associated artifact assemblage indicated an earlier occupation, suggesting that this date represents the upper end of the prehistoric component (Schledermann 1971).

Ethnographic information

Labrador-Ungava

Turner described the remains of old semi-subterranean dwellings observed in Ungava: "In former times these people inhabited permanent winter houses like those used by the Eskimos elsewhere, as is shown by the ruins of sod and stone houses to be seen in various parts of the country. These appear to have had walls of stone built up to support the roof timbers, with the interstices filled up with turf or earth. From the depression remaining in the inside of these ruins, the floor seems to have been excavated to a greater or lesser depth. The present inhabitants relate that their ancestors dwelt in these huts..." (Turner 2001: 228). According to Balikci, the snow house was the winter dwelling for Inuit of the western Labrador-Ungava peninsula, while "the eastern groups anciently built stone, semi-subterranean houses, roofed with turf, some of which were still inhabited at the end of this last century...Ridgepole sealskin tents were in general use in the summer" (Balikci 1964a: 378). He suggested that, prior to the near eradication of local caribou herds in the early 20th century following (and, according to Balikci, consequent to) the introduction of repeating rifles, caribou skins would have served as the primary material employed in tent-making (ibid.). The decimation of the caribou herd was directly correlated to an increased dependence upon resources from trading stores (ibid.: 381).

Although there is some evidence for peaceful contact between Inuit and Indian groups, their exploitation of different ecological zones and distinctly different cultural patterns seems to have contributed towards the maintenance of established boundaries between north and south (Malaurie 1964: 20; Fitzhugh 1972: 55). Balikci expressed the belief that "the hunting methods of the Quebec-Labrador Peninsula Eskimos indicated clearly a winter and spring adaptation to the sea with sea mammal hunting being the major activity and a late summer and autumn inland adaptation characterized by collective caribou hunting and intensive fishing" (1964a: 378). This two-phase annual cycle was suggested to have characterized the subsistence round viewed in the Ungava area and along the east coast of Hudson Bay at the end of the 19th century, however the earlier European contact on coastal Labrador altered the traditional annual cycle much sooner.

Hawkes outlined the Inuit descriptions of local resource availability (i.e., "months") for both the eastern Labrador coast and Ungava. The Labrador data spans from December to June: according to Hawkes informant, the summer months are plentiful and therefore there is no need to distinguish one season from the other (Hawkes 1916: 28). Information for Ungava shares common terminology with Labrador until June, whereupon the description of "month of the young Ranger seal" becomes inapplicable. The freshwater Ranger seal of Labrador is present only in Labrador's Lower Seal Lake. Low hypothesized that this seal, now known as *Phoca vitulina mellonae*, had become land-locked in Lower Seal Lake soon after the glacial recession approximately 4000 years ago, and had developed into a new subspecies through the gradual adaptation to a freshwater environment (in Davies 1963: 83).

Months (Hawkes 1916)**:**
(from east Labrador coast – Atlantic)

Sikalut "ice-forming month"	– December
Nelekaituk "coldest month for frost"	– January
Koblut "ground cracked by frost"	– February
Netcelut "the month of the young Jar seal (netceq)"	– March
Teyelulut "the month of the young Bearded seal (teyelut)"	– April
Noyalut "month of fawning (noyoq, 'fawn')"	– May
Kuciyialut "the month of the young Ranger seal (kuciyiukciuk)"	– June

(from Ungava) – same as Labrador until June

Munilut "egg-month (from munik 'egg')"	– June
Kituyialut "mosquito-month (from kituyioq 'mosquito')	– July
Punalut "berry-month (from punaq 'berry', puna Lab.)	– August
Qonolilut "fading-month (from qonolit 'fade')	– September (when leaves and mosses fade)

Sikualut "the month when ice forms around the shore" (from sikuaq 'thin, young ice')
Nunalialut "inland month (from nunaliq 'the interior country) – when they go into the interior for deer.

Tuvaaluk

Two of the most detailed ethnographic accounts of subsistence practices in Nunavik were conducted in the Tuvaaluk region: by Louis-Jacques Dorais during the 1960's through to the early 1990's (Dorais 1997) and Monique Vézinet in the late 1970's (Vézinet 1982). These studies provided a valuable body of information for the present research. Both researchers described Tuvaaluk as a profitable area for hunting. According to Dorais, "within Nunavik, the Tuvaaluk area is generally recognized as a kind of hunting paradise" (Dorais 1997: 9), although Vézinet described Tuvaaluk as less diverse than neighbouring regions (1982: 97).

In Nunavik, 1920 represents the approximate end of the "traditional" era, following the introduction of the repeating rifle and expansion of trading posts. Both of these factors altered the movement and duration of Inuit settlements: the spread of firearms has been linked to a decline in communal hunting practices (Balikci 1964a, b; Vézinet 1980), and the increased number of trading posts led to the movement of Inuit closer to these posts (Vézinet 1982: 22). At the same time, caribou populations were dwindling, according to Asen Balikci as a direct result of the introduced repeating rifle (Balikci 1964a, b). This created more demand for an alternate food source (i.e., trading post foods) and instigated a dramatic change in the seasonal round. Fur-trapping developed as an important economic activity, resulting in a related movement towards the interior in pursuit of fox (Vézinet 1982: 23). This movement may also have been associated with the pursuit of caribou as their range contracted further south and further inland.

Vézinet described the pre-1920 seasonal round for the Tuvaalummiut. She emphasized that the hunting in Diana Bay was most profitable in the spring and fall, but the region became less-frequented during the winter. In the autumn, camp locations were determined by the migration of beluga and walrus. These were mainly set up along the east coast of Diana Bay, particularly at Innaajuit located approximately mid-way down the coast at the northeastern end of Hall Bay. Once the thin ice had formed, breathing hole sealing took place at the same camp, and also further down the coast on Kamik Bay at Iggiajaq (on the mainland just east of Illutalialuk), at Tunusuk (on the mainland immediately south of Illutalialuk), and at Siarqituq (found on the mainland further west of Illutalialuk). In this region at base of Diana Bay there is more protection from the wind and the early freeze-up allows breathing-hole sealing through the young ice (ibid.: 92).

Once the ice became too thick in winter, camps moved further north and eastwards along the western shore of Ungava Bay (Vézinet 1982: 93). However, there were a few camps located at the bottom of Diana Bay, with two slightly northwest of Illutalialuk on Pupik Island and Ukiivik Island (ibid.: 91). These were abandoned post-1920 due to the increased interest in fox-trapping in the interior, and the decline in breathing-hole sealing following the spread of gun-use (ibid.), which made the hunt of basking seals easier by increasing the range from which they could caught.

The placement of spring camps showed little difference between the traditional and post-traditional periods. Vézinet pointed out the important observation that these divisions of seasonal camp types were not discrete categories: often the 'spring' camp was retained into the summer, and occupation of 'winter' camps often began in the fall (Vézinet 1982: 90). In spring, as in summertime, camps were totally maritime-oriented (ibid.: 92). Good seal hunting was available on the ice and other sea mammals were accessed between slabs of drift ice (ibid.: 94). Often spring camps were set up near river littorals, in order to intercept anadromous fish runs descending towards the sea (ibid.: 92).

Vézinet made particular reference to Illutalialuk as an ancient spring camp (ibid.: 109): ideally, the faunal materials will provide evidence to either confirm or deny this ascription.

Chapter 5

FAUNAL ANALYSIS of JfEl-10, NUNAVIK

Site introduction

JfEl-10 is located on Illutalialuk (Igloo Island), situated in the southeastern corner of Diana Bay in the Tuvaaluk region along Hudson Strait (Figure 4.1). Rather than referring to the presence of archaeological house ruins, the name *Illutalialuk* derives from the legend of an ogre who lived in a house on the island (Vézinet 1982: 109). The *Tuvaaluk* region describes the bay and adjacent mainland, and this name translates as "large ice field", referring to the early freeze-up and late thaw that typifies Diana Bay. The nearest modern community, Quaqtaq, rests near Cape Hopes Advance in the northeastern boundary of Diana Bay, facing onto Hudson Strait. The site itself lies in a valley extending from the northwestern shore of Illutalialuk. JfEl-10 (Figure 5.1; Note: all site and excavation diagrams supplied by Claude Pinard of Avataq Cultural Institute), formerly known as DIA-10, is composed of three large oval semi-subterranean structures with entrance tunnels: identified as Houses D, E and H. House D is unique in the addition of an external kitchen, which extends out from the entranceway.

Also present at the site are a number of other features formerly identified as potential houses by the Tuvaaluk team in the 1970's. Observations made by the CURA crew in 2002 found that these features were too structurally ambiguous to be described as houses; however no excavation was undertaken in order to confirm this. Features C, F, and G were tentatively identified as potential sod-excavation areas, where sod used in the construction of Houses D, E, and H would have been removed. These areas may, however, with subsequent investigation, reveal evidence for Dorset structures: the presence of Dorset artifacts in the assemblages of House D, E, and H indicates disturbed contexts that may have been related to the use of sod from Dorset features in the construction of Thule homes. This practice of removing sod from old ruins for the use in new homes has been described ethnohistorically (Mathiassen 1928: 209) and, as

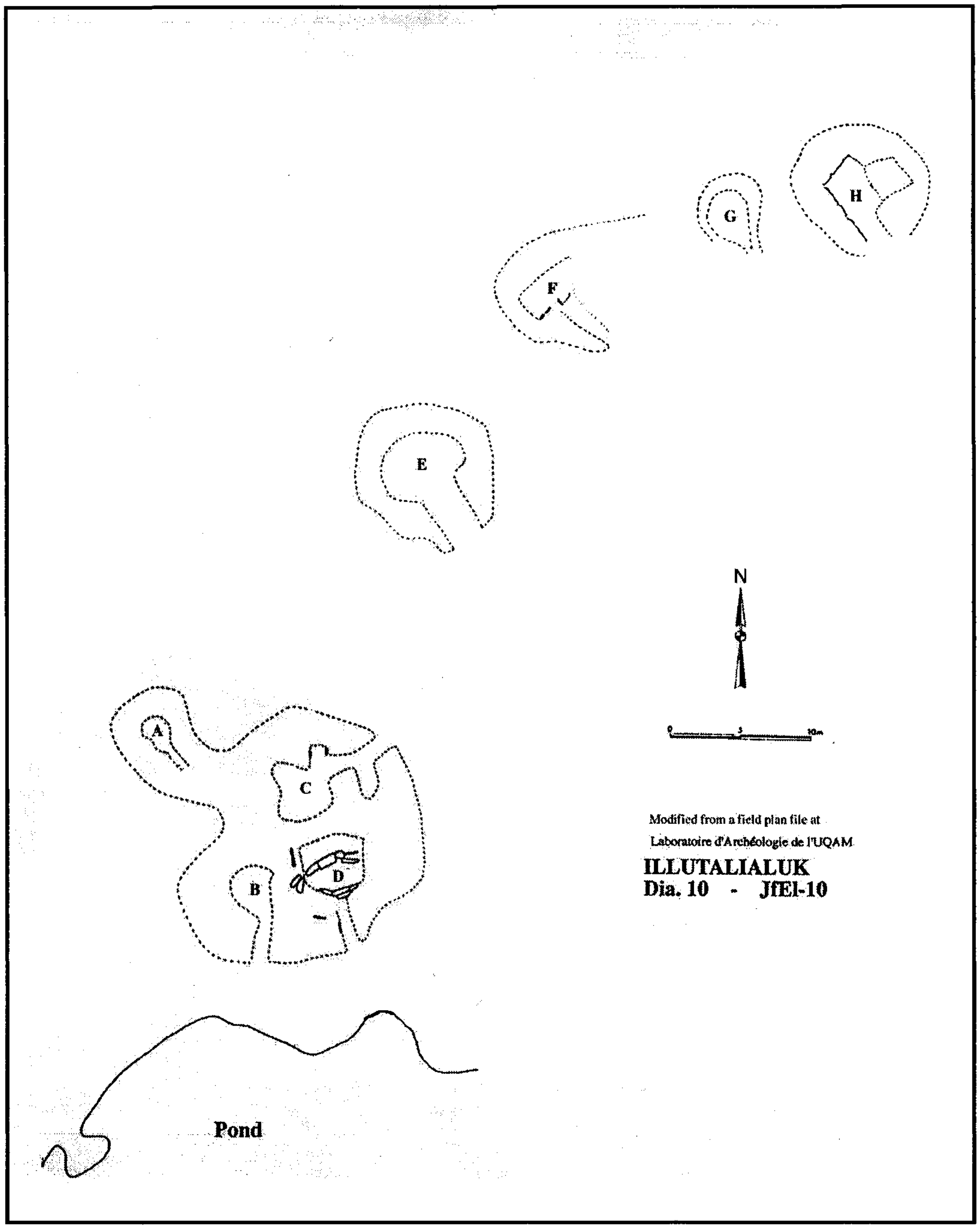

Figure 5.1: Map of JfEl-10 (2002 version revised from the Tuvaaluk project original).

discussed in Chapter 4, Maxwell (1985) suggested that the prehistoric Neoeskimo appear to have practiced the same technique. Feature B resembles a very small semi-subterranean house with an entrance tunnel, however without any substantial stone walls apparent. In the centre of the sunken "house interior" lies a large chunk of bowhead whale bone. It appears to lie on top of the sod, suggesting that it may have been removed from elsewhere and placed or rolled into Feature B's pit – post-occupation. Feature A has even less evidence for construction by humans, and seems more likely to be explained as a natural feature of the landscape.

Project

The faunal materials analysed for this thesis were recovered from JfEl-10 in two stages. The first phase took place in 1974 with the partial excavation of House H by members of the Laboratoire d'Archéologie from the Université de Québec à Montréal, through the framework of the Tuvaaluk project. This excavation resulted in a total of 254 bones and bone fragments that were washed and labelled, and then placed in storage. Observations made during the more recent field season found that other bones and bone fragments had been discarded by the Tuvaaluk project in the backdirt pile of House H. Both small and large bones were found here, suggesting that the recovery of faunal materials during the 1974 excavation was incomplete. Of the total 254 bones and bone fragments, 225 were identified to the genus or, more commonly, to the species level. In 2002 a team composed of members from Avataq Cultural Institute, McGill University, Université Laval, and students from the nearby community of Quaqtaq, conducted a partial excavation of Houses D, E, and H. This archaeological investigation was undertaken through the framework of the Community-University Research Alliance, a

Social Sciences and Humanities Research Council (SSHRC)-sponsored project which united the efforts of Avataq, McGill, Laval, and residents of communities along Hudson Strait in researching the prehistoric occupation of the region. The CURA 2002 field season at JfEl-10 recovered a total of 4995 bones and bone fragments – 903 of which have been identified to either genus or species.

Excavation procedure

North-oriented grids were laid over Houses D, E, and H during the 2002 field season and measurements were taken within 1 by 1 m^2 units. Recovery techniques involved the use of trowels and dustpans. House D received the most extensive excavation (Figure 5.2), undertaken by three students from McGill University – John Beaten, Christine Iorio, and the author – and an alternating crew of students from Quaqtaq: Jeannie Arnatuk, Susie Arnatuk, Jobie Aupaluk, Monica Ezekiel, Billie Keleutak, Johnny Okpik, Stevie Pagé, Putulik Puttayuk, Susana Puttayuk, Pierre St.-Cyr, and Aita Tukkiapik. Excavation included an area to the south of the house and east of the entrance tunnel, in search of a midden that failed to substantially materialize. Much of the entrance tunnel and the house interior was excavated, and the external kitchen hearth attached to the southwestern edge of the house body was completely excavated. This house was of particular architectural interest, since it featured the external kitchen and an intact entranceway with the lintel still in position (Figure 5.3). The architectural integrity, in addition to the relatively thin occupation layer and apparent absence of any significant midden, led to the interpretation that this feature, despite being architecturally very substantial, had experienced only a short-term occupation.

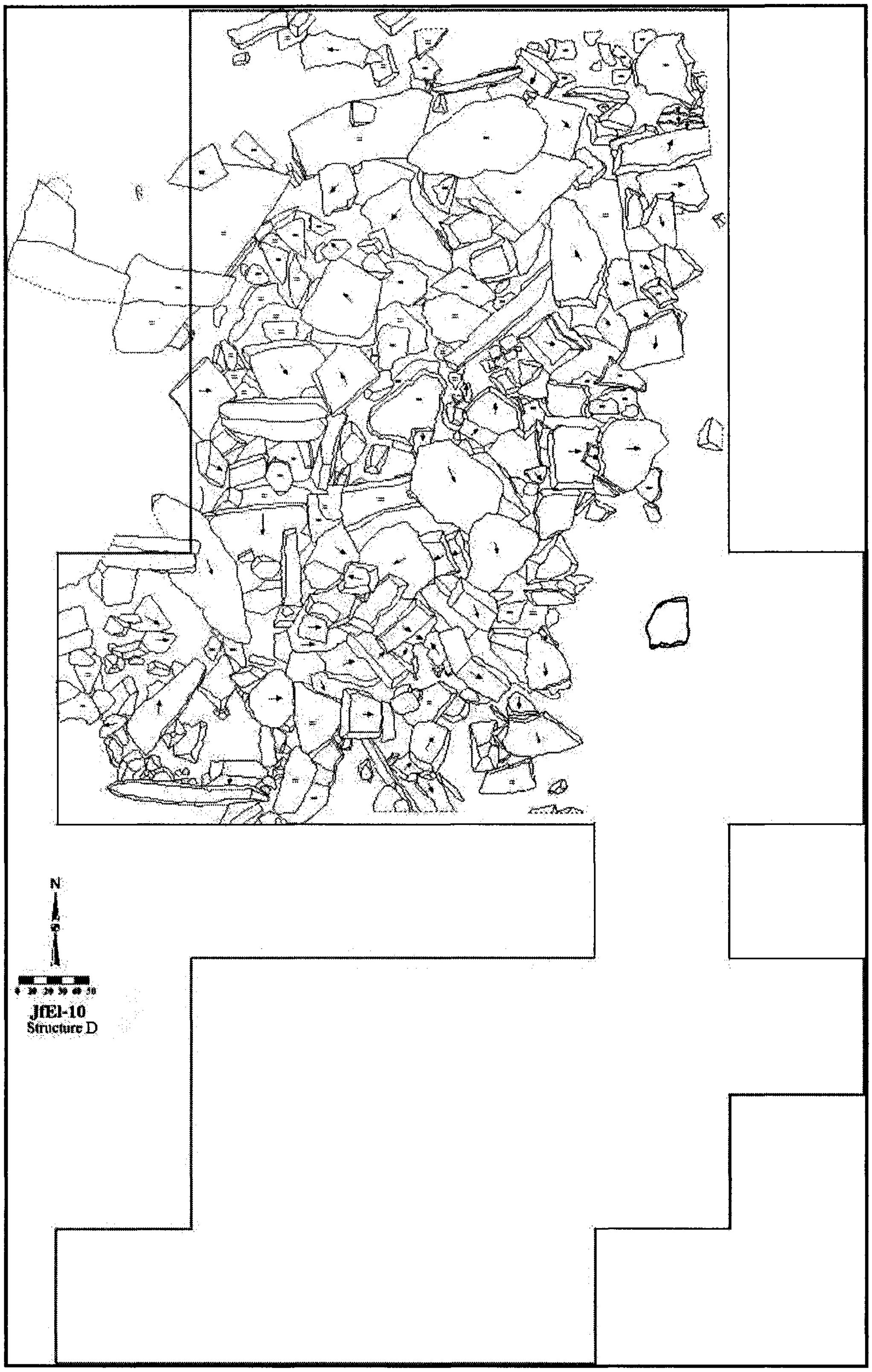

Figure 5.2: Map showing excavation area of Structure D.

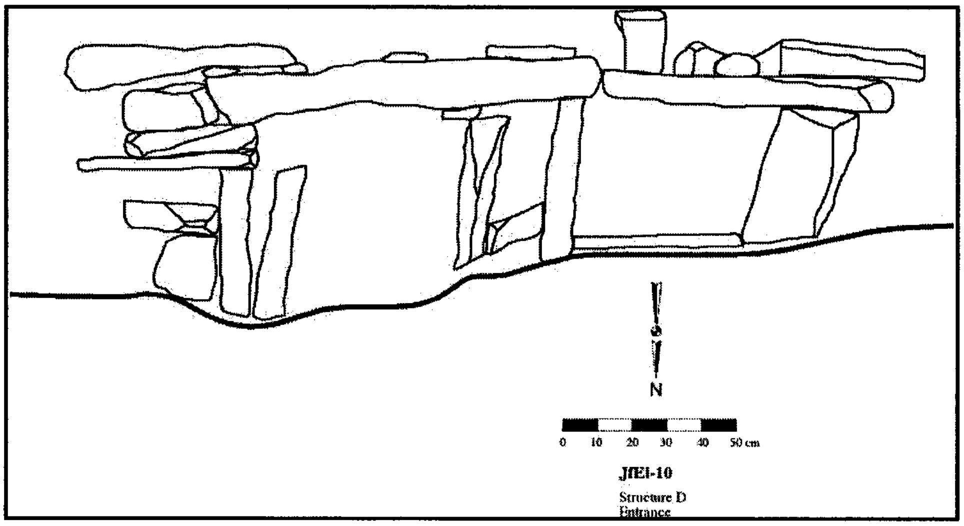

Figure 5.3: Map of Structure D's entranceway with intact lintel (diagram drawn by Louis Gilbert of the Department of Anthropology, Université Laval).

Excavation of House E (Figure 5.4) was initiated by Christine Iorio, John Beaten, Susie Arnatuk and Lisa Tukkiapik, and continued by Louis Gilbert and Amélie Langlais of Université Laval, and Claude Pinard of Avataq Cultural Institute. Excavation here was less extensive, covering an area to the south and east of the entrance tunnel. Little was recovered from here until the last week, when an apparent midden was revealed to the east of the entrance tunnel. Unfortunately time constraints prevented a significant investigation of the area at this point. A small area (approximately 2 by 2 m^2) was also excavated in the house interior. Excavation of House H, conducted by Louis Gilbert, Amélie Langlais, and Claude Pinard, focused upon the area to the south of the entrance tunnel and part of the entrance tunnel itself. The 1974 investigation was confined to the interior of House H. This excavation area had been left open, covered with a plastic sheet held down by some large whale bones and a few shovelfulls of backdirt: we are therefore confident that there was no overlap in the excavation area for House H.

Screens were not employed during either excavation at JfEl-10. This was particularly unfortunate during the 2002 excavation, as many of the junior students

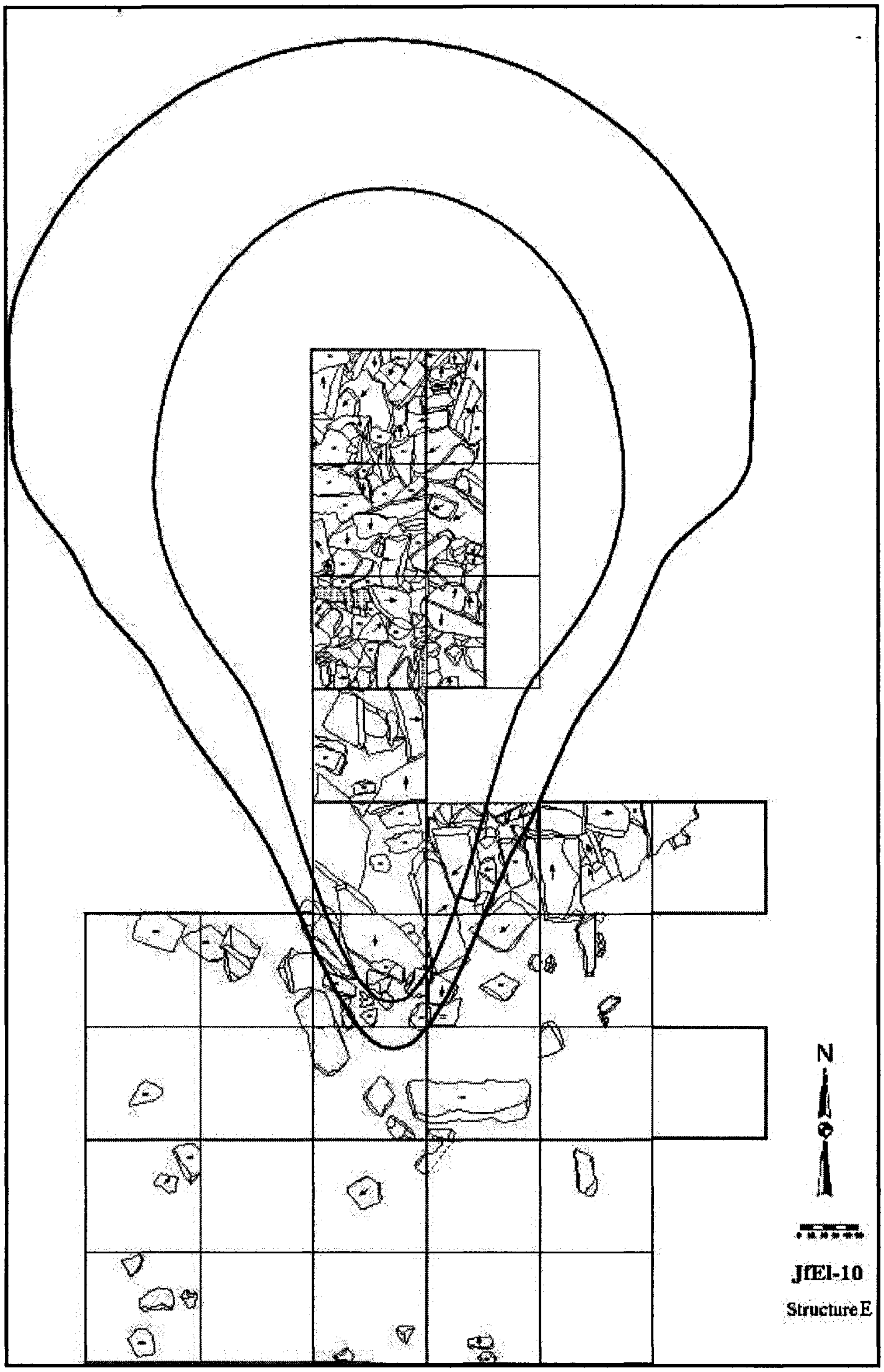

Figure 5.4: Map showing excavation area of Structure E.

involved in the fieldwork possessed no prior experience in archaeological field methods. As a result, the recovery rate of faunal materials, particularly the smaller bones, may have been compromised. For this reason, both the 1974 and 2002 assemblages may be considered of comparable integrity and have therefore been grouped together in this analysis, resulting in a total of 1128 bones identified from an assemblage of 5249 bones and bone fragments. As a result of the relatively poor preservation of the faunal remains and modest size of the assemblage, the faunal remains from all three houses were analysed as a single unit. The afore-mentioned issues concerning the potential "representativeness" of this assemblage in terms of subsistence pursuits, makes JfEl-10's faunal sample ideally suited for a taphonomic study.

Assemblage preparation

Owing to the generally poor degree of bone preservation in the assemblage, bones were dry-brushed or scraped clean. Wet-cleaning was avoided as this often softens fragile bones and renders them more vulnerable to macrostructural disturbance. As many bones exhibited a flaking periosteum, labelling was also not an option – therefore provenience information was preserved by individually bagging and tagging each specimen. Analysis, which involves the comparison of bones and bone parts to reference specimens, was initiated at the McGill Zooarchaeological Laboratory, and completed at the University of Toronto's Faunal Archaeo-Osteology Laboratory, with the kind permission of Dr. Max Friesen of the Department of Anthropology. Specimens were identified to the lowest possible taxonomic category, generally to species, although in some cases secure identification could be made no further than family or genus. Identifications erred on the side of caution, so that taxonomic categories were assigned with only as much precision as could be confidently applied. Each identified specimen was assigned a catalogue number and recorded in manual form, which was then transferred to a computer database.

In addition to taxonomic category, each identification recorded element, portion of element, side, sex estimates if possible (rarely: this applied only to male baccula), and age estimates if possible. Five broad age categories were applied: fetal/newborn, juvenile, immature, subadult, and adult. Fetal/newborn is identified by the very small size, absence of fused epiphyses, presence of the porous juvenile bone cortex, and lack of distinct morphological features. Juvenile bone also features juvenile cortex and unfused epiphyses, but is larger and morphologically more distinct. Immature bone is distinguished through the absence of juvenile cortex, larger size, and presence of distinct morphological attributes. Absence of fusion or partial fusion of epiphyses may sometimes be observed on immature bones, depending upon the element and the fusion-timing particular to that specific species. Subadult bone is similar in size to adult specimens, but with incomplete fusion of some epiphyses. Adult bone is fully-fused. Age may also be distinguished in the teeth of some species, particularly ungulates, based upon predictable stages of eruption and wear. Modification of bone, and the location on the element, was recorded in the form of burning, gnawmarks, cutmarks, oil-stains, and root-etching. Evidence for significantly poor preservation was also recorded.

Methodology

The quantitative methods employed in this faunal analysis are: number of identified specimens (NISP), minimum number of individuals (MNI), and dietary contribution based upon the quantity of edible tissue represented by the MNIs. Grayson (1989) provided a valuable discussion of the pros and cons of both NISPs and MNIs.

NISPs are affected by selective butchery, known as the *schlepp* effect (see Binford 1978, 1981). The schlepp effect anticipates that the larger the animal and the greater the transport distance, the more extensive the butchering is expected to be: therefore, low-utility body parts are more likely to be discarded at the kill site. Also, inter-taxonomic variation in skeletal design affects species comparisons based upon NISPs, since the number of bones in an individual skeleton can vary between species. This has a particularly dramatic effect when developing class counts, as fish skeletons are composed of far more bones than either bird or mammal. NISPs are also affected by differential preservation. Collection techniques can affect NISPs, if they allow smaller fragments to be over-looked. One of the biggest criticisms of NISPs is that the potential for interdependence is ignored, so that, for example, a complete dog skeleton would be treated the same way as an equal number of seal skulls.

MNIs are calculated using the most abundant element per taxon as an indicator of the minimum number of a particular species present in an assemblage. In the case of paired elements, side is taken into consideration. Using a conservative estimate of the minimum number of individuals avoids the problem of interdependence that is encountered with specimen counts. One problem associated with MNIs, however, is the over-representation of rare taxa. In addition, this quantitative method is susceptible to the effects of aggregation. Increasing the number of aggregation units (for example, dividing the site assemblage according to house, or even square) will usually increase the MNIs per taxon. This technique encounters problems with interdependence, and the smaller the sample size, the greater the problem. "As a result, when an analyst studies minimum number values, that person is studying not only taxonomic abundances, but also the decisions made concerning aggregation" (Grayson 1984: 49). In favour of using MNI counts as a comparative quantitative method, Grayson (ibid.: 25) pointed out that differential preservation of elements affects the most abundant elements as well as all other elements. Specimen counts, in contrast, will be more dramatically affected by differential preservation across element categories. In this study, age was also taken into consideration when calculating MNIs

The number of identified specimens and minimum number of individuals per taxon display a relationship that, in general, is curvilinear (Grayson 1984: 49-68). This means that "the slope of the relationship between MNI and NISP within any given faunal collection will be a function of the probability of drawing a most abundant element across all aggregation units and across all taxa" (ibid.: 61). In other words, as the sample size of a given taxon increases, MNIs are added at a decreasing rate. The larger the sample, the more obvious this pattern becomes. Figure 5.5 shows the relationship between MNI and NISP in JfEl-10's faunal materials. The relative linearity of the relationship reflects the small sample size for a number of the taxa represented in the assemblage, however the line is faintly curvilinear.

The relationship between MNI/NISP and NISP can also be informative (see Grayson 1984: 68-84). MNI/NISP indicates the number of individuals defined per bone, which promises to be a useful analytical tool by lending insight into differential degrees of fragmentation (and therefore possibly butchery) between taxa. However, "as NISP increases, values of MNI/NISP decrease strictly as a function of sample size" (Grayson: 1984: 73), which is therefore all that the ratio measures. Figure 5.6 illustrates this relationship based upon JfEl-10's faunal materials.

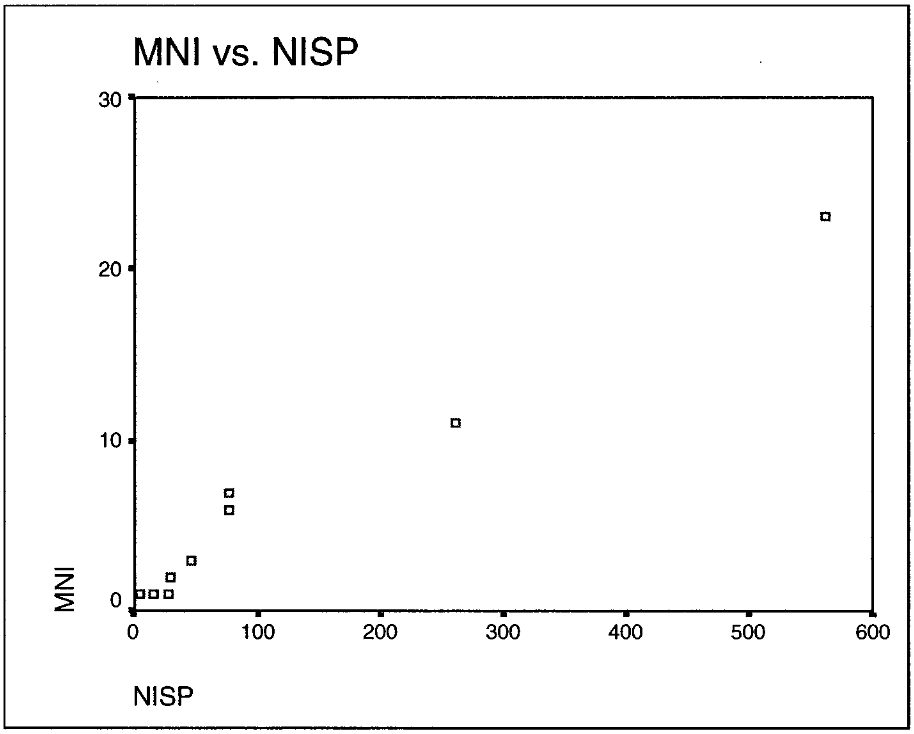

Figure 5.5: The relationship between MNI and NISP in JfEl-10's faunal assemblage.

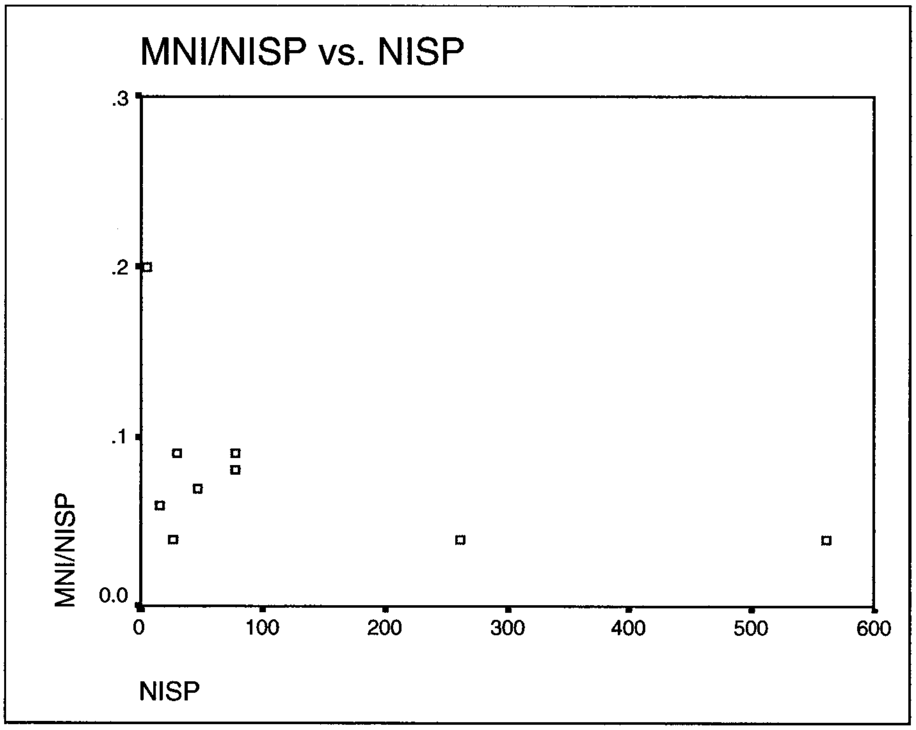

Figure 5.6: The relationship between MNI/NISP to NISP in JfEl-10's faunal assemblage.

Since economies, rather than bone counts, are the primary topic of interest in zooarchaeological analyses, it is the amount of meat represented by each taxa that serves this interest best. For this reason, relative dietary contributions are often calculated in order to compare the amount of edible tissue actually contributed to the assemblage by all taxa present. This quantitative measure is calculated by multiplying the MNI for each taxon by the average total body weight for that species, multiplied by the proportion of that weight that represents edible tissue. As a result, this method is subject to the same problems faced with species proportions calculated with MNIs.

Given the suite of problems associated with each quantitative method, it has become common practice within zooarchaeology to parsimoniously present the data as calculated through all three techniques, so that all forms of information are available to the reader.

Faunal analysis

Table 5.1 shows the relative contribution of each species by NISP and MNI, while Table 5.2 illustrates the significantly different view offered when considering available edible tissue. These differing perspectives are more clearly illustrated in Figure 5.7. The faunal assemblage from JfEl-10 is almost exclusively composed of mammals, with bird present only in the form of one identified specimen and three unidentified burned bone fragments. Fish were completely absent, as were small mammals with the exception of Microtinae (voles and lemmings). Five Microtinae elements were identified, as well as a complete lemming skeleton with the skin still partially preserved. The Ungava variety of lemming is the Labrador Varying Lemming (*Dicrostonyx hudsonius*). This was located at the bottom of a clearly intrusive tunnel, and was therefore excluded from the assemblage.

Numerous lemmings were observed at the site during the 2002 field season, and as a result of the likely intrusive nature of their presence they have been excluded from calculations of relative assemblage contribution.

Table 5.1
Species distributions based upon MNI and NISP

TAXON	NISP	%NISP	MNI	%MNI
Mammal				
Vole/Lemming	5	-	-	-
Beluga	16	1.4	1	1.8
Beluga/Walrus	7	0.6	-	-
Bowhead	28	2.5	1	1.8
Dog/Wolf	5	0.4	1	1.8
Lg. Bear	31	2.7	2	3.6
Small Seal	552	49.2	21	38.2
Small-Med Seal	8	0.7	-	-
Harp Seal	86	7.7	8	14.5
Bearded Seal	49	4.4	3	5.5
Walrus	76	6.8	6	10.9
Caribou	264	23.5	11	20.0
Subtotal	**1127**	**100**	**54**	**98.1**
Bird				
Larinae	1	0.1	1	1.8
Total	**1128**	**100.1**	**55**	**99.9**

Table 5.2
Species distribution based upon dietary contribution

TAXON	MNI	**WGT per individual(kg)**	**Edible tissue by % WGT**	**Available meat (kg)**	**% Total available meat**
Beluga	1	400	70	280.0	4.0
Dog/Wolf	1	20	50	10.0	0.1
Lg. Bear	2	420	70	588.0	8.5
Small Seal	21	91	70	1 337.7	19.4
Harp Seal	8	140	70	784.0	11.4
Bearded Seal	3	280	70	588.0	8.5
Walrus	6	665	70	2793.0	40.5
Caribou	11	95	50	522.5	7.6
Gull (ave.)	1	1.2	70	0.8	0.0
TOTAL				**6904**	**100.0**

All meat weight values, with the exception of walrus, taken from Friesen and Arnold (1995: 26).
Walrus meat weight value is the average derived from average weights for male and female adult Atlantic walrus, provided in Banfield (1974: 363).

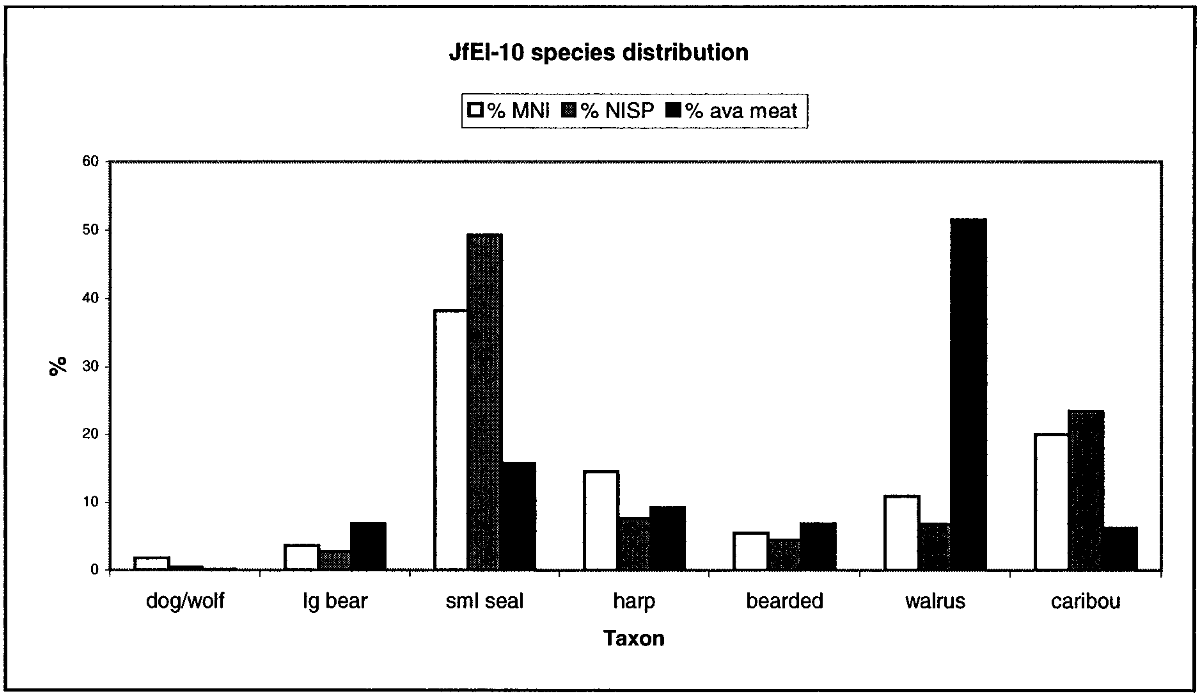

Figure 5.7 Comparison of species distributions according to quantitative method

Relative species contribution and seasonality

Marine mammals

Small seal:

Ringed seal (*Phoca hispida*) is the phocid most commonly found in the Tuvaaluk area. Occasionally, harbour seal (*Phoca vitulina*) is also seen; however this is a rare visitor to Tuvaaluk. In fact, Dorais (1997: 9) states that "many hunters have never encountered it". As a result of the morphological similarity between the two species, post-cranial elements were identified using the conservative label of "small seal".

In early fall seals were hunted from kayaks and from shoreline vantage points all along the Tuvaaluk coast. The latter technique has been described historically, although Vézinet (1982: 72) suggests that it was probably not a likely practice prior to the introduction of firearms. Later in the autumn, breathing-hole sealing (*allu*) took place at the base of Diana Bay, particularly along the shore surrounding Kamik Bay (ibid.: 92). Following this period, the ice becomes too thick and allu is impossible in Tuvaaluk throughout the winter (ibid.: 71). According to Dorais, the full freeze-up of the bay generally occurs towards the end of November, and ice break-up does not typically begin until mid-June (Dorais 1997:9).

Floe-edge (*sinaa*) hunting is also complicated in the winter, as the strong prevailing north-west winds make this practice dangerous (Vézinet 1982: 71). In April and May, Diana Bay is a favoured spot for hunting seal basking upon the ice, fitting in with Vézinet's description of Illutalialuk as a spring hunting camp. The breeding season takes place from mid-March to mid-May, during which time the male ringed seals are less desirable to hunters as they "degage une odeur typique désagréable, rappelant celles de l'assa-foetida et de l'oignon" (J.-Duchesnay 1972: 68). Birthing takes place mid-March to mid-April in snow dens built upon the land-fast ice, either excavated into the snow or naturally formed from uptilting at pressure ridges (Banfield 1974: 373).

Ringed seal is ubiquitous throughout the Arctic, and is generally viewed as "the cornerstone in the native economy of the coastal Eskimos" (Banfield 1974: 374). It has traditionally furnished Inuit not only with food (including an important source of vitamin A in the liver), but also intestines for containers and house windows, skins for clothing, tents, light lines, floats, and dog harnesses, and fat for light and heat. (ibid.).

The faunal remains analysed from Illutalialuk indicate the importance of ringed seal to the area. Small seal clearly dominates the assemblage when calculating relative species contributions by NISP and MNI, comprising 49.2% of the assemblage by NISP and 38.2% by MNI. Calculation of dietary contribution based upon edible tissue lowers the importance of small seal for the inhabitants of JfEl-10, with a minimum of 21 individuals contributing 19.4% of the total available meat. With the exception of sternabrae, carpals, and front flipper phalanges, all elements of small seal are present in the assemblage – including one (unworked) baccula that was removed from the 1974 artifact assemblage. The element distribution for small seal (Figure 5.8), which is based upon a total NISP of 552, emphasizes skulls (namely auditory bullae) and limb bones, particularly the hind limbs. In addition, eight seal claws were recovered that could not be identified beyond Phocid. Two additional claws were small enough that they could be categorized as 'small seal'. Despite the lower survivability rates for keratin over bone, these claws were recovered from all three houses. The interior house contexts suggest that they may have been deliberately conserved, possibly in the form of a tool such as a seal scratcher – used to scratch the ice around breathing holes in order to attract a curious seal (Maxwell 1983).

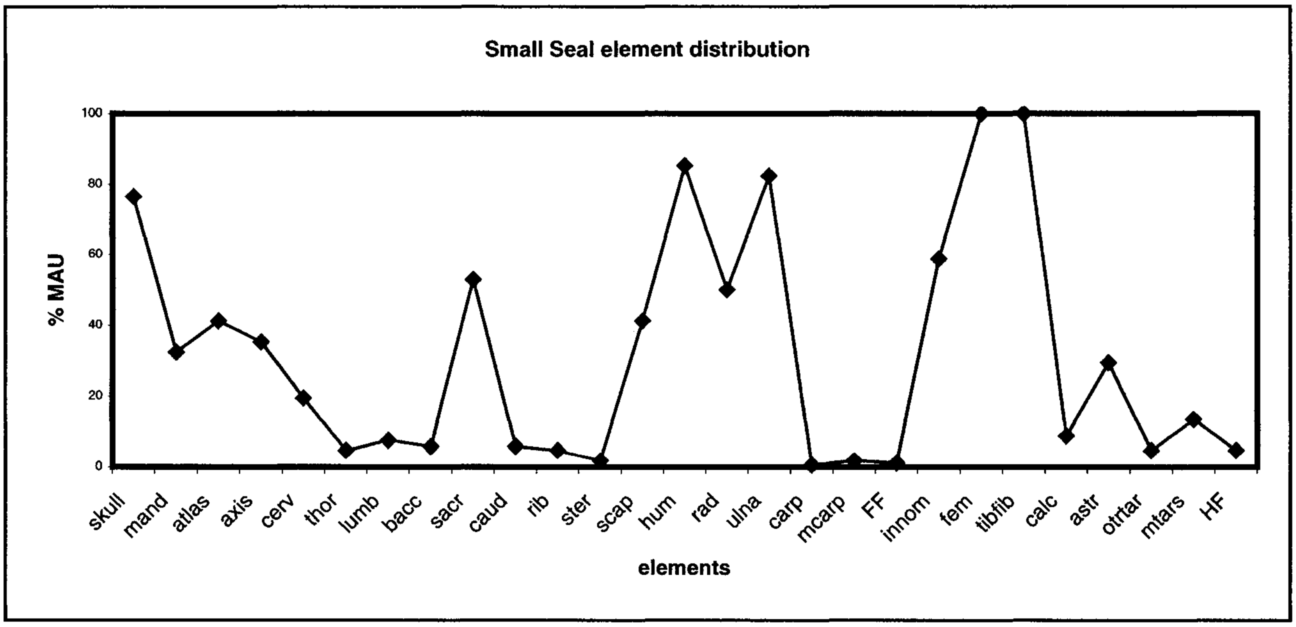

Figure 5.8: Small seal element distribution (see Appendix I for abbreviations).

Application of the food utility index supplied for ringed seal by Diab (1998) (Figure 5.9) to MAU reveals a slight positive correlation (r_s = .109, p = .698) between food utility and MAU.

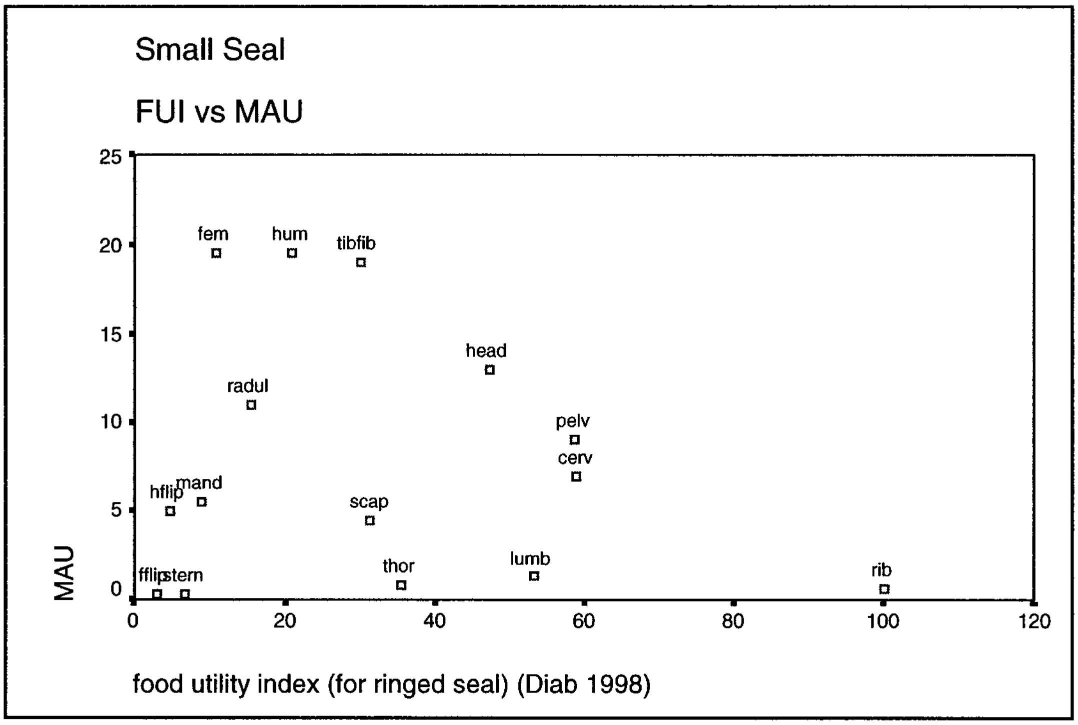

Figure 5.9: Small seal FUI vs. MAU (see Appendix I for abbreviations).

Since these faunal materials were excavated from a residential context, the greater proportion of low utility elements in the assemblage does not make economic sense. Of the 552 NISP, only 170 were categorized according to age. Eleven of these were classified as juvenile, 27 as juvenile or immature, and 96 immature. Juvenile bone was classified according to size, absence of fusion, and presence of juvenile cortex. Ringed seal pups are born between mid-March and mid-April (Banfield 1974: 374). Seal skeletons mature slowly in comparison to other animals, taking 6-7 years to reach sexual maturity (ibid.) and some epiphyses may remain unfused almost to adulthood. For this reason, the presence of juvenile or immature seal bone is not a reliable seasonality indicator. In order to draw seasonality interpretations, the analysts must rely upon a substantial quantity of late-term fetal or neonatal seal elements, neither of which are present in JfEl-10's assemblage.

Harp seal:

Harp seal (*Phoca groenlandica*) is hunted only occasionally and according to Vézinet (1982: 75) is available only during the open water season, when they migrate along Hudson Strait. Dorais (1997: 9) describes their presence during the spring and fall. This provides a rather narrow window of opportunity for hunting harp seal, and therefore a useful seasonality indicator. Peterson states that this species leaves for the high Arctic in May or June, travelling from the Eastern Canadian seaboard northwards along eastern Baffin Island and westwards through Hudson Strait to Hudson Bay and Foxe Basin, and remains farther north until December (Peterson 1966: 300). Banfield (1974: 374) favours an earlier departure following the freeze-up of bays towards the end of September, and places the return of harp seals to northern Labrador by mid-October.

The relatively significant contribution of 7.7% by NISP and 14.5% by MNI, suggests that the site was occupied during the spring or fall, a suggestions supported by the architecture of the semi-subterranean houses traditionally built for cold season occupations. Calculation of dietary contribution shows a minimum of eight individuals contributed 11.4% of the total available meat. The element distribution (Figure 5.10), which is based upon an NISP of 86 and therefore a relatively small sample size, shows a heavier emphasis upon limb bones – especially hind limbs. The application of the modified meat utility index to MAU (Figure 5.11) indicates a weak negative correlation ($r_s = -.029, p = .921$).

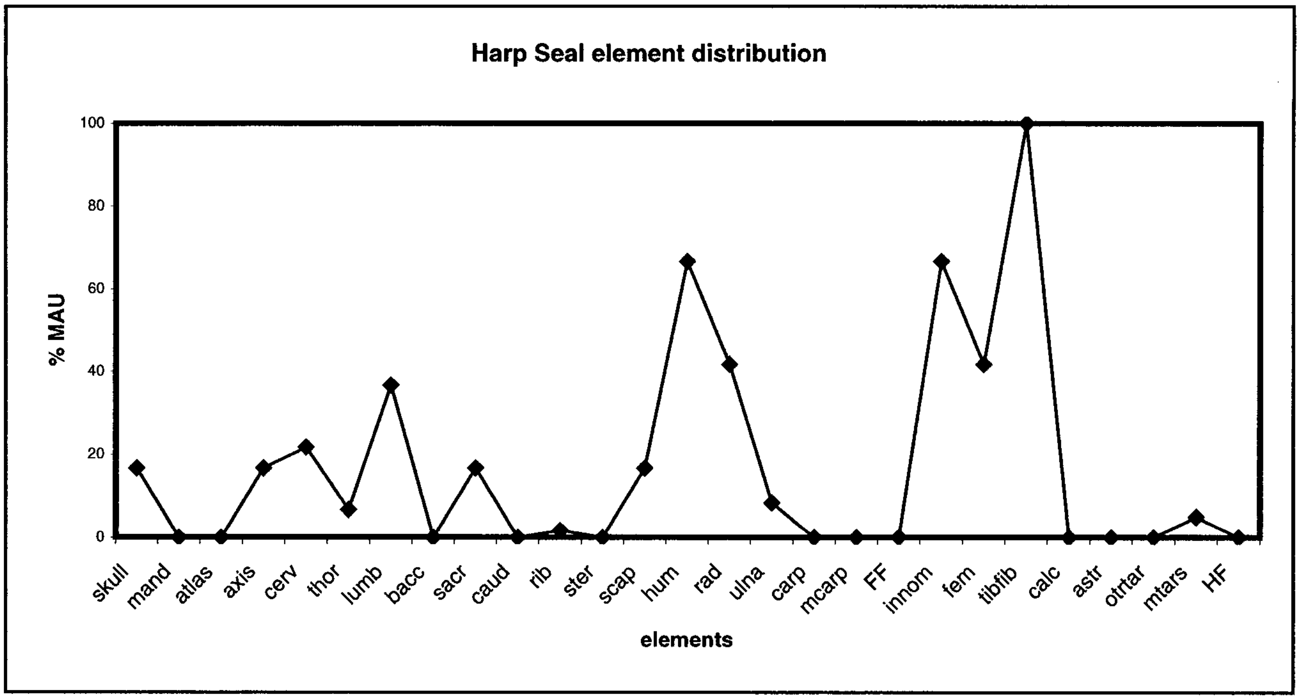

Figure 5.10: Harp seal element distribution (see Appendix I for abbreviations).

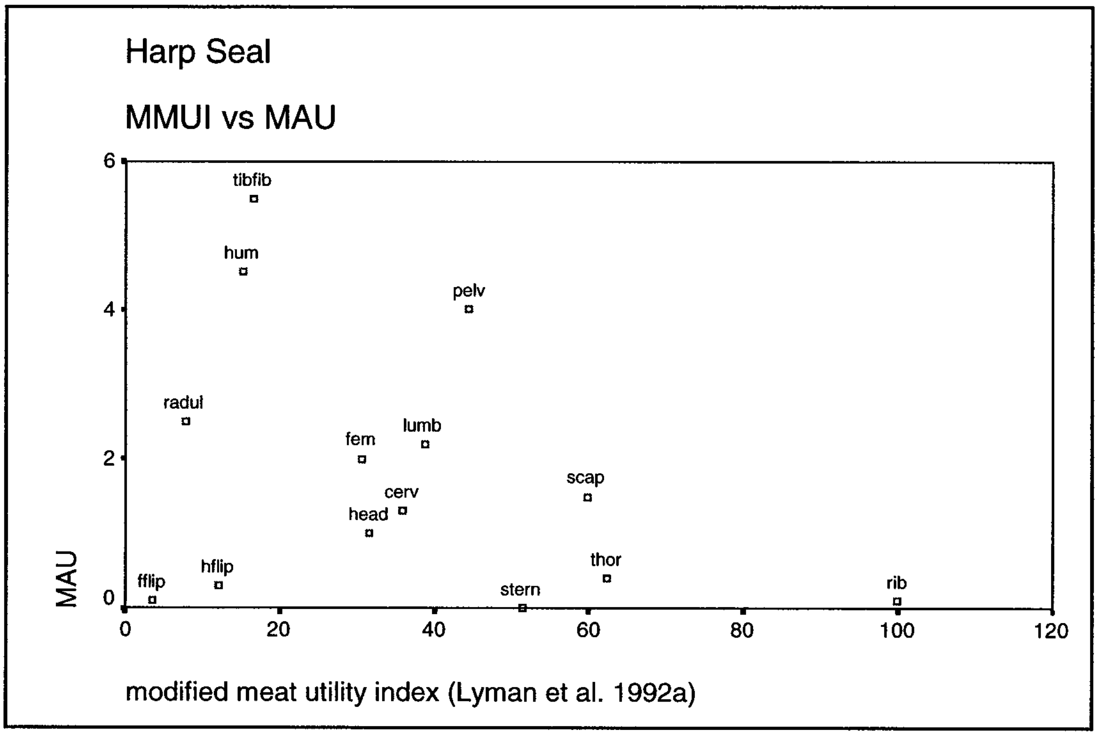

Figure 5.11: Harp seal MMUI vs. MAU (see Appendix I for abbreviations)

Of the 86 harp seal bone and bone fragments identified in the assemblage, only 32 were assigned an age category, and these were all immature and older. Harp seal breeding and birthing takes place off the coasts of Labrador and Newfoundland (Banfield 1974: 376). Therefore, the absence of juvenile seal is anticipated, since the only harp seal passing by Diana Bay would have to be mature enough to undertake the long-distance migration. Among young harp seals, migration "occurs erratically until maturity is reached" (ibid.: 377).

Bearded seal:

The bearded seal (*Erignathus barbatus*) is more common than the harp seal and may be found year-round in Tuvaaluk, where their preference for shallow waters, large bays, and open sea coasts is satisfied (Peterson 1966: 302). They feed on bottom-dwelling animals and therefore tend to occupy shallower waters. This seal is particularly valued for its large, thick hide, which is useful for the construction of tents, kayaqs, umiaqs, strong lines, dog traces, and boot soles (Banfield 1974: 366; Dorais 1997: 9). Breeding is distinguished by the fact that females only give birth every second year, with pups are born in April and May (Banfield 1974: 366). Seventeen of the 49 NISP were assigned age categories in the assemblage. One juvenile or immature element portion was identified, 8 immature, and the rest were subadult or adult. The maturation process takes six years, therefore, as with ringed seal, no seasonality inferences may be made without the presence of fetal or neonatal bones.

Bearded seal contributed 4.4% by NISP to the analysed portion of the assemblage, and 5.5% by MNI - with a minimum of three individuals represented. These three individuals represent a dietary contribution of 8.5% to the total available meat. The low sample size of 49 identified specimens means that little can be confidently inferred from the element distribution (Figure 5.12), which places more emphasis on the upper axial skeleton while the front limbs also provided a fair contribution to the bone assemblage. The modified meat utility index, derived from the values supplied for harp seal by Lyman et al (1992a) since no values are yet available for bearded seal, shows a stronger negative correlation ($r_s = -.248, p = .392$) between utility and MAU (Figure 5.13).

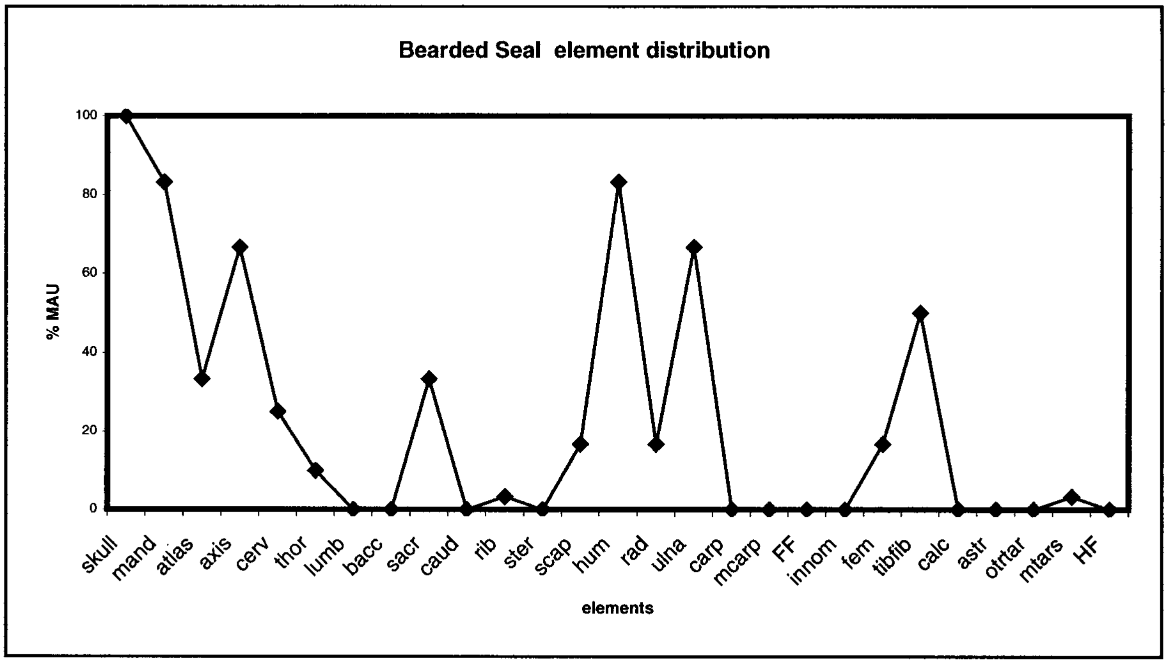

Figure 5.12: Bearded seal element distribution (see Appendix I for abbreviation)

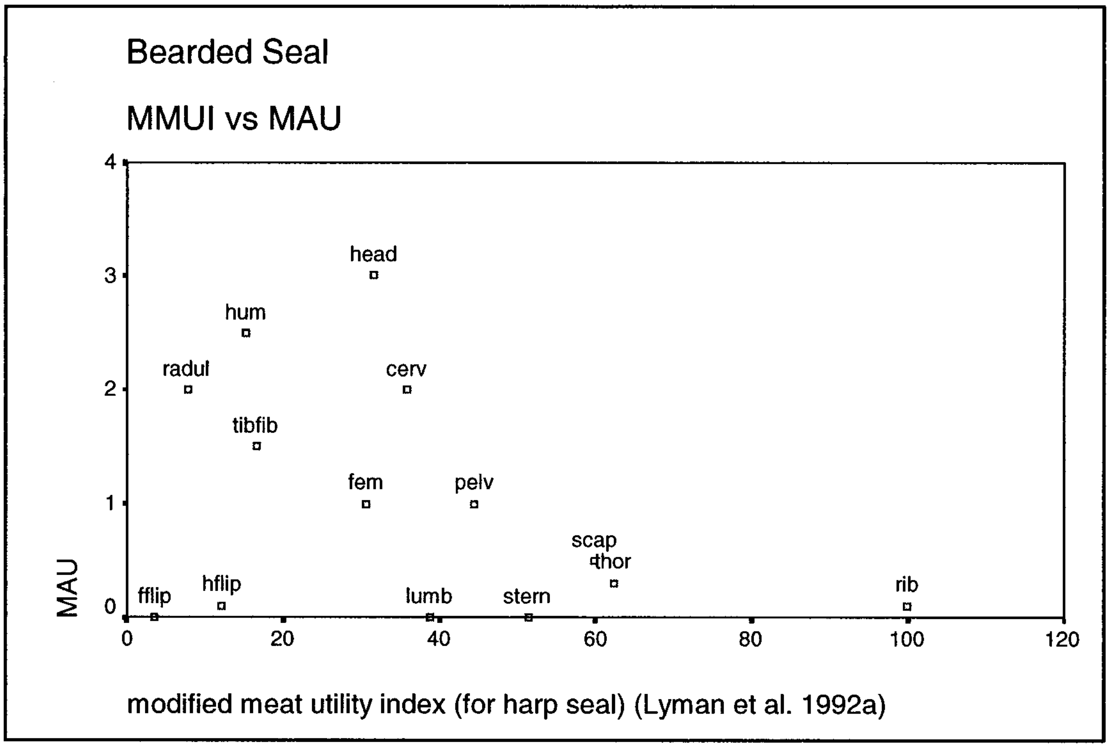

Figure 5.13: Bearded seal MMUI vs MAU (see Appendix I for abbreviations)

Walrus:

Walrus (*Odobenus rosmarus*) pass by the mouth of Diana Bay twice during their annual migrations back and forth along Hudson Strait. During the summer they are found in large numbers on Akpatok Island in the north central region of Ungava Bay and on ice floes. Travelling from Akpatok, they reach the western shore in July and travel northwards. During this time they were intensively hunted along the eastern border of Tuvaaluk on the northwestern shore of Ungava Bay (Vézinet 1982: 69). During this season walrus are hunted collectively with the use of kayaqs (never umiaqs) and harpoons (ibid.: 69). This communal hunt intensified with the introduction of wooden boats (ibid.: 23). The herds pass by Diana Bay in late July/early August after rounding Cape Hopes Advance in "successive waves" (Dorais 1997: 9), although apparently never penetrate the bay during this stretch of their migration (Vézinet 1982: 69). Continuing westwards along the southern shore of Hudson Strait, they pass Wakeham Bay around September and continue on to Hudson Bay. Following a short stay here, they return in October and may be found in northern Diana Bay and Ungava Bay in November/early December (ibid.) on their way back to Akpatok.

Walrus tend to form colonies during the summer upon rocky promontories or ice floes and spend much of their time here basking. Feeding intensifies during the autumn, when they are found more commonly in shallow waters gathering molluscs, crabs and bivalves from the seabed (Banfield 1974: 363). In the past, if the ice was not yet fully frozen in Tuvaaluk, walrus were hunted with kayaqs. When the bay was frozen over, the most common technique was to harpoon them at rest on more southerly islands within the bay. One popular walrus-hunting spot described by Vézinet was Ulliviniq, which is located between the northern portion of Diana Island and the western shore of Diana Bay (Vézinet 1982: 69).

During winter, walrus favour areas with open water, such as polynias, or thin ice: in the case of the latter, they were sometimes hunted at their breathing holes using the same non-articulated harpoon that was used at seal breathing holes (Vézinet 1982: 70); however this could only have taken place while the ice was still thin enough for marine mammals to push breathing holes through. Once the ice becomes too thick to permit the maintenance of breathing holes, as it does in Tuvaaluk, walrus retreat to the shore leads (Banfield 1974: 363). Vézinet (1982: 69) suggested that when walrus were more numerous in the past, the herds might have ventured even further south into the base of Diana Bay before freeze-up occurred.

Dorais (1997: 9) specified that walrus are far less frequently seen today in the Tuvaaluk area. Since the introduction of firearms, walrus have become more wary of the human presence and have tended to abandon their traditional hauling-out areas (*ooglit*) on open beaches (Banfield 1974: 363). While populations of the North Atlantic walrus are still fairly large, they are less commonly seen now along the southern shore of Hudson Strait (J.-Duchesney 1972: 70).

Walrus are considered to have traditionally served as a very important northern resource, in fact "probablement, parmi les mammifières marin, le plus apprécié des Inuit" (Vézinet 1982: 69). Not only does one individual provide vast quantities of meat and blubber for consumption, the large hide were also highly valued for kayaqs, umiaqs, thongs and dog traces, intestines for raincoats and containers, and bones for tools (Banfield 1974: 365). The ivory tusks served as an important raw material in a region with no wood supply apart from driftwood. "Walrus hunters had available a quality and quantity of products much superior to those of seal or caribou hunters – valuable ivory, large quantities of meat and fat – which gave them better dog teams, greater mobility, and relatively comfortable living conditions" (Saladin d'Anglure 1984: 489).

Walrus contribute a mere 6.8% of the assemblage when calculated by NISP, and 10.9% based upon an MNI of 6. When calculating dietary contribution, however, walrus take on a far more significant role and comprise 40.5 % of the total available meat. This is over twice as much as the next most important dietary contributor, small seal. Substantial proportions of walrus elements in Thule faunal assemblages have rarely been seen (see Dyke et al. 1999); therefore this aspect of JfEl-10 is particularly interesting. The element distribution (Figure 5.14), although based upon a sample size of only 76 NISP, show the presence of both axial and appendicular elements.

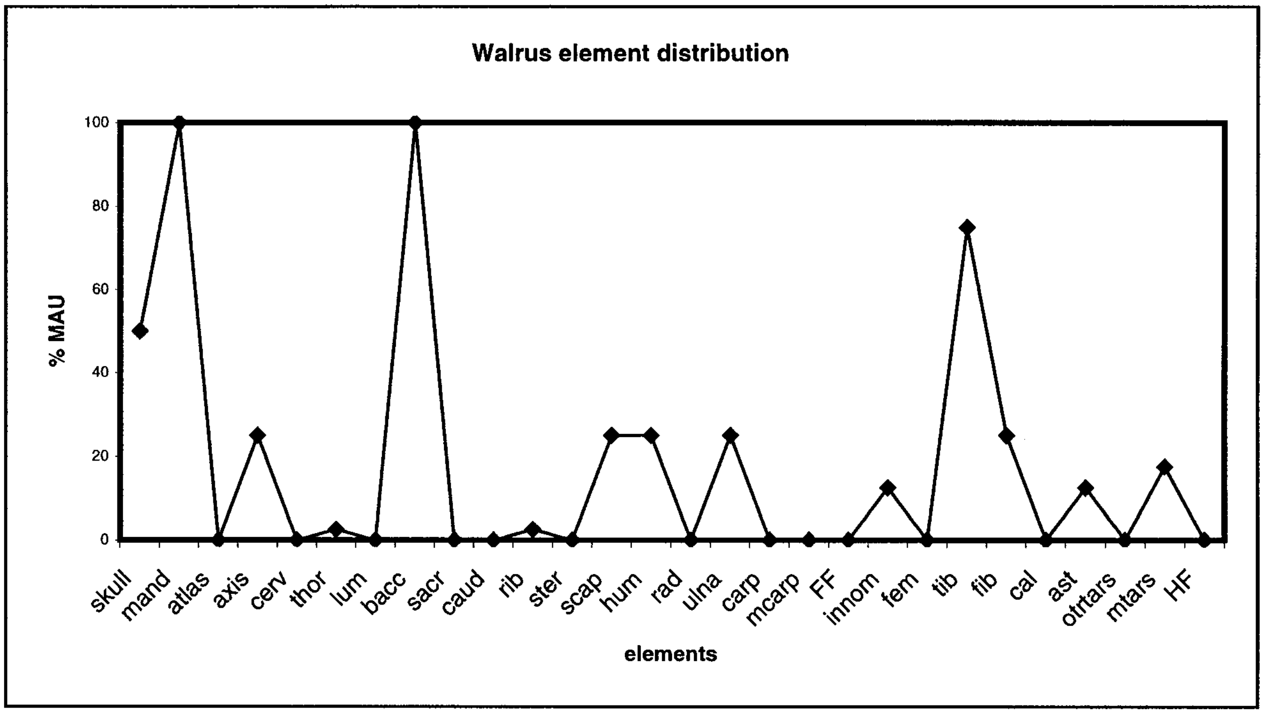

Figure 5.14: Walrus element distribution (see Appendix I for abbreviations)

The presence of a variety of post-cranial walrus elements in JfEl-10's assemblage may be evidence for a more localized walrus presence at the base of the bay, since a large, heavy animal such as walrus would be expected to undergo more intensive butchering before transport back to the homebase (Binford 1978b). However, Boas observed that while initial butchery generally took place at kill sites, most walrus parts were rolled up in the skin and brought back to the habitation areas (Boas 1964: 114). The high ratio of baccula in the assemblage is either an indicator of curation practices, with baccula being preserved for use as tools (i.e., clubs), or a higher presence of males. Walrus exhibit "a pronounced segregation of the sexes during most of the year" (Banfield 1974: 364), therefore it is possible that this segregation is maintained during the migration of herds.

The importance of skulls and mandibles in the element distribution indicates the value of ivory, both in the form of canines and post-canines. Twenty skull fragments were recovered representing both anterior and posterior portions of the head. This suggests that in addition to ivory extraction, skulls were also being conserved for brain extraction (LeMoine and Darwent 1998: 77). Several tusk fragments were present in the assemblage, including one large piece still embedded in the maxilla. Six post-canines were identified, and the 1974 artifact collection yielded a post-canine carved into the form of a sealskin float (*avataq*) plug. Turner (2001) described the use of ivory for a variety of tools, including harpoon heads, snow knives, needle cases, decorative buttons for clothing, and non-utilitarian carvings. More recently, a commercial industry of miniature figurines carved from walrus post-canines has developed in the eastern Arctic (Dion 2003). Potentially the small carvings described by Turner (2001: 260) also made use of these teeth. The presence of a relatively significant quantity of un-worked ivory in the assemblage implies either a sudden abandonment of the site or a potential excess of available ivory.

No meat utility values are available for walrus; therefore the MMUI for sealion supplied by Savelle et al. (1996) was applied (Figure 5.15). Sealion, like walrus, possess a fleshier neck and proportionally more slender body than phocids, and therefore provides a better proxy for estimating walrus meat utility values than those for harp seal. There is no correlation between MMUI and MAU (r_s =.054, p =.855).

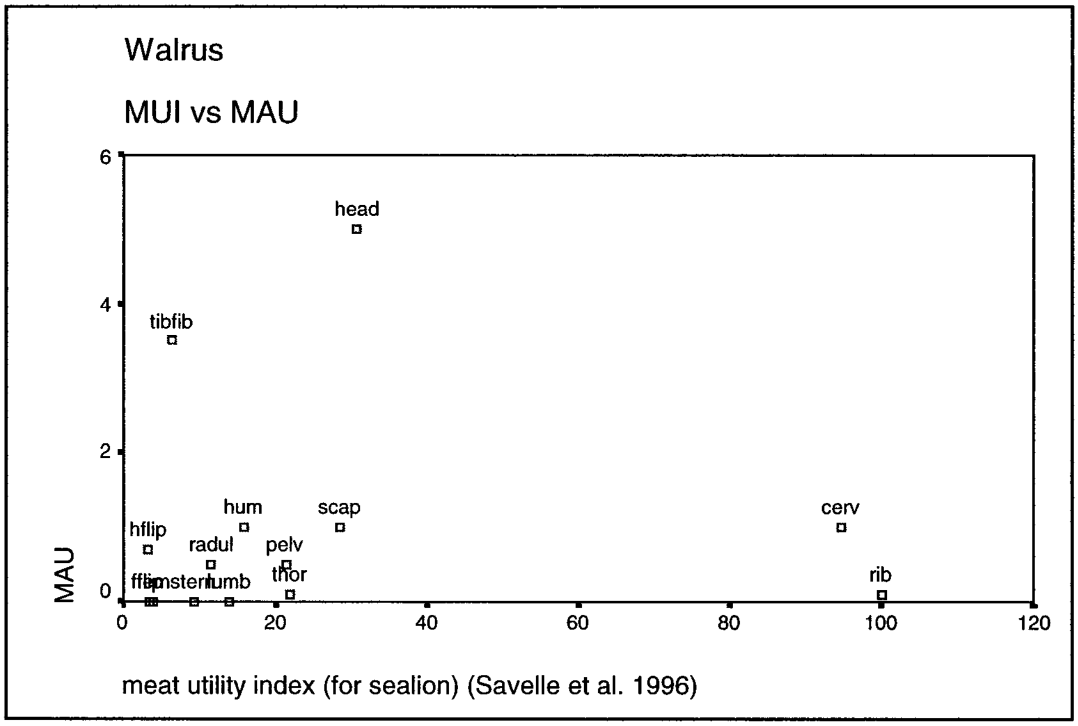

Figure 5.15: Walrus MMUI vs. MAU (see Appendix I for abbreviations)

Female walrus, like bearded seals, also give birth every two years. Calving takes place in May and June, and maturation may take between four and six years (Banfield 1974: 365). From the 22 specimen assigned age categories (NISP=76), one juvenile walrus was identified through a matching set of small mandibles. Three juvenile or immature fragments were also identified, and the rest were immature or older. The slow maturation process typical of sea mammals means that using the presence of juvenile elements alone, as with seals, does not lend any confidence to the seasonality inferences drawn from the presence of a few migratory animals.

Beluga:

Beluga (*Delphinapterus leucas*) also follow the popular migration route along Hudson Strait; passing by Diana Bay in July/August on the way to Hudson Bay and again on the return trip to Ungava Bay, Baffin Bay and Davis Strait in early September. Beluga were observed in Kamik Bay adjacent to Illutalialuk towards the end of the 2002 field season in mid-August. They remain available until November, particularly in the northern part of the bay (Vézinet 1982: 70), where the eastern shore was a favoured spot for beluga hunting. Beluga provide an important source of meat, blubber, muqtuq, and skins for umiaqs, kayaqs, boots and laces, and lamp oil (Banfield 1984: 250). Narwhal (*Monodon monoceros*) are rarely seen in Tuvaaluk. They tend to favour the edges of landfast ice and ice-floes and therefore occur farther north than beluga, frequenting deeper waters (ibid.: 255).

The category listed in Table 5.1 of beluga/walrus refers to seven intermediate rib fragments that may belong to either species. Without the more diagnostic proximal ends of these ribs, it was impossible to confidentally identify them to species. Beluga makes up only 1.4% of the assemblage by NISP and, with a minimum of one individual present, comprises 1.8% when calculating relative contribution by MNI. Although one beluga can contribute a substantial quantity of edible tissue, it contributes only 3.3% of available meat. Even this quantity may be overstated, since the value is reached with only sixteen fragments of elements randomly distributed throughout the axial and appendicular skeleton. For this reason an element distribution graph for beluga is not included. One beluga element was identified as juvenile or immature, and another categorized as immature.

Large whales:

Bowhead whales (*Balaena mysticetus*) are now uncommon, but Vézinet (1982: 68) referred to a sighting in the relatively shallow waters near Diana Bay during the Tuvaaluk project excavations here in the 1970's. According to Low's descriptions, bowheads migrated westwards along Hudson Strait in April/May and returned at the end of autumn (Low 1906: 257). This description is also backed up by more recent observations (Banfield 1974: 284). Vézinet (1982: 68) described the cooperative hunting of bowheads in the Tuvaaluk region using kayaks and articulated harpoons (*igimaq*); however, bowhead populations appeared to decline at the end of the 19th century and Vézinet states that by this time bowhead whales were no longer an important resource for the Inuit and among the Tuvaalumiut she had spoken to, none could recall more than the occasional capture of a whale (ibid.: 67).

A large bowhead cranium located a few kilometres up the beach from JfEl-10 may represent the remains of the individual that contributed both to the site's faunal assemblage and house architecture. It is impossible to determine whether this whale appeared as a result of hunting or was stranded; however a large ground slate endblade fragment with a drilled hole, recovered from House D, was likely employed in the hunting of large sea mammals – either walrus and/or large whale. Oswalt discussed the variations in harpoon size according to the respective size of the animal being pursued (Oswalt 1999: 59). A large, partially-ground, slate knife that may have been used in flensing or butchering large sea mammals, was also recovered from House D. These artifacts support the suggestion that the orchestrators of JfEl-10's faunal assemblage were engaged in the active hunting of large sea mammals. The small collection of 28 identified bowhead bones in the assemblage contributes 2.5% by NISP and 1.8% by MNI. Since these elements may have been scavenged for architectural or tool-making purposes, they may not represent any dietary contribution and therefore were excluded from these calculations.

Large bear:

Polar bear (*Ursus maritimus*) are most commonly found on the mainland and Akpatok Island in the summers, and are often encountered at the beginning of winter just prior to hibernation (Vézinet 1982: 66). Females tend to enter hibernacula from mid-November until late March, while males generally hibernate for a maximum of 50 to 60 days, during the darkest period of winter. Cubs are born during the winter while the females are in their dens (Banfield 1974: 311). During winter, polar bear were most often hunted on the islands along the northwestern shore of Ungava Bay (Vézinet 1982: 66). Given the almost mythical status of grizzly bear (*Ursus arctos*) in Ungava, these large bear post-cranial elements located in the assemblage are most likely attributable to polar bear. Erring on the side of caution, however, demands that these be categorized as "large bear". Lucien Turner referred to "a species of barren-ground bear which I shall not attempt to designate" (1885: 234 in Harper 1961: 105). Harper suggested that since there are no ground squirrels (*Spermophilus*) in Ungava that form a staple food source for grizzly bears (either as a direct source of meat or an indirect source of plant root caches), then "if perchance still extant in some remote corner of the Barrens, the Grizzly must be on the extreme verge of extinction" (Harper 1961: 104). "In conclusion, there seems to be very good evidence of the former existence of a Grizzly Bear in the northern part of the Ungava Peninsula, but comparatively little likelihood of its having survived to the present day" (ibid.: 110).

Large bear represents 2.7% of the total NISP, and a minimum of two individuals 3.5% by MNI. The small sample size of 30 large bear element fragments preludes the use of an element distribution graph or application of statistical tests. Almost half of this collection consisted of skull and mandible fragments and teeth, however the rest were front and hind limb bones, including scapulae, indicating the unlikelihood that large bear were present simply in the form of pelts. The minimum of two individuals therefore represents a relatively significant dietary contribution, making up 6.9% of the total potential available meat. Also present is one large bear claw, probably deliberately conserved as has been discussed in relation to phocid claws. One juvenile or immature bone was identified, and six immature or older.

Terrestrial mammals

Caribou:

Although Ungava-Labrador caribou (*Rangifer tarandus caboti*) populations were almost decimated throughout the first half of the 20th century, archaeological remains attest to a much greater presence in the past (Vézinet 1980: 55). Between 1915 and 1920 caribou movements to the coast gradually ceased and populations declined. Some social scientists have ascribed this decline to over-exploitation following the introduction of firearms (Balikci 1964a, b). According to Vézinet (1980: 57), an alternate explanation was offered to her by some Inuit, who suggested that the caribou had suffered from a form of suicidal madness. They currently are found along the coast from April until November, with the departure for the interior beginning in September, although Vézinet (ibid.: 55) states that some animals may remain in the interior between the Tuvaaluk region and Ungava Bay.

Like ringed seal, caribou have traditionally formed a focal resource for Inuit. Not only valued for meat and fat, caribou also provided essential hides for clothing, bedding, tents, sinews for thread, bones and antler for tools. This importance is reflected in JfEl-10's faunal assemblage, in which it ranks second to small seal in relative species proportions: 23.5% of the assemblage when calculating using NISP, and 20.0% of the minimum number of individuals. Terrestrial mammals, however, contain proportionally less edible tissue than marine mammals – calculated at only 50% of total body weight, vs. 70% total body weight for sea mammals. As a result, the minimum of eleven caribou that are present in the assemblage contribute only 6.2% to the total available meat. Figure 5.16 shows the element distribution for caribou. Emphasis lies on the appendicular skeleton, with the exception of mandibles represented largely by poorly-preserved teeth. Skulls are mainly represented by antler, with a substantial quantity of large pieces of probable debitage present in the assemblage. The meat utility index (Figure 5.17) shows a moderate reverse utility curve, with low-utility elements contributing a greater part to the assemblage. The correlation coefficient supports this observation (r_s =-.276, p =.283).

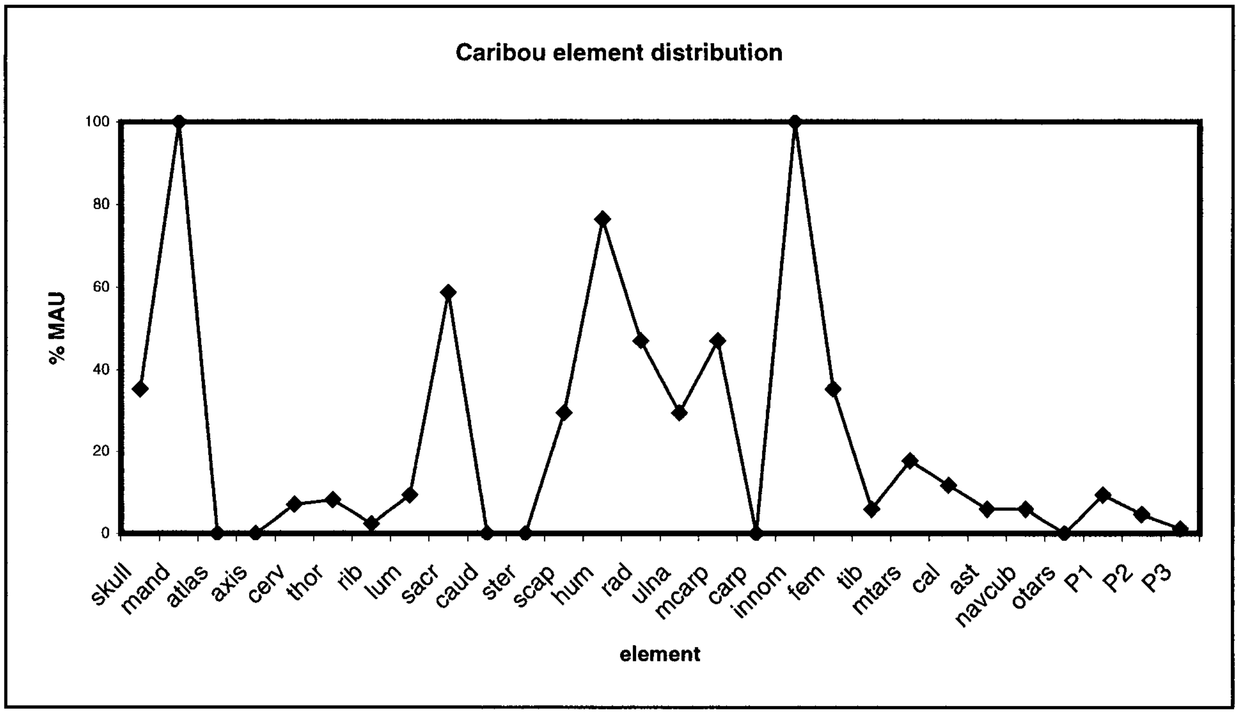

Figure 5.16: Caribou element distribution (see Appendix I for abbreviations)

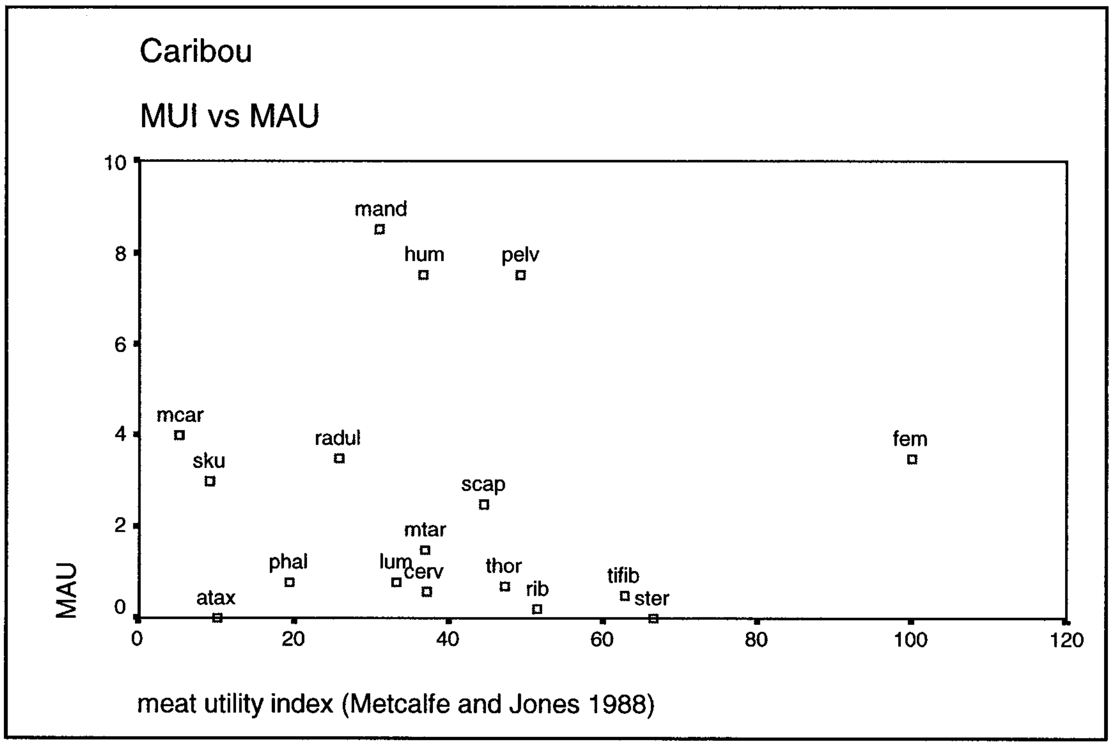

Figure 5.17: Caribou MUI vs. MAU (see Appendix I for abbreviations).

Caribou age categories are distinguished by a significiant proportion of elements identified as subadult or older (29) or adult (31), with only two juveniles, 3 juvenile or immatures, and 13 immature or older. This pattern may be related to a desire for older animals with larger skins and antler racks for tool raw material. More likely, taphonomic factors played a role in the age distribution (c.f., Binford and Bertram 1977).

Dog/Wolf:

The only canid represented in JfEl-10's assemblage is the *Canis* genus: dog (*Canis familiaris*) or wolf (*Canis lupus*). Because of the difficulties in distinguishing post-cranial material between wolves and domestic Inuit dogs, exacerbated by both intentional and unintentional inter-breeding (Banfield discussed the practice of breeding female sled dogs with wolves, in order to produce larger and stronger offspring) (Banfield 1974: 292) the canid faunal remains could not be identified beyond genus. Only five fragments of axial and appendicular elements were identified in the faunal remains. A mandible was notable in the presence of a square incision that had removed the coronoid process and the proximal end. One dog/wolf tibia was identified as immature.

Birds

As stated earlier, only one identified and four unidentified bird bones were recovered from JfEl-10's faunal assemblage. The bird humerus shaft fragment was identified as a large gull species, probably glaucous or herring (*Larus hyperboreus* or *argentus* respectively). A number of migratory waterfowl are present in Diana Bay during the fall and spring. Eider ducks are numerous during the fall in northeastern Diana Bay, when the collection of down is a popular activity. This practice may have been a more recent introduction by traders, according to Vézinet (1982: 73). Geese are especially abundant at the base of Diana Bay just before their fall migration (ibid.). They may also be seen in the Tuvaaluk area in May/June, during their spring migration. Ptarmigan are available year-round but are particularly prevalent in Tuvaaluk during April and May (Dorais 1997: 10). However, none of these useful seasonal indicators were located in the assemblage. Gull is present year-round and therefore provides little information on site occupation. The absence of any other varieties of bird, particularly given the fall or spring occupation that is suggested through the mammalian faunal remains, implies that perhaps taphonomic factors played a decisive role in the class distributions observed in JfEl-10's zooarchaeological materials.

Summary

Relative species contributions at JfEl-10 vary considerably depending upon the quantitative method selected. Ringed seal plays the most important role in subsistence pursuits at Illutaliluk, when calculating proportions based upon NISPs or MNIs. Caribou plays a supporting part, with harp seal, bearded seal, walrus, beluga, and bowhead whale taking subsidiary roles. Calculation of relative dietary meat contributions, however, indicates that walrus played a much more important part than pure bone counts would suggest – contributing over 40% of the available tissue inferred from the assemblage. In addition, walrus provided a valuable source of raw material in the form of ivory.

Harp seal, walrus, and beluga are all migratory species that travel along Hudson Strait, passing Diana Bay as they move both eastwards and westwards. Harp seal appear in the Tuvaaluk area in spring and early fall, according to Banfield (1974), although Peterson (1967) suggests that they may appear later into the winter. Beluga whale pass by during the summer, return in September, and may remain in Tuvaaluk until November. Walrus first appear in late July/early August, and return towards the end of November or early December (Vézinet 1982). In addition, caribou tend to be found along the coast from April until September, with some remaining as late in the fall as November. The presence of both axial and appendicular walrus elements provides the strongest seasonality indicator, as more extensive butchery would be expected with the transport of large animals across significant distances. The presence of lower-utility elements implies that walrus-hunting was a more localized event, a practice that would only be possible from late summer through to winter. The species composition of JfEl-10's faunal assemblage does not provide any strong seasonal indicators; however, it may be suggested that the combination of migratory sea mammals suggests a late fall/winter/ possibly spring occupation. This interpretation is supported by the site architecture, which is composed of the Thule semi-subterranean houses traditionally associated with a cold season occupation.

Food caching is always an issue that needs to be considered in Arctic subsistence analyses. Food caught in the fall may frequently be cached and saved for consumption much later in the winter, when food becomes more scarce and hunting more difficult during the shortened days. Walrus in particular is still considered a delicacy when consumed in the form of *igunaq*, a form of rotten meat that is eaten in the winter (Malaurie 1982: 93-94). Walrus that have been killed during the fall hunting season are often butchered and wrapped in the skin, then cached carefully so that the meat is allowed to spoil gradually for later consumption during the winter (Johnny Oovaut, personal communication). However, the dominance of migratory animals present in the area during fall and early winter suggests that caching alone does not provide a significant explanation for the species present in JfEl-10's assemblage.

Chapter 6

TAPHONOMIC ANALYSIS of JfEl-10, NUNAVIK

As the faunal assemblage at JfEl-10 was being removed from the ground, it became clear that the sample we were assembling had undergone a variety of taphonomic processes since the intial bone debris was deposited by the site's inhabitants. While relatively few bone stains (in which the bone has decayed into nothing more than a light-coloured patch of soil) were observed, many bones recovered were mushy and exhibited delamination of the bone surface. This indicated poor organic preservation. Therefore, subsistence interpretations based upon these faunal remains need to be treated with caution. In order to evaluate the potential effects of taphonomic factors upon the collected sample, it is necessary to apply statistical tests. Density-mediated attrition of osteological materials provides a valuable means of quantitatively testing for taphonomic alteration. While density cannot be completely held accountable for differential preservation between elements and taxa, it may at least provide an indicator for the impact of natural rather than cultural formation processes.

The application of Lyman's (1994) bone density indices to this assemblage revealed a moderate positive correlation between bone density and MAU, with MAU indicating each element's relative presence in the assemblage. While the application of this technique often applies to only the highest density value per element, or restricts analysis to the proximal and distal ends of elements, the present study also includes the middle portions of bones. This provides a more intensive assessment of density-mediated attrition, and considers the possibility that more shaft than end fragments may be present in the assemblage. An over-dependence upon the end portions of bones is a criticism that has more recently been levelled at faunal analysts (Marean and Frey 1997; Lam et al. 1998): "while long bone ends are typically diagnostic of taxon and thus useful in estimations of species abundance, they will produce inaccurate assessments of skeletal part frequency in faunal assemblages that have been subjected to density-mediated attrition" (Lam et al. 1998: 568). This method reduces the correlation between MAU and bone density, but provides a clearer description of the relationship between the two.

Figures 6.1 - 6.5 illustrate this relationship for each taxa. The strongest correlation exists for small seal (r_s =.543, p =.001), which is the only pattern significant at the .01 level. This is quite likely attributable to the fact that small seal represents by far the most abundant taxa in the assemblage, when calculated using bone counts. Curiously, walrus follows small seal with the second strongest positive correlation between MAU and bone density (r_s =.412, p =.017), significant at the .05 level. This is interesting, given the small sample size of only 76 NISP. Were density values available for the baccula, a very dense element in walrus, this correlation would no doubt be even stronger. Next is bearded seal, with a weaker positive correlation (r_s =.365, p =.037), also significant at the .05 level. The sample size for bearded seal is even smaller, with only 49 identified specimens. Harp seal, although a larger sample with 77 bone fragments, exhibits a very weak positive correlation that is not significant (r_s =.116, p =.520). Finally, caribou also reveals only a slight positive correlation with no significance (r_s =.198, p =.204), even though it is the second most abundant taxon in the assemblage in both bone counts (264) and minimum number of individuals (11). The fact that harp seal element counts show no significant correlation with bone density, suggests that the significant correlation observed with walrus and bearded seal MAUs is not attributable to smaller sample sizes.

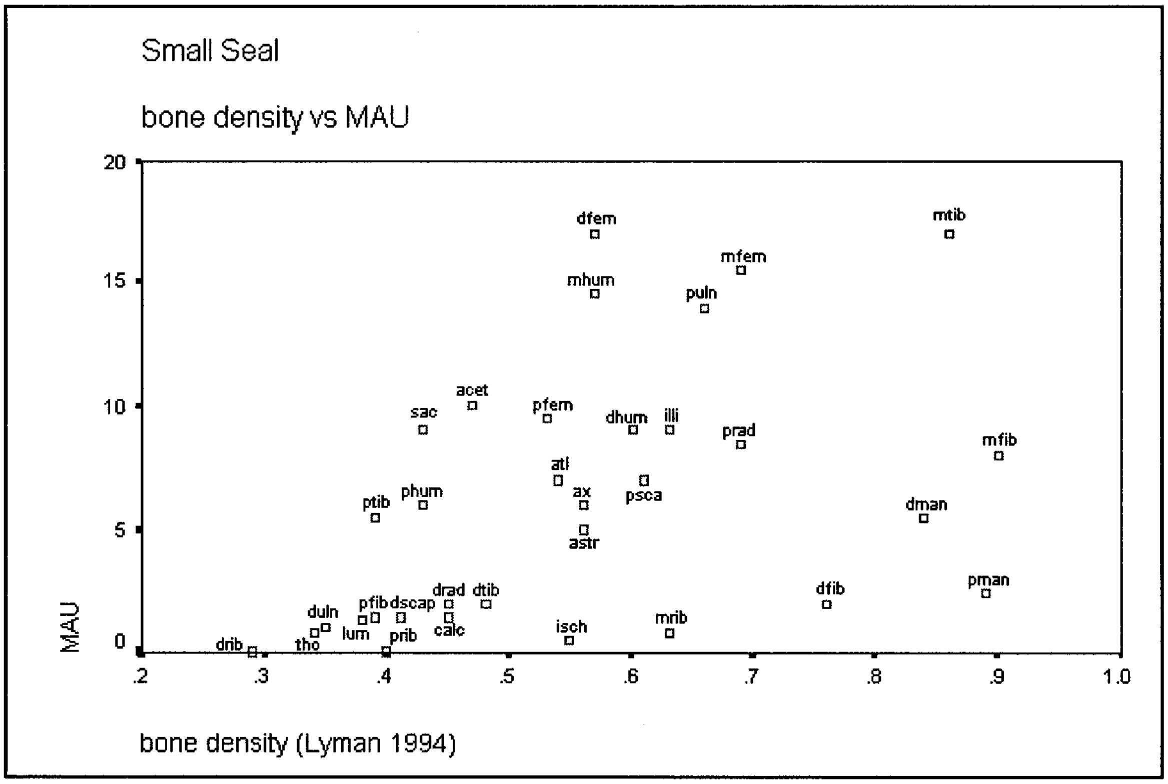

Figure 6.1: Small seal bone density vs. MAU (see Appendix I for abbreviations).

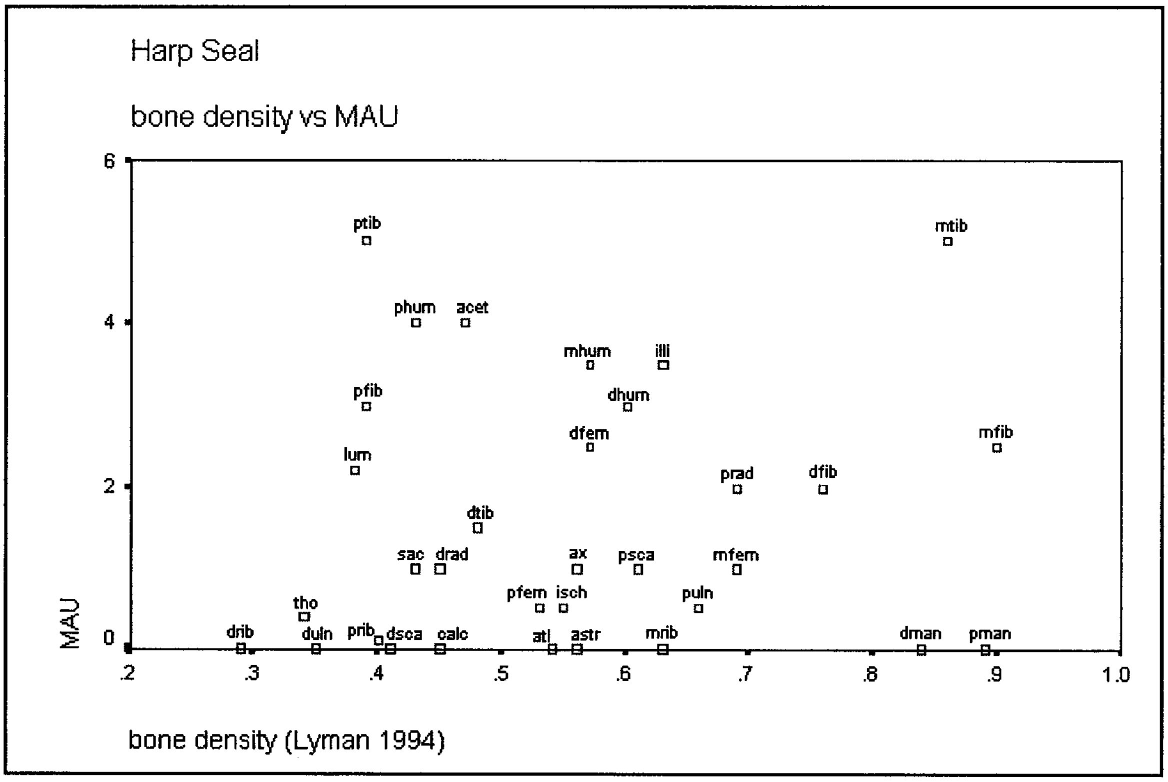

Figure 6.2: Harp seal bone density vs. MAU (see Appendix I for abbreviations)

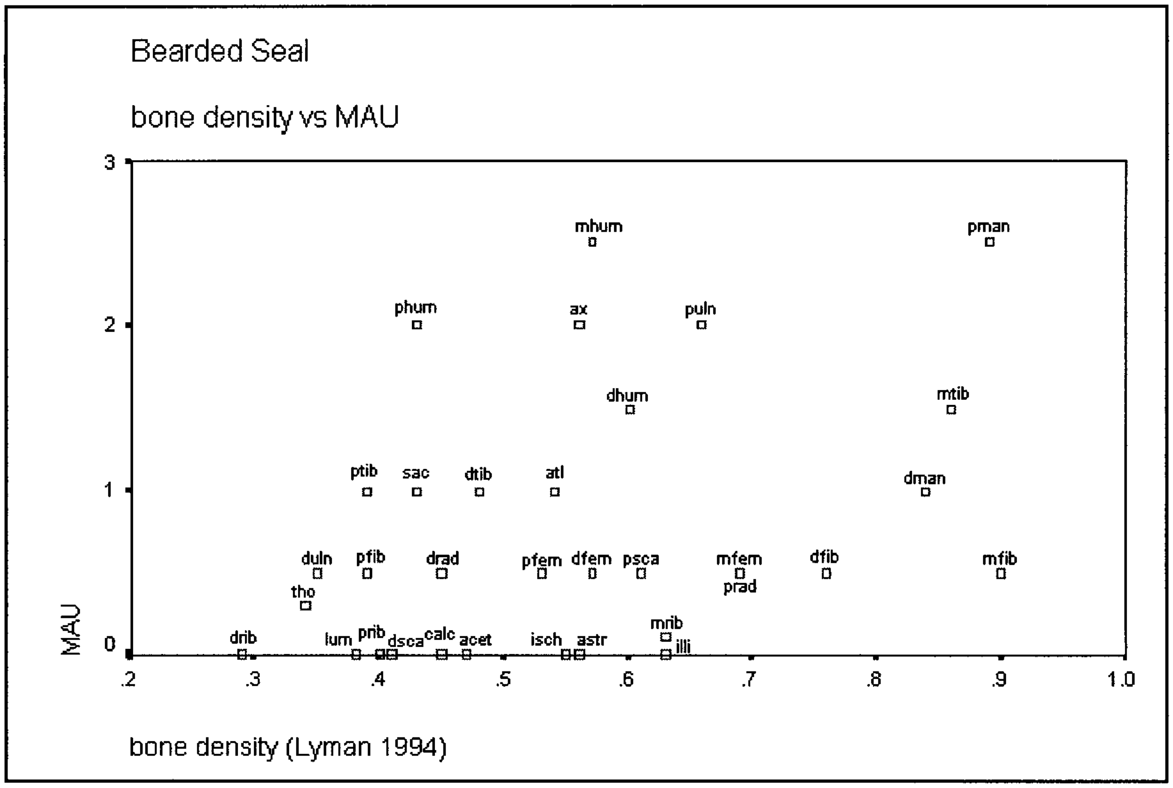

Figure 6.3: Bearded seal bone density vs. MAU (see Appendix I for abbreviations)

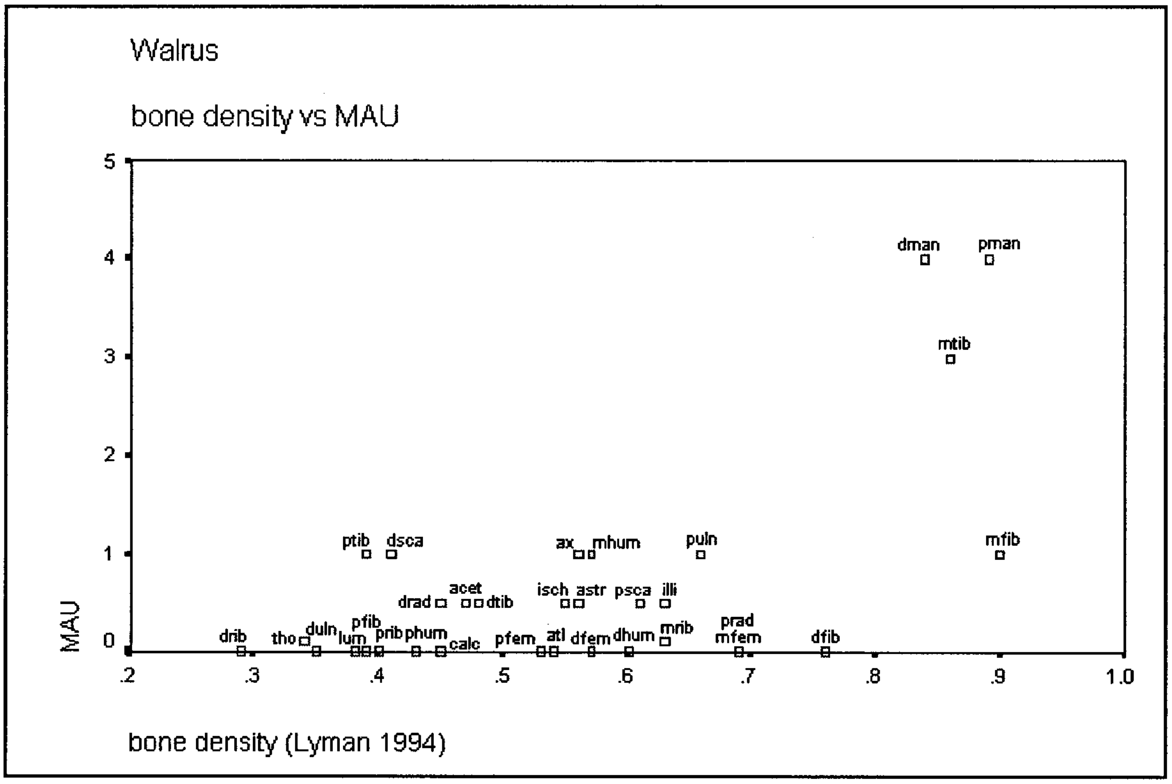

Figure 6.4: Walrus bone density vs. MAU (see Appendix I for abbreviations).

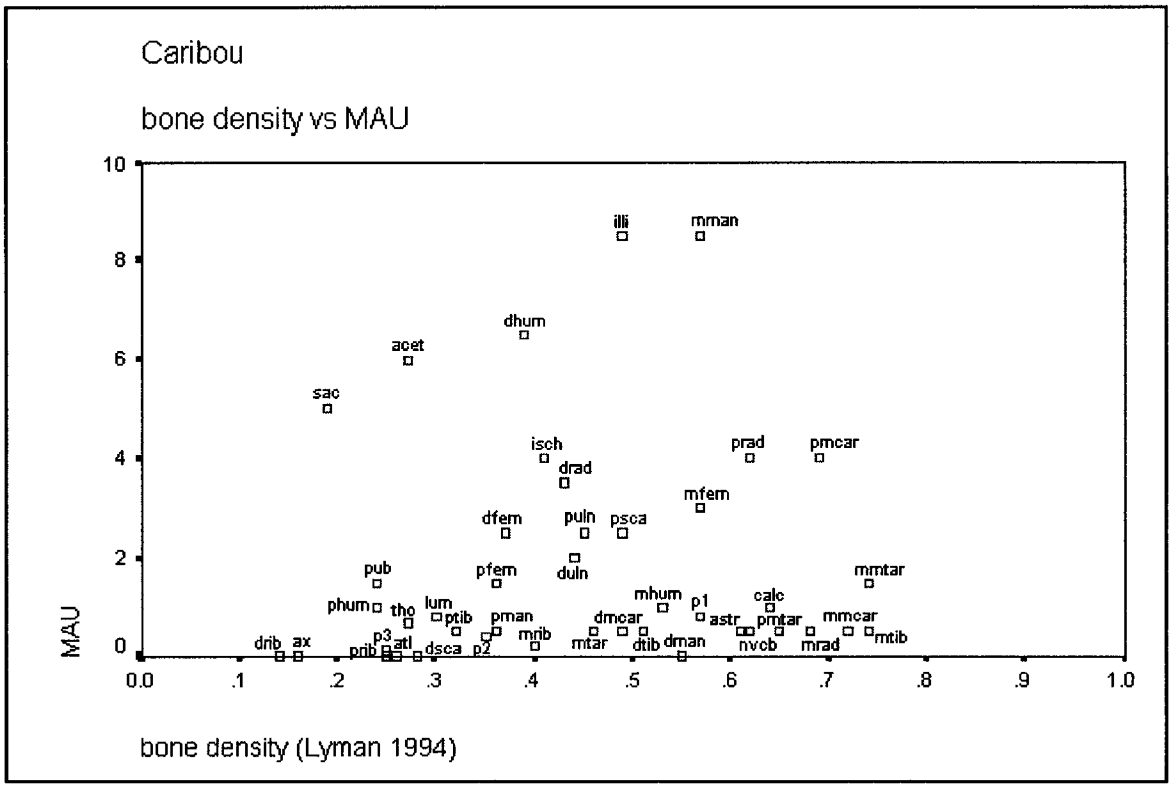

Figure 6.5: Caribou bone density vs. MAU (see Appendix I for abbreviations)

Evidence for carnivore gnawing, cutmarks, and burning was noted during the analysis. At 21.5%, the identification rate was low. This is attributable in part to the poor preservation, which can severely reduce the recognizability of diagnostic markers on bone fragments, as well as the recovery of a large number of very small fragments of burnt bone from the kitchen hearth that could not be identified. Burnt bones recovered from the kitchen hearth account for almost half (45.8%) of the unidentified bones.

As discussed previously, the taphonomic history of an assemblage consists of a series of seven consecutive processes: biotic, thanatic, perthotaxic, taphic, anataxic, sullegic, and trephic – which move from the life assemblage to analysis in that order. The following discussion will consider the array of influences at work on the animal bone recovered from JfEl-10, through each of these stages of the faunal materials' taphonomic history. As with anything conditioned by human activity, these processes are not discrete units, and some may merge with others. Hence, "the taphonomic history of a given assemblage may not lend itself to such simple subdivision" (O'Connor 2000: 20); however it provides a useful framework for structuring the discussion of the factors involved in forming JfEl-10's zooarchaeological assemblage.

Biotic processes

The biotic phase concerns "1) the character and magnitude of the environment exploited, 2) the species available and their abundances, seasonal and otherwise, and 3) the species perceived as useful by the prehistoric inhabitants" (Hesse and Wapnish 1985: 20). Seasonality plays an important role in this phase. At JfEl-10 the presence of a number of migratory species suggests a late fall/winter/early spring occupation. Thickness of the ice in Diana Bay makes the common technique of breathing hole sealing during the winter difficult, as the thick ice serves as a barrier to maintenance of breathing holes. This makes it a difficult environment for pinnipeds to survive in during the winter. Their presence suggests that the site was occupied outside of that season. Walrus and bearded seal are particularly valued not only for meat and fat, but also skins and tool raw material (ivory tusks and baccula). Therefore more effort may have been exerted in pursuing these less-commonly seen pinnipeds. Other animals available in the area may not have been pursued due to the poor return rates offered (ex., smaller animals such as hare or lemming) for energy exerted. All of these factors contributed to the presence of these particular animals within the hunting radius of the inhabitants of Illutalialuk. Biotic processes therefore condition the formative phase of the site's faunal assemblage.

Thanatic processes

Thanatic processes characterize the next stage of the taphonomic history. These factors relate to the killing of members from the living population, resulting in their deposition at the site. This phase is affected by hunting techniques, such as breathing hole sealing allowing the capture of more seals through the ice, or the use of boats that permit the hunting of animals in a larger catchment area. Walrus, for example, have been suggested to only enter the upper reaches of Diana Bay. The use of boats would facilitate their transportation down to Illutalialuk at the base of the bay. The presence of both axial and appendicular elements in the assemblage implies that the schlepp effect did not dictate the degree of butchery performed on walrus kills. Therefore the postulated transport of walrus carcasses through towing them behind boats (see Malaurie 1982: 66-69) provides a better fit with the element distribution.

Butchering decisions are also involved in the thanatic stage. Hesse and Wapnish (1985) suggest that this practice falls into the category of perthotaxic agents; however, O'Connor (2000: 20) discusses it as a thanatic factor. Since selective culling at the kill site determines which elements will return back to the residential site, and hence (in this case) the final formation deposit, butchering will be considered a thanatic agent.

Cutmarks were noted on 17.4% of the identified bones. This figure is relatively high, given the poor preservation of the assemblage. Degradation of the periosteum means that evidence for butchery becomes harder to identify, particularly since "...not all cultural or food bone will display butchering marks because it is quite possible to butcher an animal of any size without leaving a mark on any bone" (Lyman 1982: 351). The utility indices, however, give no strong indication of a particular culling strategy. A weak negative correlation between utility and MAU was apparent, meaning that lower-utility body parts were more prominent. Butchering disturbs the macrostructral integrity, so that the microstructure of the bone is thereby subjected to a more intensive damage from subsequent perthotaxic and taphic effects.

Another practice to be considered is caching. Through caching, a species moves beyond its seasonal availability and may enter the formation deposit of a site occupied during a different season. Caching also has important implications for the perthotaxic stage.

Perthotaxic processes

Perthotaxic processes relate to agents such as fluvial and sub-aerial weathering, scavenging, and human garbage disposal practices that result in the movement and destruction of bones before their final deposition. Hesse and Wapnish (1985: 23) suggested that animals die twice: "the first time, their lives are snuffed out by thanatic processes. Once dead, their parts enter the cultural stream where they are used, reused, and eventually discarded".

Cooking techniques have an important impact upon the survivability of bone. Bone microstructure becomes weakened through boiling, and is therefore at greater risk from other taphonomic factors. Burning bone, on the other hand, increases its ability to survive subsequent taphic processes. 39.8% of the assemblage revealed evidence for burning, ranging from slight carbonization (brown to dark brown), through full carbonization (black), to full calcification (white). 89.8% of these burnt bones were recovered from the kitchen hearth area of House D. Many of them were too small or disfigured to permit identification (45.8% of the unidentified bones were burnt bones from the kitchen hearth). Burning bone debris is one method of disposing of kitchen garbage; therefore this cultural practice effectively acts as a taphonomic agent by removing those bones from the identifiable portion of the assemblage.

Another mode of reducing food remains is to feed it to the dogs. Evidence for carnivore gnawing was relatively low, at 22.6%; however this figure could be misleading. With the degradation of the periosteum and increased fragmentation of brittle spongibone that is seen in poorly preserved assemblages, the scoring and pitting generally used to identify the effects of carnivore behaviour upon an assemblage (Binford and Bertram 1977; Binford 1981) can be obliterated. Gifford (1981: 407) noted that carnivore damage may often only reveal itself through scraps of bone that are commonly relegated to the 'unidentified' portion of an analysed assemblage, without close examination. As with butchery, the disruption of the structural integrity of bones through carnivore activity renders them more susceptible to other perthotaxic and taphic factors, hence further decreasing their identifiability. Morrison suggested that in Arctic assemblages, carnivore gnawing is probably the most significant density-mediated taphonomic factor that affects the organic remains (Morrison 1997: 80), particularly those recovered from habitation sites.

External middens are also a means of disposing of kitchen debris. Faunal remains that were deposited outside of the semi-subterranean house were in a shallower deposit than those recovered from within the house, and therefore less protected by the next stage of taphic processes. Shallower deposits are also potentially at greater risk from the effects of cryoturbation than those more deeply buried under the collapsed roof of a semi-subterranean house. Also, the practice of scavenging sod from older house ruins removes those remains from their initial context and introduces them into a new formation deposit.

1.2% of the identified portion of the assemblage had been oil-soaked. These were largely recovered from the entrance tunnel of House H. Oil-drenching is a quite often observed in Thule archaeological deposits. This has the effect of dessicating the bones and rendering them far more fibrous and brittle, so that they are more likely to break apart and become less identifiable.

The curation of bones for use as tools can also remove bones as identifiable portions of a faunal assemblage. Two caribou scapulae were removed from the 1974 faunal collection as artifacts. The spines and distal ends had been removed, as well as the cranial border of the proximal end. Wear on the distal end indicated that these scapulae were likely used as skin scrapers, as described ethnohistorically by Turner (2001) and Boaz (1964). One walrus bacculum had clearly been cut across one end, possibly improving its 'wieldiness' as a club. Removal of bones from the faunal assemblage through their transformation into artifacts plays a taphonomic role by deleting them as identifiable parts of the faunal remains, and relocating them in the artifact assemblage. On the other hand, the curation of elements that otherwise would have been unlikely to survive archaeologically, such as the bear and seal claws recovered from all three houses, increases their analytical survivability.

Taphic processes

Taphic processes concern the "variety of mechanical and chemical actions affecting bones subsequent to burial" (Hesse and Wapnish 1985: 26). Cryoturbation is a taphic process that can often have an important impact upon Arctic zooarchaeological materials. On Illutalialuk, the archaeological deposits were relatively shallow, and permafrost was not encountered in many parts of the site. Salaün (1975: 17) suggested that much of the site had been disturbed by freeze-thaw action, which tends to grind up objects in shallow depositions. Nunavik occupies the southern-most reach of the Canadian Arctic zone, and therefore is characterized by a lower permafrost layer. As a result, sites are likely to experience a greater level of destruction from cryoturbation. Wood and Johnson (1978: 333-346) described cryoturbation and gelifluction as the two most destructive pedoturbatory processes in arctic and subarctic areas.

JfEl-10 is located in a valley covered with the type of low, wet tundra most likely to experience extensive cryoturbation (Wood and Johnson 1978). It is likely that the site has been subjected to accumulations of water each spring, as snow-melt runs down from the adjacent ridges. There was evidence for this during the 2002 field season in the form of a number of small ponds. Also, the sunken form of the semi-subterranean houses encourages the retention of this snow-melt, further contributing to the destruction of organic remains. Organic tools, which generally form the bulk of Thule artifact assemblages, were rare and poorly preserved. Although the assemblage yielded a fair number of antler branches and fragments, they were often degraded and flaking. Once the macrostructure of the antler beams have been disrupted, as through tool-making, they are rendered more vulnerable to subsequent taphonomic disturbance. In areas outside of the core bowhead whale-hunting zone (Savelle 1987a), Thule artifacts are more often composed of antler, wood, or ivory. A few chunks of worked ivory and one flaking ivory avataq plug were found; some evidence for (degraded) worked wood was also recovered from the site.

The levels of acid and alkaline in the soil also play an important role during the taphic stage of a taphonomic history. Child (1995a, 1995b) pointed out that archaeological bone preservation was conditioned mainly by the environment of burial, and such factors as length of burial or bone density were of less significance: "The chemical and physical deterioration of buried bone depends solely upon the chemistry (and biochemistry) of the surrounding burial environment" (Child 1995a: 21). Acidic soils tend to dissolve the mineral component (hydroxyapatite) of bone, as do soils low in phosphate. Calcium-rich soils encourage the break-up of bone by replacing the mineral component with calcite, forming larger crystals within the matrix that render the bone more brittle, leading to cracking. This degradation is furthered through subsequent exposure to freeze/thaw action (ibid.).

This series of events described by Child (1995a, 1995b) may explain the appearance of the teeth recovered from JfEl-10, which were surprisingly badly-preserved. Teeth, although denser than bone and therefore generally expected to be more likely to preserve, are prone to splitting in response to dessication (Toots 1965: 39; Behrensmeyer 1978: 153). The density of teeth is related to the greater proportion of the mineral component, hydroxyapatite. This means that there are more mineral crystals to be replaced by the larger calcite crystals, resulting in a greater potential for structural disturbance. This disruption is further exacerbated through dessication associated with extensive freeze/thaw cycles. Even large polar bear canines were cracked and flaking. Caribou teeth, although abundant, were also highly fragmented and often difficult to identify, while seal teeth were practically non-existent. This suggests that size may also be an important factor in determining tooth survivability. In addition, morphology plays a decisive role: "the lack of an unambiguous pattern of weathering suggests that the individual characteristics of each tooth...are important controls on their rate of weathering" (Martin 1999: 155).

Child (1995a) also observed the greater susceptibility to decay of bones surrounding the abdomen and thorax, since the presence of gut microorganisms means that axial elements, with the exclusion of the skull, are subject to a longer period of demineralization from decay of the internal organs. This means that the lower frequencies of axial elements often attributed to density-mediated attrition may not actually be associated with the lower densities of these elements. The fact that the Inuit often fed these parts to the sled dogs, since the intricate morphology of vertebrae makes meat-removal from the spine more difficult for a relatively low return-rate, means that identification of the primary cause of lower axial element frequencies is close to impossible. Processed remains from kitchen garbage, however, may not be subject to this taphic factor, since presumably meat and organs have already been separated from the bones before deposit in a midden.

Miccozzi (1986, 1991) found that previously frozen carcasses disarticulate faster than fresh carcasses. Frozen bodies also appear to decay from the 'outside-in' upon thawing, largely as a result of the invasion of soil organisms. The decomposition of unfrozen animals is mainly caused by microorganisms working their way first through the marrow and internal grease, and then the bone, thereby instigating decay from the 'inside-out' (Micozzi 1991: 43). During the analysis of JfEl-10's assemblage, a qualitative impression was formed of differences between the patterns of decay of marine and terrestrial mammal elements. Caribou bone appeared to possess a more fibrous cortex, with the outer periosteum flaking off in layers. The same pattern was observed on a few of the dog/wolf bones; however the sample size for this species is too small to substantially provide support for the marine-terrestrial mammal bone divide. Seal and walrus bones seemed to be breaking down differently, with the bone cortex remaining more consolidated but more prone to cracking, with some delamination of the periosteum. Polar bear, as a transitory animal occupying both marine and terrestrial ecozones, exhibited a similar pattern. Caribou and dog/wolf elements gave the appearance of 'shredding' with decreased quality of preservation, while seal, walrus and polar bear became more crumbly, almost chalky, as the apparent level of preservation became worse.

These impressions are difficult to express in any quantitative way, and for this reason there is little comparative information on the qualitative aspects of a faunal assemblage. Behrensmeyer (1978) developed a weathering index applied to fresh bones that had been left to decay on the surface over a controlled period of time. This provided a means of gauging length of time since death. However, as detailed by Lyman and Fox (1989), this index does not provide a useful scale for describing archaeological bone – for which the range and combination of taphonomic agents cannot be known. Micozzi's findings provoke some interesting, although unprovable, suggestions for these faunal materials.

It is possible that the suggested differences between the two groups of species within the assemblage may be related to season of death. The caribou bones that were more fibrous and delaminated may have begun decaying from the inside-out due to the activity of enteric micro-organisms feeding on internal bone soft tissues. This would mean that they had been killed prior to freeze-up, so that decomposition began upon death of the animal. Seal, walrus, and polar bear, on the other hand, may have a different pattern of decay attributable to their death during the cold season, so that the bone debris froze following death, and began the decay cycle following thaw – whereupon the decomposition proceeded from the outside-in following attack by soil organisms. This hypothesis fits in with the seasonal availability of the migratory taxon, as caribou depart for the interior in September, and therefore would have been killed before the colder period. Walrus and harp seal, on the other hand, appear later in the area – in the late fall or early winter, when freeze-up could have already begun.

This array of taphic processes at work on JfEl-10's faunal assemblage indicate that although density-mediated attrition plays a role in determining the final collection of buried remains, many other factors need to be considered – in fact, far more than can ever be measured for. The moderate correlation between density and MAU in the excavated zooarchaeological materials supports this suggestion that density is simply one of many factors determining the survivability of a bone: "Both the inorganic and the organic phases of bone can be changed by taphonomic processes, and estimation of the degree of preservation of these phases based upon external morphology has been proved to be unreliable" (Child 1995a: 19).

Anataxic processes

Following initial burial, bones may be re-exposed to taphonomic agents through a variety of anataxic processes, including erosion and animal (human and non-human) interference. However, it should be remembered that "anataxic processes may accelerate, redirect or even halt the physical and chemical changes initiated by taphic processes. The effects will not be the same as those of the perthotaxic processes" (O'Connor 2000: 20).

Of greater significance at JfEl-10 is disturbance through animal activity. Numerous abandoned lemming tunnels, in addition to the presence of lemmings bones, indicate that these burrowing animals have been inhabiting Illutaliluk for some time; possibly since soon after the site was abandoned. This has the effect of moving artifacts and bones around and relocating them in other parts of the soil matrix. Scavenging of archaeological bone by modern dogs is another form of faunalturbation that has been observed in Arctic contexts.

Souvenir-hunting by humans also has the effect of removing items from the deposit and exposing others to further perthotaxic agents. Park (1993) discussed the historically-documented practice of scavenging mementoes from old house ruins, and suggested that it may provide an explanation for the discovery of Dorset artifacts in Thule structures. An alternative explanation offered by Park (ibid.), one that is also supported by ethnohistorical information, was the excavation of sod from Dorset features in the construction of Thule homes. This appears to have been the case at JfEl-10. While not an anataxic factor as far as the Thule zooarchaeological assemblage is concerned, the practice served as an anataxic agent affecting the Dorset archaeological assemblage that had been disturbed.

Sullegic processes

Sullegic processes concern the selective recovery or non-recovery of bones at the excavation stage. Grayson noted that "[...] a faunal analyst is always working with samples. The only real direct control the analyst has over the nature of those samples lies in the means used to retrieve them from the ground" (Grayson 1989: 116). He is only partly right in this statement. Quite often, the faunal analyst is given an excavated sample in which he or she had absolutely no involvement in its excavation, and may not even have access to any information concerning that process other than the provenience data attached to the assemblage.

In the case of JfEl-10's materials, no control was available to the analyst concerning the portion of the assemblage excavated in 1974, and only partial control during the 2002 excavation. During the 1974 excavation, there was clearly a deliberate selection of some bones over others – although the criteria applied in this decision-making process is unknown. Some bones, of varying sizes, were collected, while others, also of varying sizes, remained at the site. In 2002, the anticipated screens that were to be employed during the excavation failed to materialize. This meant that some smaller bones almost certainly travelled from the archaeological matrix to the backdirt pile undetected. As a result, sullegic processes likely had an important impact upon the final recovered assemblage that was removed from Illutalialuk for analysis. Brain (1981) observed that in the Sterkfontein assemblages "the fossils had not been recovered with the regard for subtle detail that is prerequisite for reliable taphonomic reconstructions" (ibid.: 274), an observation that is just as applicable to JfEl-10's materials. Sullegic factors play an important role in determining the final size of a zooarchaeological assemblage – and size has a major impact upon the validity of subsequent subsistence inferences.

Trephic processes

Finally, trephic processes relate to information loss due to selective sorting, recording and publication of material. The 1974 assemblage was washed and labelled, but then remained unanalysed in storage until 2001, effectively rendering that information non-existent. Bones may also have been destroyed through the washing process, which can reduce the identifiability of fragile bones. One beluga caudal vertebra was discovered in the 1974 collection still wet and mouldy in the bag: a smaller, less dense bone may have been destroyed under these conditions. By analysing both the 1974 and 2002 collection, and recording the data in the form of this M.A. thesis, this information has been retained. The availability of comparative material may also be considered a trephic agent. If some bones that exhibit diagnostic markers remain unidentified due to lack of suitable comparative specimens, they are effectively removed from the recorded portion of the assemblage.

Summary

While density provides a useful means of quantitatively assessing the attrition of faunal materials through taphonomic processes, it is only a broad indicator and measures simply one of an array of decisive factors involved in the assemblage formation. The series of taphonomic processes outlined by Clark and Kietzke (1967) and Hesse and Wapnish (1984) provided an effective means for dissecting the range of potential agents of taphonomic disturbance that yielded the final faunal assemblage recovered from JfEl-10.

Hunting methods and site seasonality were the main biotic factors involved in enabling access to the selection of animals observed in JfEl-10's animal remains. The presence of walrus, harp seal, and beluga provide seasonal indicators, since these are migratory animals that appear in the Tuvaaluk area during late spring and late fall. Caribou is present along the coast from later spring through to fall, with departure for the interior beginning in September. The difficulties involved in breathing hole sealing through the thick ice of Diana Bay during the winter, suggest that the abundant numbers of small seal present in the assemblage are the result of hunting activities undertaken in the late fall/early winter or early spring.

Butchery methods are particularly relevant thanatic factors. Butchering of bone renders it more vulnerable to further taphonomic agents, by exposing more surface area.

As the exposed surface area of a bone increases, chemical and attritional agents are able to operate faster and more efficiently. Lyman extrapolated from this the observation that porous (less dense) bone is therefore more subject to the effects of attrition than more solid (denser) bone. In addition, it should be added that fractured bone, with its increased surface area, is also more susceptible to attritional impact. Therefore, more heavily-butchered elements have a greater surface area exposed, and, regardless of the initial size of the bone, may undergo a greater level of attrition. Lyman also made the important observation that: "bone material may not be physically or chemically destroyed, but it may be so altered as to be effectively destroyed in terms of identification or analysis" (Lyman 1984: 283). As a result, element size is not necessarily a useful indicator for estimating survivability, as larger taxon are more subject to butchering and therefore these elements are exposed to a slightly different chain of taphonomic disturbance.

Methods of garbage disposal serve as major perthotaxic agents. Three important modes have been discussed: burning food remains, feeding them to dogs, and depositing them in a designated area that eventually becomes classified as an archaeological midden. Burnt bone made up a significant portion of the assemblage (39.8%), with the majority excavated from House D's kitchen hearth area. Burning not only enhances the physical survivability of bone, through carbonization, but it also affects the analytical survivability of bone. Carbonization may preserve smaller fragments of bone, but these bones often are relegated to the identifiable portion of the assemblage. The bulk of the unidentified bones recovered from the site were burnt bones retrieved from the kitchen hearth.

The practice of feeding food debris to dogs results in significant bone destruction through carnivore gnawing, which also reduces the analytical survivability of bones. Although hard to identify from the flaking bone surfaces in the assemblage, carnivore activity is expected to have likely served as a major perthotaxic agent in JfEl-10's taphonomic history. External middens were difficult to locate at the site, which was characterized by a shallow occupation layer. House E yielded a midden towards the end of the field season; however this was not extensively investigated. The shallow (i.e, apparently brief) occupation is essentially a c-transform that exposed the cultural materials to a greater likelihood of disturbance through subsequent n-transforms. Another c-transform observed was the curation of bones for tool-use. Two caribou scapulae skin scrapers and one modified walrus baccula were removed as artifacts from the faunal assemblage. The presence of a number of seal claws and one bear claw are inferred to have been curated, since keratin usually has low-survivability in archaeological contexts.

Cryoturbation appears to have been the most significant taphic process operating at Illutaliluk. Observations made during the 1974 field season had suggested the JfEl-10 had been severely disturbed through freeze-thaw action. This may explain the paucity of organic tools that generally characterize Thule artifact assemblages, thereby giving a further indicator that the faunal assemblage has experienced substantial attrition since the formation deposit was initially laid down.

The fact that this attrition is not always density-mediated is apparent in the quality of teeth remains recovered from JfEl-10, which were generally cracked and flaking. Although teeth are much denser than bone, the higher mineral content of teeth may have contributed to the poor quality of preservation. Child's (1995a, 1995b) description of the transformation of hydroxyapatite into calcite during bone degradation may explain these observations.

Micozzi's (1986, 1991) experiments with the decay sequence of frozen vs. fresh carcasses found that previously-frozen skeletons disarticulate faster than unfrozen, resulting in more rapid exposure to other taphonomic agents. He also observed that putrefaction in previously-frozen corpses is initiated on the outside and gradually works it way inwards, while decay in unfrozen bodies begins on the inside and progresses outwards. This has important implications for the effects of caching and season of kill upon the progression of decay in skeletons. This may explain qualitative observations made upon JfEl-10's faunal materials, in which caribou (and to a minor extent, dog/wolf) exhibited a different pattern of decay than the other marine mammals in the assemblage. Caribou bones appeared more fibrous and flaky, while seal, walrus, and polar bear bones were more likely to crack and seemed crumbly. Although no known comparative literature exists concerning the qualitative aspects of a faunal assemblage, these observations are recorded in order to emphasize the value of qualitative data *in addition* to quantitative descriptions of zooarchaeological materials.

Re-exposure of bones to taphonomic agents occurs through anataxic processes. Most important of these to JfEl-10's faunal materials is human-scavenging. The mixed Dorset and Thule artifact assemblage suggests the use of sod removed from old Dorset ruins in the construction of the Thule houses. This also suggests that faunal materials removed from Dorset contexts have subsequently become mixed with those laid down by the Thule occupants of JfEl-10. This problem appears to further negate attempted reconstructions of Thule subsistence activities at Illutaliluk. However, Dorset houses are typically shallower than Thule semi-subterranean structures, and the deposits have a taphonomic history that stretches over a longer period of time. For these reasons, Dorset sites in Nunavik often yield very little faunal material, and it is possible that the sod removed from Dorset features did not contribute a substantial quantity of bone material to JfEl-10's zooarchaeological assemblage.

Faunalturbation has also had an anataxic impact upon JfEl-10, as is apparent through the numerous lemming burrows that were observed during the 2002 field season. Scavenging of bone by modern dogs may also have had an impact, however the location of Illutalialuk at the base of Diana Bay places if quite far from the modern community of Quaqtaq, and no evidence for recent disturbance was observed at the site.

Excavation methods had an important sullegic role in determining the final selection of zooarchaeological materials available for analysis. The absence of screens and relative inexperience of a number of the excavators means that an unknown number of small and possibly larger bones were not retrieved during the 2002 field season. In addition, apparently arbitrary collection techniques were applied during the 1974 analysis, resulting only partial collection of the excavated zooarchaeological materials. Finally, washing and labelling of the 1974 collection may have resulted in further information loss through the destruction of more delicate bones.

Chapter 7

CONCLUSION

David Clarke described archaeology as "the discipline with the theory and practice for the recovery of unobservable hominid behaviour patterns from indirect traces in bad samples" (1973: 17). In saying this, he recognized that by developing an ability to identify archaeological correlates of cultural and natural formation processes, the information latent in disturbed contexts may be extracted. In order to identify these c-transforms and n-transforms, a careful consideration of the taphonomic history of an assemblage needs to be developed between any other interpretations may be made.

Faunal analyses on materials recovered from Arctic contexts often make the assumption of an unadulterated zooarchaeological record, permitting a unique opportunity for confident reconstructions of subsistence behaviour. While this may be closer to the truth in High Arctic contexts, where organic materials often remain firmly encased in permafrost until excavation, the Arctic ecozone is not uniform. The southern end of the Arctic region, particularly south of the Arctic Circle, generally has a lower permafrost layer. As a result, archaeological assemblages often experience a more complex array of taphonomic processes. The faunal materials analysed for this thesis were excavated from a site at the southern end of the Canadian Arctic, located on Hudson Strait, Nunavik.

JfEl-10's zooarchaeological assemblage revealed evidence for significant taphonomic disturbance, as expressed in the form of poorly-preserved animal remains. Application of food utility indices to the identified bones in the assemblage found no significant correlation for any taxa between food utility and MAU. A faint negative correlation was apparent, however, in the patterns observed in the scatterplots. Bone density indices were therefore applied in order to assess the effects of density-mediated attrition upon the assemblage. This statistical analysis yielded moderate significant correlations between density and MAU for small seal, walrus, and bearded seal. Harp seal and caribou, however showed no significant correlation; however, a faint positive correlation was observed in the scatterplots.

The moderate correlation found between bone density and the identified animal bones indicated that while density-mediated attrition had altered the initially deposited assemblage, bone density alone did not provide a sufficient explanation for the observed element distributions. As Lyman pointed out "because bias is relative, not all assemblages of animal remains are biased in all ways" (Lyman 1994: 12). Other taphonomic agents, such as those related to the degree of butchering and the potential affects of freeze/thaw upon remains, also need to be taken into account. Density alone, therefore, does not explain differential preservation. But density in combination with an almost limitless suite of other agents of taphonomic disturbance, does. It is apparent that the myriad of taphonomic factors that may be active upon a zooarchaeological assemblage could be beyond the scope of the faunal analyst's abilities to test for all forms of taphonomic disturbance.

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APPENDIX I

Abbreviations used in graphs

Element distributions Chapter 5

mand – mandible
cerv – cervical
thor – thoracic
lumb – lumbar
bacc – baccula
sacr – sacrum
caud – caudal
ster – sternum
scap – scapula
hum – humerus
rad – radius
carp – carpal
mcarp – metacarpal
FF – front flipper
innom – innominate
fem – femur
tibfib – tibiofibula
calc – calcaneus
astr – astragalus
otrtar – other tarsals
mtars – metatarsal
HF – hind flipper

Food utility indices Chapter 5

head – skull and mandibles
radul – radius and ulna
fflip – front flipper
pelv – pelvis (innominates and sacrum)
hflip – hind flipper

Bone density indices Chapter 6

p – proximal
m – intermediate
d – distal

man – mandible
ax – axis
atl – atlas
tho – thoracic
lum – lumbar
sac – sacrum
sca – scapula
hum – humerus
rad – radius
uln – ulna
illi – illium
isch – ischium
acet – acetabulum
fem – femur
tib – tibia
fib – fibula
calc – calcaneus
astr – astragalus

(caribou only)
mcar – metacarpal
nvcb – naviculo-cuboid
mtar – metatarsal
p1 – 1st phalanx
p2 – 2nd phalanx
p3 – 3rd phalanx

APPENDIX II

FAUNAL DATA

Small Seal (axial and front appendicular)

Element	Scan Site (Lyman 1994)	Minimum # of elements	Elements per complete skeleton	Minimum Animal Units (MAU)	% MAU	Bone Density (Lyman 1994)
Head	N/A	13	1	13.0	76.5	N/A
Mandible					32.4	
prox	DN6	5	2	2.5		0.89
dist	DN2	11	2	5.5		0.84
Atlas	AT1	7	1	7.0	41.2	0.54
Axis	AX1	6	1	6.0	35.3	0.56
Cervical 3-7	N/A	13	4	3.3	19.4	N/A
Thoracic	TH1	11	13	0.8	4.7	0.34
Lumbar	LU1	8	6	1.3	7.6	0.38
Baccula	N/A	1	1	1.0	5.9	N/A
Sacrum	SC1	9	1	9.0	52.9	0.43
Caudal	N/A	11	11	1.0	5.9	N/A
Rib						
prox	RI1	1	26	0.0		0.40
inter	RI4	20	26	0.8	4.7	0.63
dist	RI5	1	26	0.0		0.29
Sternabra	N/A	2	8	0.3	1.8	N/A
Scapula						
prox	SP3	14	2	7.0	41.2	0.61
dist	SP5	3	2	1.5		0.41
Humerus						
prox	HU1	12	2	6.0		0.43
inter	HU3	29	2	14.5	85.3	0.57
dist	HU5	18	2	9.0		0.60
Radius						
prox	RA2	17	2	8.5	50.0	0.69
dist	RA5	4	2	2.0		0.45
Ulna						
prox	UL2	26	2	14.0	82.4	0.66
dist	UL3	2	2	1.0		0.35
Carpal	N/A	1	14	0.1	0.6	N/A
Metacarpal	N/A	3	10	0.3	1.8	N/A
FF phalange	N/A	6	28	0.2	1.2	N/A

Small Seal cont'd (rear appendicular)

Element	Scan Site (Lyman 1994)	Minimum # of elements	Elements per complete skeleton	Minimum Animal Units (MAU)	% MAU	Bone Density (Lyman 1994)
Innominate						
acetabulum	AC1	20	2	10.0	58.8	0.47
illium	IL2	18	2	9.0		0.63
ischium	IS3	1	2	0.5		0.55
Femur						
prox	FE2	19	2	9.5		0.53
inter	FE4	31	2	15.5		0.69
dist	FE6	34	2	17.0	100.0	0.57
Tibia						
prox	TI1	11	2	5.5		0.39
inter	TI3	34	2	17	100.0	0.86
dist	TI5	4	2	2.0		0.48
Fibula						
prox	FI1	3	2	1.5		0.39
inter	FI3	16	2	8.0		0.90
dist	FI5	4	2	2.0		0.76
Calcaneus	CA2	3	2	1.5	8.8	0.45
Astragalus	AS3	10	2	5.0	29.4	0.56
Other Tarsal	N/A	8	10	0.8	4.7	N/A
Metatarsal	N/A	23	10	2.3	13.5	N/A
HF Phalange	N/A	23	28	0.8	4.7	N/A

Harp Seal (axial and front appendicular)

Element		Scan Site (Lyman 1995)	Minimum # of elements	Elements per complete skeleton	Minimum Animal Units (MAU)	% MAU	Bone Density (Lyman 1995)
Skull		N/A	1	1	1.0	16.7	N/A
Mandible							
	prox	DN6	0	2	0		0.89
	dist	DN2	0	2	0		0.84
Atlas		AT3	0	1	0		0.54
Axis		AX1	1	1	1.0	16.7	0.56
Cervical 3-7		N/A	5	4	1.3	21.7	N/A
Thoracic		TH1	5	13	0.4	16.7	0.34
Lumbar		LU1	13	6	2.2	36.7	0.38
Baccula		N/A	0	1	0	0	N/A
Sacrum		SC1	1	1	1.0	16.7	0.43
Rib							
	prox	RI1	2	26	0.1	1.7	0.40
	inter	RI4	1	26	0.0		0.63
	dist	RI5	0	26	0.0		0.29
Sternabra		N/A	0	8	0		N/A
Scapula							
	prox	SP3	3	2	1.0	16.7	0.61
	dist	SP5	0	2	0		0.41
Humerus							
	prox	HU1	8	2	4.0	66.7	0.43
	inter	HU3	7	2	3.5		0.57
	dist	HU5	6	2	3.0		0.60
Radius							
	prox	RA2	4	2	2.0	41.7	0.69
	dist	RA5	2	2	1.0		0.45
Ulna							
	prox	UL2	1	2	0.5	8.3	0.66
	dist	UL5	0	2	0		0.35
Carpal		N/A	0	14	0		N/A
Metacarpal		N/A	0	10	0		N/A
FF Phalange		N/A	2	28	0.1		N/A

Harp Seal (rear appendicular)

Element	Scan Site (Lyman 1995)	Minimum # of elements	Elements per complete skeleton	Minimum Animal Units (MAU)	% MAU	Bone Density (Lyman 1995)
Innominate						
acetabulum	AC1	8	2	4.0	66.7	0.47
illium	IL2	7	2	3.5		0.60
ischium	IS3	1	2	0.5		0.55
Femur						
prox	FE2	1	2	0.5		0.53
inter	FE4	2	2	1.0	41.7	0.69
dist	FE6	5	2	2.5		0.57
Tibia						
prox	TI1	10	2	5.0		0.39
	TI2	12	2	6.0	100	
inter	TI3	10	2	5.0		0.86
dist	TI5	3	2	1.5		0.48
Fibula						
prox	FI1	6	2	3.0		0.39
inter	FI3	5	2	2.5		0.90
dist	FI5	4	2	2.0		0.76
Calcaneus	CA2	0	2	0		0.45
Astragalus	AS3	0	2	0		0.56
Tarsal	N/A	0	10	0		N/A
Metatarsal	N/A	3	10	0.3	5	N/A
HF Phalange	N/A	1	28	0		N/A

Bearded Seal (axial and front appendicular)

Element	Scan Site (Lyman 1995)	Minimum # of elements	Elements per complete skeleton	Minimum Animal Units (MAU	% MAU	Bone Density (Lyman 1995)
Skull	N/A	3	1	3.0	100	N/A
Mandible						
prox	DN6	5	2	2.5	83.3	0.89
dist	DN2	2	2	1.0		0.84
Atlas	AT1	1	1	1.0	33.3	0.54
Axis	AX1	2	1	2.0	66.7	0.56
Cervical 3-7	N/A	3	4	0.8	25	N/A
Thoracic	TH1	4	13	0.3	10	0.34
Lumbar	LU1	0	6	0	0	0.38
Baccula	N/A	0	1	0	0	N/A
Sacrum	SC1	1	1	1.0	33.3	0.43
Caudal	N/A	0	11	0	0	N/A
Rib						
prox	RI1	1	26	0		0.40
inter	RI4	3	26	0.1	3.3	0.63
dist	RI5	0	26	0		0.29
Sternabra		0	8	0	0	N/A
Scapula						
prox	SP3	1	2	0.5	16.7	0.61
dist	SP5	0	2	0		0.41
Humerus						
prox	HU1	4	2	2.0		0.43
inter	HU3	5	2	2.5	83.3	0.57
dist	HU5	3	2	1.5		0.60
Radius						
prox	RA2	1	2	0.5		0.69
dist	RA5	1	2	0.5	16.7	0.45
Ulna						
prox	UL2	4	2	2.0	66.7	0.66
dist	UL3	1	2	0.5		0.35
Carpal	N/A	0	14	0	0	N/A
Metacarpal	N/A	0	10	0	0	N/A
FF Phalange	N/A	0	28	0	0	N/A

Bearded Seal (rear appendicular)

Element	Scan Site (Lyman 1995)	Minimum # of elements	Elements per complete skeleton	Minimum Animal Units (MAU)	% MAU	Bone Density (Lyman 1995)
Innominate						
acetabulum	AC1	0	2	0		0.47
illium	IL2	0	2	0	0	0.63
ischium	IS3	0	2	0		0.55
Femur						
prox	FE2	1	2	0.5		0.53
inter	FE4	1	2	0.5	16.7	0.69
dist	FE6	1	2	0.5		0.57
Tibia						
prox	TI1	2	2	1.0		0.39
inter	TI3	3	2	1.5	50	0.86
dist	TI5	2	2	1.0		0.48
Fibula						
prox	FI1	1	2	0.5		0.39
inter	FI3	1	2	0.5		0.90
dist	FI5	1	2	0.5		0.76
Calcaneus	CA2	0	2	0	0	0.45
Astragalus	AS3	0	2	0	0	0.56
Tarsal	N/A	0	10	0	0	N/A
Metatarsal	N/A	1	10	0.1	3.3	N/A
HF Phalange	N/A	1	28	0	0	N/A

Walrus (axial and front appendicular)

Element	Scan Site (Lyman 1995)	Minimum # of elements	Elements per complete skeleton	Minimum Animal Units (MAU)	% MAU	Bone Density (Lyman 1995)
Skull	N/A	2	1	2.0	50	N/A
Mandible						
prox	DN6	8	2	4.0	100	0.89
dist	DN2	8	2	4.0		0.84
Atlas	AT1	0	1	0	0	0.54
Axis	AX1	1	1	1.0	25	0.56
Cervical 3-7	N/A	1	4	0.0	0	N/A
Thoracic	TH1	1	13	0.1	2.5	0.34
Lumbar	LU1	0	6	0	0	0.38
Baccula	N/A	4	1	4.0	100	N/A
Sacrum	SC1	0	1	0	0	0.43
Caudal	N/A	0	11	0	0	N/A
Rib						
prox	RI1	0	26	0		0.40
inter	RI4	2	26	0.1	2.5	0.63
dist	RI5	0	26	0		0.29
Sternabra	N/A	0	8	0		N/A
Scapula						
prox	SP3	1	2	0.5		0.61
dist	SP5	2	2	1.0	25	0.41
Humerus						
prox	HU1	0	2	0		0.43
inter	HU3	2	2	1.0	25	0.57
dist	HU5	0	2	0		0.60
Radius						
prox	RA2	0	2	0		0.69
dist	RA5	1	2	0.5		0.45
Ulna						
prox	UL2	2	2	1.0	25	0.66
dist	UL3	0	2	0		0.35
Carpal	N/A	0	14	0	0	N/A
Metacarpal	N/A	0	10	0	0	N/A
FF Phalange	N/A	0	28	0	0	N/A

Walrus cont'd (rear appendicular)

Element	Scan Site (Lyman 1995)	Minimum # of elements	Elements per complete skeleton	Minimum Animal Units (MAU)	% MAU	Bone Density (Lyman 1995)
Innominate						
acetabulum	AC1	1	2	0.5		0.47
illium	IL2	1	2	0.5	12.5	0.63
ischium	IS3	1	2	0.5		0.55
Femur						
prox	FE2	0	2	0		0.53
inter	FE4	0	2	0		0.69
dist	FE6	0	2	0	0	0.57
Tibia						
prox	TI1	2	2	1.0		0.39
inter	TI3	6	2	3.0	75	0.86
dist	TI5	1	2	0.5		0.48
Fibula						
prox	FI1	0	2	0		0.39
inter	FI3	2	2	1.0	25	0.90
dist	FI5	0	2	0		0.76
Calcaneus	CA2	0	2	0	0	0.45
Astragalus	AS3	1	2	0.5	12.5	0.56
Tarsal	N/A	0	10	0	0	N/A
Metatarsal	N/A	7	10	0.7	17.5	N/A
HF Phalange	N/A	1	28	0	0	N/A

Caribou (axial and front appendicular)

Element	Scan site (Lyman 1994)	Minimum # of elements	Elements per complete skeleton	Minimum animal units (MAU)	% MAU	Bone Density (Lyman 1994)
Skull	N/A	3	1	3.0	35.3	N/A
Mandibles						
prox	DN7	1	2	0.5		0.36
inter	DN4	17	2	8.5	100	0.57
dist	DN1	0	2	0		0.55
Atlas	AT3	0	1	0	0	0.26
Axis	AX1	0	1	0	0	0.16
Cervicals 3-7	N/A	3	5	0.6	7.1	N/A
Thoracic	TH2	9	13	0.7	8.2	0.27
Rib						
prox	RI2	0	26	0		0.25
inter	RI3	5	26	0.2	2.4	0.40
dist	RI5	0	26	0		0.14
Lumbar	LU2	5	6	0.8	9.4	0.30
Sacrum						
prox	SC1	5	1	5.0	58.8	0.19
Caudal	N/A	0		0		N/A
Sternabra	N/A	0		0		N/A
Scapula						
prox	SP2	5	2	2.5	29.4	0.49
dist	SP5	0	2	0		0.28
Humerus						
prox	HU1	2	2	1.0		0.24
inter	HU3	2	2	1.0		0.53
dist	HU5	13	2	6.5	76.5	0.39
Radius						
prox	RA2	6	2	3.0		0.62
inter	RA3	1	2	0.5		0.68
dist	RA5	8	2	4	47.1	0.43
Ulna						
prox	UL2	5	2	2.5	29.4	0.45
dist	UL3	4	2	2.0		0.44
Carpal		2	6	0.3	0	N/A
Metacarpal						
prox	MC2	8	2	4.0	47.1	0.69
inter	MC3	1	2	0.5		0.72
dist	MC5	1	2	0.5		0.49

Caribou cont'd (rear appendicular)

Element	Scan site (Lyman 1994)	Minimum # of elements	Elements Per complete skeleton	Minimum Animal Units (MAU)	% MAU	Bone Density (Lyman 1994)
Innominate						
acetabulum	AC1	12	2	6.0		0.27
illium	IL2	15	2	8.5	100	0.49
ischium	IS1	8	2	4.0		0.41
pubis	PU2	3	2	1.5		0.24
Femur						
prox	FE2	3	2	1.5		0.36
inter	FE4	6	2	3.0	35.3	0.57
dist	FE5	5	2	2.5		0.37
Tibia						
prox	TI2	1	2	0.5		0.32
inter	TI3	1	2	0.5	5.9	0.74
dist	TI4	1	2	0.5		0.51
Metatarsal						
prox	MR2	1	2	0.5		0.65
inter	MR3	3	2	1.5	17.7	0.74
dist	MR5	1	2	0.5		0.46
Calcaneus	CA2	2	2	1.0	11.7	0.64
Astragalus	AS3	1	2	0.5	5.9	0.61
Naviculo-cuboid	NC3	1	2	0.5	5.9	0.62
Other Tarsal	N/A	2	4	0.5	5.9	N/A
Phal 1	P13	6	8	0.8	9.4	0.57
Phal 2	P23	3	8	0.4	4.7	0.35
Phal 3	P31	1	8	0.1	1.2	0.25

Small seal

Element	MNE	MNI
Skull	13 (left bulla)	13
Mandible	6 right, 5 left	6
Atlas	7	7
Axis	6	6
C3-7	13	3
Thoracic	11	1
Lumbar	8	2
Sacrum	9 (SA1)	9
Caudal	11	1
Rib	20	1
Bacculum	1	1
Sternabra	2	1
Scapula	3 right, 6 left	6
Humerus	21 right, 18 left	21
Radius	14 right, 8 left	14
Ulna	10 right, 10 left	10
Carpals	1	1
Metacarpals	3	1
FF phalanges	6	1
Innominate	10 right, 8 left	10
Femur	20 right, 19 left	20
Tibiofibula	21 right, 17 left	21
Calcaneus	3	2
Astragalus	10	5
Other tarsals	8	1
Metatarsals	23	3
HF phalanges	23	1

Harp seal

Element	MNE	MNI
Skull	1 (left bulla)	1
Axis	1	1
C3-7	5	2
Thoracic	5	1
Lumbar	13	3
Sacrum	1 (SA1)	1
Rib	2	1
Scapula	2 right, 1 left	2
Humerus	4 right, 4 left	4
Radius	3 right, 2 left	3
Ulna	1 left	1
FF phalanges	2	1
Innominate	5 right, 3 left	5
Femur	2 right, 2 left	2
Tibiofibula	8 right, 3 left	8
Metatarsals (IV)	1 right, 1 left	1

Bearded seal

Element	MNE	MNI
Skull	3 (left bulla)	3
Mandible	2 right, 3 left	3
Atlas	1	1
Axis	2	2
C3-7	3	1
Thoracic	4	1
Sacrum	1 (SA1)	1
Rib	3	1
Scapula	1 left	1
Humerus	4 right, 3 left	4
Radius	1 right	1
Ulna	2 right, 2 left	2
Femur	1 right, 1 left	1
Tibiofibula	1 right, 1 left	1
Metatarsals	1	1
HF phalanges	1	1

Walrus

Element	MNE	MNI
Skull	1	1
Mandible	6 right, 4 left	6
Axis	1	1
C3-7	1	1
Thoracic	1	1
Rib	2	1
Bacculum	4	4
Scapula	1 right, 1 left	1
Humerus	2 left	2
Radius	1 left	1
Ulna	2 right	2
Innominate	1 right	1
Tibia	2 right, 5 left	5
Fibula	2 right	2
Astragalus	1	1
Metatarsals (I)	3 right	3
HF Phalanges	1	1

Caribou

Element	MNI	MNI
Skull	3 (right M1)	3
Mandible	11 right, 6 left (M1)	11
C3-7	3	1
Thoracic	9	1
Rib	4 right, 4 left	4
Lumbar	5	1
Sacrum	5 (SA1)	5
Scapula	1 right, 4 left	4
Humerus	4 right, 11 left	11
Radiuoulna	6 right, 1 left	6
Metacarpal	4 right, 1 left	4
Innominate	6 right, 9 left	9
Femur	5 right, 1 left	5
Tibia	1 right	1
Metatarsal	1 right, 2 left	2
Calcaneus	2 right	2
Astragalus	1	1
Naviculocuboid	1	1
Other tarsals	2	1
1st phalanx	6	1
2nd phalanx	3	1
3rd phalanx	1	1