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Lesley Howse

Abstract. This paper presents a detailed study of animal bones from a Late Dorset house structure and midden at the Bell site, Victoria Island. Previous research has shown seal to be the staple resource of Late Dorset subsistence in most other regions. Bones of terrestrial mammals such as caribou are rarely found in Late Dorset sites, leading researchers to suggest that Late Dorset people may not have been actively hunting caribou or that caribou population numbers were low during the Late Dorset period across much of the eastern Arctic. In contrast to other sites, faunal remains from the Bell site indicate that Late Dorset people living there were primarily dependent on caribou and Arctic char, and relied only minimally on seal. Thus, the Bell site presents a rare opportunity to understand terrestrial aspects of the Late Dorset economy.

Introduction

Dorset people occupied the Arctic for 1,800 years, subsisting on a variety of seasonally available marine and terrestrial resources. The focus of their economic activities varied from region to region, depending on local resource availability. However, our understanding of the Dorset economy is biased towards marine mammal exploitation, since most of the previous research has focused on coastal occupations (Bendix 1998, 2000; Hodgetts 2005; Hodgetts et al. 2003; McCartney and Helmer 1989; Maxwell 1985, Meldgaard 2004; Murray 1996; Nagy 1997; Renouf 2000). As a result, little is known about the Late Dorset peoples' exploitation of terrestrial resources such as caribou, yet caribou are common in many regions throughout the Arctic, and were a prominent source of food and raw materials for many recent Inuit groups (Binford

1978; Birket-Smith 1929; Burch 1972; Spiess 1979; Spencer 1959). Furthermore, the high frequency of Dorset artifacts made from antler suggests that caribou were an important resource at least for raw materials (Maxwell 1985).

Recently, LeMoine (2005) discussed the low frequency of caribou in Late Dorset faunal assemblages and the high frequency of artifacts made from antler on sites located on Little Cornwallis Island. She suggests that at these sites Dorset were probably collecting shed antler and not killing the animals, and that it is possible that Dorset may not have used caribou skins to make their clothing (LeMoine 2005), while also considering the possibility that caribou hunting sites exist in the area, but have not yet been found by archaeologists. Darwent (2001, 2002) on the other hand suggests the low frequency of caribou bone in Late Dorset faunal assemblages from the High Arctic may be linked to a decline in caribou popula-

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Figure 1. Map of the Arctic highlighting the sites discussed in the texts. 1) Hatherton Bay sites; 2) Lea Point Site; 3) Bache Peninsula sites; 4) Little Cornwallis Island sites; 5) Kalivik Island sites; 6) Nunguvik 71; 7) Foxe Basin sites; 8) Bell Site.

tions caused by over hunting and unfavorable climate conditions.

In contrast to Early and Middle Dorset, during the Late Dorset period there was a decrease in mobility, an increase in storage pits, and the appearance of substantial architecture (Darwent 2001). Late Dorset sites are found throughout the eastern Canadian Arctic, and northwest Greenland, and date between approximately 500 and 1300 A.D. (Friesen 2007; Fig. 1). The Late Dorset economy remained unspecialized. A comprehensive study by Darwent (2001) has shown that in comparison to Early/Middle Dorset, Late Dorset people maintained a more varied economy with an increase in diet breadth. Darwent (2001) analyzed Late Dorset faunal material recov-

ered from sites located throughout the High Arctic and Greenland and her study revealed a predominance of small terrestrial mammals, low frequencies of artiodactyls, and a decline in seal in comparison to earlier periods (Darwent 2001). However, while the proportion of seal declined in the Late Dorset samples in comparison to those of Early/Middle Dorset origin, seal remained the most abundant mammal.

Murray's (1996) study of Palaeoeskimo economy in the Foxe Basin indicates seal was the focus of economic activity during the Late Dorset period in that region. Damkjar's (2005) study of Late Dorset fauna from Creswell Bay also shows seal to be a staple resource. More significant numbers of terrestrial resources were found at Late Dorset sites

located in northern Greenland (Bendix 1998, 2000) and from northern Baffin Island (Mary-Rousseliere 1976). Bendix (2000) investigated the faunal remains from four sites located in Hatherton Bay, in the Thule district, Greenland. His analysis showed that Arctic fox was the most frequently occurring species, followed by walrus, seal, muskox, and birds. Mary-Rousseliere's (1976) analysis of faunal material from Nunguvik showed the most abundant resource was caribou, however, high frequencies of seal and bird were also identified.

As a result of these zooarchaeological analyses, a clear picture of Dorset subsistence across much of the Arctic is beginning to emerge. However, the nature of the Late Dorset economy in regions that contain an abundance of terrestrial resources, and in particular caribou, remains poorly understood. This paper presents an analysis of faunal remains from the Bell Site, Victoria Island, Nunavut. Today, this site is located in a region where marine mammals are infrequent but terrestrial resources such as caribou, and riverine resources such as Arctic char, are plentiful during late summer and fall (Friesen 2002).

The Bell Site and House 6

The Bell site (NiNg-2) is located on the south side of the Ekalluk River, on Victoria Island, Nunavut (Fig. 1). It is a large site containing components relating to Early, Middle, and Late Dorset Palaeoeskimo; Thule Inuit; and recent Inuit occupations (Friesen 2002, 2003, 2004b; Taylor 1964, 1967). The site was first excavated by William E. Taylor, Jr. in the 1960s. He returned in 1988 to excavate several additional Late Dorset and Thule house features (Taylor 1964, 1967, 1988). More recently, the Bell site has been further investigated as part of the on-going Iqaluktuuq Project, which began in 2000; the goal of which is to reconstruct the cultural history of this Arctic region (Friesen 2002, 2003, 2004a, 2004b; Ryan 2003a). The site contains a minimum of 11 Dorset house structures, six Thule houses, and a large number of tent rings, caches, and unidentified features (Friesen 2002; Ryan 2003a). The focus of this analysis, House 6, is a Late Dorset semi-subterranean house (Fig. 2). Faunal material from within the structure was collected during the 2002 field season and during the 2004 field season the associated midden was sampled (Friesen 2004b; Ryan 2003a).

The excavation of House 6 (Fig. 2) was performed with extreme care, and was supervised by Karen Ryan (2003a, 2003b) with a goal of achieving a high resolution understanding of Late Dorset architecture. Thirty-three square meters were excavated, revealing the house to be sub-rectangular in shape, measuring 5.75 by 4.5 meters (Ryan 2003a). House construction took advantage of a natural de-

pression, with the northern portion of the structure positioned against the slope of a natural embankment (Ryan 2003a). The walls of the house were not well defined, with the exception of those in the northwest corner. An activity area was identified in the northwest corner where several vertical stones, sod deposits, flagstones, flat paving stones, and a relatively thick cultural deposit were found. The deposit from this area was "greasy and pungent," and Ryan suggested that it was associated with cooking activities (Ryan 2003a:104). In the southwest corner, several post holes were identified as well as several flat and rounded stones which did not appear to be in a patterned arrangement.

The central house floor was compact and included a few flat stones lacking any obvious pattern; it yielded only a small number of artifacts and flakes (Ryan 2003a). The southern perimeter of the structure included various flat and rounded stones. The eastern perimeter of the structure was found to extend from the main room, with a natural deposit of stones forming the northern wall of what appears to have been an entrance. An entrance has been inferred based on the absence of a stone border and a relatively deep depression, which is 10 cm below the main living deposit (Ryan 2003a). A midden was located 7 m from the entrance of the structure (Fig. 2), and is plausibly related to the house occupation.

Acquiring a Representative Faunal Sample

The integrity of a faunal sample is related to recovery and sampling methods and the taphonomic processes that affected the bone material (O'Connor 1996). Understanding these factors will help determine how representative faunal samples are of past human activities.

In the Arctic it is standard practice to sample faunal material from either within a house structure (see McCartney and Helmer 1989; Murray 1996; Ramsden and Murray 1995), or a midden area (see Gotfredsen 1996; Gronnow et al. 1983; Hodgetts 2005; Hodgetts et al. 2003). However, Friesen and Betts (2004) recently identified the potential drawbacks to this practice. Their study showed strikingly different faunal assemblages from different contexts within a Thule house and midden, leading them to suggest that faunal assemblages from one part of a feature should not automatically be considered as representative of an entire occupation.

Ultimately, understanding the taphonomic processes at a site will help isolate patterns that reflect primary human activities such as butchering, burning, consumption, and refuse disposal, and help provide inferences regarding social or-

Figure 2. Plan of House 6, highlighting the four different areas discussed in the text (adapted from Ryan 2003a:97).

ganization, food distribution, differences in location of consumption, and the use of space (Friesen and Betts 2004). However, as a result of post-depositional disturbance, information derived from faunal assemblages is often at best only indirectly related to primary human activities (Friesen and Betts 2004). More specifically, Friesen and Betts (2004) showed that taxonomic and skeletal element frequencies were largely related to taphonomic processes such as carnivore activity and weathering, and that these processes affected different areas within the house and midden to varying degrees.

In this study, to ensure the faunal material is representative of the site's economy, I will discuss the recovery methods used, the differences between faunal samples from the house structure and midden, modification frequencies, and the relationship between bone density and survivorship in the sample.

Study Assemblages

The house floor and the associated exterior midden were excavated by trowel and all material was screened through 3 mm (1/8") mesh (Friesen 2004b; Ryan 2003a). The house interior was divided into four arbitrary contexts for the present faunal analysis: the northwest corner, southwest corner, central floor, and entrance; with each context containing four 1 m² units (Fig. 2). Two square units were chosen from each of the four different contexts based on a table of random numbers. Selection of units from these four contexts ensured that faunal variability that may have resulted from functional differences within the house could be accounted for.

Six stratigraphic levels were defined in the structure. Level 4 was the Late Dorset occupational level (Ryan 2003a) and yielded the bones used in this analysis. Level 4 was a dark brown/black,

greasy deposit and contained small pebbles. The deposit varied in depth, reaching a maximum of 15 cm in the northwest corner, and was less than 5 cm deep toward the eastern wall (Ryan 2003a). Although no material from the 2002 field season has been radiocarbon dated, several Late Dorset artifacts were found in this level (Ryan 2003a). In addition, a radiocarbon date of 1035 ± 125 B.P. (radiocarbon sample number S-3038; CARD), based on caribou bone, was obtained when the house was partially excavated by Taylor.

The midden feature, excavated in 2004, provided the second faunal sample used in this analysis (Friesen 2004b). Due to its proximity to House 6 and its location directly in front of the entrance, it is likely that this midden is associated, at least in part, with the House 6 occupation. A 1 m² sample was collected from the midden and ten arbitrary levels were removed, however, no significant change in matrix was found throughout the deposit (Friesen 2004b). The majority of artifacts from the midden were Late Dorset in origin; Levels 5 and 6 from the test pit were analyzed in their entirety for this research.

Analysis

The faunal assemblages from the house interior and midden contain similar quantities of bone and exhibit similar levels of preservation. The total faunal sample from the analyzed portion of the interior of House 6 contained 3,050 individual specimens, 2,253 (74%) of which were identified to at least order. The midden sample yielded 4,416 bone specimens, 3,323 (75%), of which were identified to at least order. Table 1 presents the taxonomic frequencies distributed throughout the four different contexts from the house interior and the midden. The number of individual specimens (NISP) was used to compare taxonomic frequencies in the study assemblages. The minimum number of individuals (MNI), a derived unit, was also determined for each taxon (Ringrose 1993).

The midden produced the largest number of individual specimens, and within the house the northwest corner contained a higher NISP than the other interior contexts (Table 1). The areas that were likely most intensely used, the entrance and central floor, exhibit lower NISP's. In general, class frequencies are quite similar throughout the different contexts (Fig. 3). However, when the samples from the interior of the house are combined and compared to the midden sample, more pronounced differences between the animal bones found in the house and midden become apparent.

Figure 3 presents the class frequencies for samples from within the house structure and the midden. While mammal is the most frequent class occurring within the house, comprising 59.5% of identified bone, it comprised a slightly lower per-

centage of identified bone in the midden at 46.9% of the identified bone within the midden; fish is most abundant, comprising 49.3% of identified bone (Table 1; Fig. 3). Bird bones are also more frequent within the house, comprising 8.3% of the identified bone yet only comprising 3.8% of the identified bone from the midden. The differences between the distributions of mammal, bird, and fish remains from the house interior and the midden are statistically significant ($X^2 = 182$, $p < 0.001$). This suggests that the distribution did not occur randomly and different activities or taphonomic processes affected the resulting faunal distribution within House 6 and the external midden. Several differences are also apparent when the distribution of mammal species from the house is compared to the distribution of mammal species from the midden, where there is a larger abundance of ringed seal, and a lower abundance of caribou.

Of the differences in class frequencies found between the house and midden a key pattern is the different distribution of fish. The lower proportion of fish bones in the house and higher proportion of fish bones in the midden (Fig. 3) may be the result of several factors. First, the pattern may reflect the fragile structure of fish bone which makes it more susceptible to destructive taphonomic factors in comparison to the more resilient mammal bone. In particular, the interior of the house was likely subject to a higher degree of trampling than the midden. The house was also less deeply buried than the midden; this would have compounded taphonomic factors and possibly contributed to a lower number of fish identified in the structure.

Second, the differing distribution of fish remains between the house and midden might suggest that the midden feature was used by subsequent or other inhabitants of the Bell site, as there are other unexcavated Dorset houses located nearby. Therefore, it is possible that different households contributed to the midden fauna, resulting in a higher frequency of fish than what was recovered from the interior of House 6.

Third, seasonality may have also influenced the different distribution of fish remains between the house and the midden. If the house and midden were utilized during the same season, the higher frequency of fish in the midden might suggest deposition of the fish bone occurred during a warm season. During a warm season it is likely that the majority of food preparation and perhaps consumption of this resource took place outside the house, with the relatively lower proportion of fish from the house interior indicating that fish were less frequently brought into the house.

The fact that a higher proportion of bird bones were recovered from the interior of House 6

Table 1. Taxonomic frequencies from Bell site, House 6 faunal assemblages.

	Northwest corner		Central floor		Southwest corner		Entrance		House 6 total		Midden	
	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	MNI	%
Mammal												
Lemming*	2	0.7%	8	9.0%	16	9.7%	1	0.9%	27	4.2%	4	0.8%
Arctic fox	35	12.8%	28	31.8%	27	16.5%	13	11.9%	103	16.2%	3	25.2%
Arctic hare	0	0.0%	0	0%	0	0.0%	0	0.0%	0	0.0%	0	2.7%
Bearded seal	1	0.4%	0	0%	3	1.8%	0	0.0%	4	60.0%	1	1.2%
Ringed seal	4	1.5%	3	3.4%	6	3.7%	3	2.7%	16	2.5%	1	7.8%
Wolverine	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	10.0%
Caribou	231	84.6%	57	64.8%	128	78.0%	93	85.3%	509	80.3%	10	64.4%
Muskox	2	0.7%	0	0.0%	0	0.0%	0	0.0%	2	30.0%	1	90.0%
Unidentified Large Mammal**	68		18		35		52		173			
Unidentified mammal	218		102		121		93		534			
Total Mammal	559	64.3%	208	52.9%	320	54.7%	254	63.9%	1341	59.5%	1559	46.9%
Birds												
Lapland longspur	0		0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	1.5%
Snowbunting	0		0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	1.5%
Canada goose	7	17.9%	0	0.0%	0	0.0%	0	0.0%	7	9.2%	2	7.5%
Goose***	7	17.9%	2	18.2%	1	6.3%	3	30.0%	13	17.1%	1	44.8%
Cf. Goose	0		0	0.0%	2	12.5%	3	30.0%	5	6.6%	1	3.0%

(continued)

Table 1. (*continued*)

	Northwest corner		Central floor		Southwest corner		Entrance		House 6 total		Midden	
	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	MNI	%
Tundra swan	0		0	0.0%	1	6.3%	1	10.0%	2	2.6%	1	3.0%
Common Eider	2	5.1%	1	9.0%	2	12.5%	0	0.0%	5	6.6%	3	6.0%
King Eider	8	20.5%	0	0.0%	3	18.8%	1	10.0%	12	15.8%	3	7.5%
Eider***	4	10.3%	0	0.0%	0	0.0%	0	0.0%	4	5.3%	1	0.0%
Pintail	2	5.1%	0	0.0%	0	0.0%	0	0.0%	2	2.6%	1	1.5%
Oldsquaw	2	5.1%	0	0.0%	0	0.0%	0	0.0%	2	2.6%	1	1.5%
Cf. Oldsquaw	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	3.0%
Duck***	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	1.5%
Cf. Duck	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	1.5%
Glaucous gull	2	5.1%	0	0.0%	2	12.5%	0	0.0%	4	5.3%	1	4.5%
Iceland gull	1	2.6%	1	9.0%	0	0.0%	0	0.0%	2	2.6%	1	4.5%
Small size gull	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	1.5%
Medium size gull	0	0.0%	0	0.0%	0	0.0%	1	10.0%	1	1.3%	1	0.0%
Gull***	0	0.0%	1	9.0%	0	0.0%	1	10.0%	2	2.6%	1	4.5%
Jaeger	1	2.6%	0	0.0%	0	0.0%	0	0.0%	1	1.3%	1	0.0%

	Northwest corner		Central floor		Southwest corner		Entrance		House 6 total		Midden	
	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	MNI	%
Cf. jaeger	0	0.0%	1	9.0%	0	0.0%	0	0.0%	1	1.3%	1	0
Arctic tern	0	0.0%	1	9.0%	1	6.3%	0	0.0%	2	2.6%	1	0
Sandhill-crane	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	1
Ptarmigan	3	7.7%	4	36.4%	4	25.0%	0	0.0%	11	14.5%	3	0
Unidentified bird	48		28		18		17		111			59
Total Bird	87	10.0%	39	9.9%	34	5.8%	27	6.8%	187	8.3%	126	
Fish												
Arctic Char	70	93.3%	40	88.9%	30	88.2%	13	52.0%	153	85.5%	7	345
Cf. Arctic Char	0	0.0%	3	6.6%	3	8.8%	9	36.0%	15	8.4%	3	108
Lake Trout	5	6.6%	2	4.4%	1	2.9%	1	4.0%	9	5.0%	2	19
Cf. Lake Trout	0	0.0%	0	0.0%	0	0.0%	2	8.0%	2	1.1%	1	5
Unidentified fish	148		101		206		91		546			1161
Total Fish	223	25.6%	146	37.1%	240	41.0%	116	9.2%	725	32.1%	1638	49.6%
Shell			4						4			260
Unidentified	223		168		268		138		797			1093
TOTAL	1092	561	862	535	3050	4416						

* Lemming and shell are not included in the total counts as they are considered intrusive.

** Large mammals include large terrestrial mammal, caribou, muskox or bear; specimens were placed in this category if they could not be distinguished between these species.

*** NISP's and MNI's of goose, duck, eider, and gull include bone that could not be identified to species.

Figure 3. Class frequencies from the study assemblages.

than from the midden indicates the house was occupied when birds were frequenting the area. It is also likely that the bird bones were cleaned less often from the house than larger mammal bone, as the small size of bird bone would not disrupt daily activities.

A higher frequency of seal bones were found in the midden in comparison to the house (Table 1), marking a key difference between the distribution of mammal species at the site. The higher frequency of seal remains in the midden might indicate that it was used for a longer period than the house, perhaps during a season when House 6 was not in use, either earlier in the summer or later in the winter. It is also possible, however, that seal was more often disposed of outside of the house. This could be related to the differences between seal and caribou bone use. Caribou long bones contain marrow that can be easily extracted after initial processing, but seal bones do not contain easily accessed marrow. Therefore, there was less of a reason to keep seal bones inside for further processing.

Modification Frequencies

In order to understand the taphonomic processes that affected the faunal distribution at the site, cut marks, burning, gnaw marks, and fragmentation were noted for each context and are presented in Table 2. Only mammal bone was considered, as it is more robust than bird and fish bone. Cut marks were most frequent on bone recovered from the house central floor area, which could suggest this area was the focus of consumption practices. The highest frequency of burnt material was found in the southwest corner, suggesting that material from the adjacent northwest corner, the likely location of the hearth (Ryan 2003a), was re-deposited here as a result of household cleaning practices, or

abandonment/post-abandonment activities. The percentage of gnaw marks on bone vary throughout the house and midden, and are most frequent in the central floor area and entrance. It is likely that scavengers such as arctic fox chewed the bone once the house was abandoned. Although the midden would seem more vulnerable to scavenger activity, the rapid deposition of the midden appears to have protected lower levels from being gnawed. Fragmentation was relatively even throughout the house.

The modification frequencies from within the house and midden (Table 2) show that the house was generally more affected by taphonomic processes. The modification frequencies also suggest that different areas of the house were affected by taphonomic factors to varying degrees. The modification frequencies, however, are low. While household cleaning activities and scavenger activity have likely obscured subtle differences in the use of space within the house, and likely have disrupted the original deposition of the bone, they do not appear to have compromised the integrity of the assemblages.

Caribou Element Distribution

The distribution of skeletal elements on archaeological sites can offer information on past human behavior and economic decisions (Binford 1978; Metcalf and Jones 1988). However, interpreting past human behavior from element distribution is often skewed by density mediated attrition, as elements with high meat utility tend to have low density, making them more vulnerable to destructive agents (Lyman 1985, 1992). In order to understand the distribution of elements throughout House 6 and its associated midden, meat utility indices, meat drying indices, and bone density indices are used. Only caribou bone is included in this

Table 2. Modification frequencies on mammal bone from the interior of House 6 and midden, Bell site.

	Northwest corner	Southwest corner	Central floor	Entrance	Midden
NISP	559	320	208	254	1559
Cut marks	14	3	11	0	18
% cut marks	2.5	0.9	5.2	0	1.2
Burnt material	5	27	7	4	28
% burnt	0.9	8.4	3.4	1.57	1.8
Gnaw marks	22	2	12	14	19
% gnawed	3.9	0.6	5.8	5.5	1.2
MNE	185	117	62	84	497
Fragmentation (NISP/MNE)*	3	2.7	3.4	3	3.1

*Fragmentation was calculated using an NISP:MNE ratio of bone, following Lyman (1994). As the ratio of NISP:MNE increases, so does fragmentation.

part of the analysis as it is the most abundant mammal species identified from both study assemblages. Caribou element representation is presented using minimum animal units (%MAU; Fig. 4; Table 3).

To address whether food utility and transport practices are related to the distribution of caribou elements at House 6, food utility values for caribou elements (Table 4) were plotted against the %MAU values from the house interior (Fig. 5) and the midden (Fig. 6). The food utility indices predict different element patterns will occur depending on a site's function; the predicted element patterns are related to the amount of meat found on different elements (Binford 1978; Metcalf and Jones 1988); for example, a kill site is expected to display a high frequency of elements low in meat utility, as the elements of high meat utility would be transported elsewhere. The body

part representation of caribou in both House 6 interior and midden does not, however, correspond with a food utility strategy. In addition, correlation tests between food utility and %MAU from the house interior ($r_s = -0.8$, $p = 0.76$) and the midden ($r_s = -0.31$, $p = 0.22$) are weak and not statistically significant. Therefore, this pattern of element distribution cannot be explained by reference to food utility.

Element distribution was also plotted against the meat drying index (MDI) to determine whether the distribution of bone within the house and midden resulted from meat drying practices. Although meat will survive well during the colder seasons, during warmer seasons meat will spoil quickly (Friesen 2001). Drying meat will preserve it to some extent during warm seasons. The head as well as elements containing high contents of marrow are removed when meat is being dried, as they

Figure 4. Caribou element representation.

Table 3. Caribou element frequencies from the interior of House 6 and midden, Bell site.

House Interior	Number per				Midden	Number per			
	MNE	Individual	MAU	%MAU		MNE	Individual	MAU	%MAU
Cranium	4	1	4.0	44.4	Cranium	7	1	7.0	82.4
Mandible	9	2	4.5	50.0	Mandible	17	2	8.5	100.0
Atlas	2	1	2.0	22.2	Atlas	1	1	1.0	11.8
Axis	1	1	1.0	11.1	Axis	1	1	1.0	11.8
Cervical	2	5	0.4	4.4	Cervical	8	5	1.6	18.8
Thoracic	8	13	0.6	6.8	Thoracic	6	13	0.5	5.4
Lumbar	2	6, 7	0.3	3.7	Lumbar	2	6, 7	0.3	3.9
Caudal	1	11	0.1	1.0	Caudal	1	11	0.1	1.1
Sacrum	1	4, 5	0.3	2.8	Sacrum	3	4, 5	0.8	8.8
Rib	99	26	3.8	42.3	Rib	33	26	1.3	14.9
Sternum	6	2	1.0	11.1	Sternum	3	2	0.3	3.9
Scapula	4	2	2.0	22.2	Scapula	7	2	1.5	17.6
Humerus	10	2	5.0	55.6	Humerus	13	2	3.5	41.2
Radius/Ulna	16	2	8.0	88.9	Radius/Ulna	13	6	6.5	76.5
Metacarpal	6	2	3.0	33.3	Metacarpal	7	2	3.5	41.2
Carpal	13	12	1.1	12.0	Carpal	10	12	0.8	9.8
Innominate	4	2	2.0	22.2	Innominate	2	2	1.0	11.8
Femur	6	2	3.0	33.3	Femur	6	2	3.0	35.3
Tibia	18	2	9.0	100.0	Tibia	14	2	7.0	82.4
Fibula	2	2	1.0	11.1	Fibula	3	2	1.5	17.6
Astragalus	4	2	1.0	11.1	Astragalus	2	2	1.0	11.8
Calcaneum	3	2	0.8	8.3	Calcaneum	0	2	0.0	0.0
Tarsal	6	6	1.0	11.1	Tarsal	6	6	1.0	11.8
Metatarsal	13	2	6.5	72.2	Metatarsal	14	2	7.0	82.4
Phalanges	34	24	1.4	15.7	Phalanges	70	24	2.9	34.3

Figure 5. Food utility of caribou bone from the interior of House 6, Bell site.

Element abbreviations for Figures 5–8:

CR: cranium HU: humerus MT: metatarsal
 LU: lumbar TI/FI: tibia/fibula CE: cervical
 IN: innominate AT/AX: atlas/axis SC: scapula
 FE: femur ST: sternum MC: metacarpal
 MA: mandible RA/UL: radius/ulna PH: phalange
 RI: rib TH: thoracic

will cause the meat to spoil. However, meat on other elements is dried on the bone. This common practice creates an element distribution pattern characteristic of meat drying activities (Binford 1978; Friesen 2001). An index predicting the elements chosen for meat drying was developed by

Figure 6. Food utility of caribou bone from the Bell site midden.

Binford (1978) and further elaborated by Friesen (2001; Table 4). If meat drying occurred at the site, the element pattern is expected to correspond with the meat drying index. Figures 7 and 8 present the meat drying index and %MAU for the house and midden. In both the house ($r_s = -0.72$, $p = 0.001$) and midden ($r_s = -0.85$, $p < 0.0001$) the relationship between the meat drying index and %MAU is negative and significant. Elements that are associated with dried meat are not found in significant numbers in either sample. Therefore there is no evidence that dried meat was consumed and discarded at the site. The significant relationship,

Table 4. Food utility index values, meat drying index values, and %MAU values for the House 6 and midden, Bell site.

Element	House Interior	Midden	SFUI*	Meat Drying Index**
Cranium	44.4	82.4	9.1	1.9
Mandible (with tongue)	50.0	100.0	31.1	66.4
Atlas/Axis	22.2	11.8	10.2	88.2
Cervical	4.4	18.8	37.1	186.7
Thoracic	6.8	5.4	47.3	311.3
Lumbar	3.7	3.9	33.2	205.8
Rib	42.3	14.9	51.6	745.4
Sternum	11.1	3.9	66.6	195.2
Scapula	22.2	17.6	44.7	89.5
Humerus	55.6	41.2	36.8	18.5
Radius/Ulna	88.9	76.5	25.8	16.4
Metacarpal	33.3	41.2	5.2	15.5
Innominate	22.2	11.8	49.3	196.8
Femur	33.3	35.3	100	17
Tibia/Fibula	100.0	82.4	62.8	13
Metatarsal	72.2	82.4	37.0	11.2
Phalanges	15.7	34.3	19.4	67.3

* Values are from Metacalf and Jones 1988.

** Values are from Friesen 2001.

however, between the MDI and the faunal samples from the house interior and midden may suggest that meat drying occurred at the site, but that the dried meat was transported elsewhere. This is because elements that are commonly removed dur-

ing meat drying were present in both the house and the midden.

The mineral density of certain bones (Table 5) may also have affected the distribution of caribou elements within House 6 and the midden.

Table 5. Bone mineral density values and %MAU values for House 6 and midden, Bell site.

Element	Bone mineral density* (highest value of scan sites)	House Interior (%MAU)	Midden (%MAU)
Mandible	0.61	50.0	100.0
Atlas	0.26	22.2	11.8
Axis	0.16	11.1	11.8
Cervical	0.19	4.4	18.8
Thoracic	0.27	6.7	5.4
Lumbar	0.3	3.7	3.9
Caudal	0.64	1.0	1.1
Sacrum	0.19	2.8	8.8
Rib	0.4	42.2	14.9
Sternum	0.22	11.1	3.9
Scapula	0.49	22.2	17.6
Humerus	0.63	55.6	41.2
Radius/Ulna	0.68	88.9	76.5
Metacarpal	0.72	33.3	41.2
Carpal	0.64	12.0	9.8
Innominate	0.55	22.2	11.8
Femur	0.57	33.3	35.3
Tibia	0.74	100.0	82.4
Astragalus	0.61	11.1	11.8
Calcaneum	0.64	8.9	0.9
Metatarsal	0.74	72.2	82.9
Phalanges	0.57	15.6	34.2

* Values are for deer, from Lyman 1994.

Figure 7. Meat drying index and %MAU from the interior of House 6, Bell site.

Thoracic, lumbar, and caudal vertebrae, and sacrum and sternum are generally poorly represented in the faunal assemblages. This may be the result of their low density, which decreases the likelihood that they would survive a variety of taphonomic agents. The survivorship of bone material from the interior of House 6 and the midden feature is presented in Figures 9 and 10; the %MAU values of caribou elements are plotted against the bone mineral density of these elements. Similar patterns are found in the samples from the interior of House 6 and the midden. The statistical correlation between bone mineral density and %MAU values from the house interior ($r_s = 0.51$, $p = 0.01$) and midden ($r_s = 0.43$, $p = 0.04$) are positive and significant, suggesting that bone mineral density affected the representation of caribou elements at House 6 and the midden.

Although MDI and bone density are both shown to be correlated significantly with the element distribution at the Bell site, and because MDI and density are negatively and significantly correlated, it is not clear which of these factors had a greater impact on the composition of the assemblage. The discussion on modification frequencies does show, however, that fragmentation, gnawing, and other taphonomic factors have impacted the sample, at least minimally. In addition, there is no corollary evidence, such as storage or drying racks, to suggest the drying of meat, therefore it seems most parsimonious to suggest that element distribution results primarily from density mediated attrition.

Summary: The Late Dorset Economy at the Bell Site

The faunal analysis shows a lack of variability between the different contexts within the house interior, and although slightly different proportions of taxa are found in the house and midden con-

Figure 8. Meat drying index and %MAU from the Bell site midden.

texts, they both demonstrate the same range of taxa. The modification frequencies indicate that bones from the house and midden were affected by taphonomic processes, however, the modification frequencies were generally low. Density mediated attrition has affected the distribution of caribou elements within both the house and midden, yet similar faunal compositions occur in both contexts. This indicates that the faunal assemblages analyzed from House 6 and the midden are representative of the site's economy.

The similar distribution of mammal, bird, and fish throughout House 6 and the midden is contrary to what was found by Friesen and Betts (2004) in their analysis of a Thule house where each context displayed very different class and mammal proportions. This is perhaps a reflection of the differences between Thule and Dorset cultural practices. Friesen and Betts (2004) have suggested that the presence of dogs at Thule sites may have affected the distribution of faunal material by altering primary patterns of discard and contributing to the variation in faunal material between different contexts within a house structure. Also, Thule house structures, including the house analyzed by Friesen and Betts (2004), incorporate a more rigid division of space in comparison to the Late Dorset house structure analyzed for this study (Ryan 2003a). The division of space in the Thule structure served to confine different activities to specific areas within the house. The uniform class and mammal proportions found throughout House 6 at the Bell site suggest that similar activities took place throughout the house, or that different activity patterns were masked by taphonomy resulting in a generalized pattern. The absence of dogs and the unspecialized use of space may suggest that at Late Dorset sites faunal material sampled anywhere within the house or midden will provide a representative sample of a site's economy. However, further research is needed to determine whether this is a uniform pattern characteristic of

Figure 9. Survivorship of caribou bone from the interior of House 6, Bell site.

Element abbreviations for Figures 9 and 10:

MA: mandible	CL: calcaneum	PH: phalange
CA: caudal	AX: axis	TH: thoracic
HU: humerus	RI: rib	SC: scapula
AS: astragalus	MC: metacarpal	FE: femur
AT: atlas	MT: metatarsal	LU: lumbar
SA: sacrum	CE: cervical	IN: innominate
RA/UL: radius/ ulna	ST: sternum	TI: tibia
	CP: carpal	

Late Dorset sites. It is likely that faunal collections will be more variable within Dorset houses that have well defined contexts and activity areas.

The combined study assemblages from the house interior and the midden produced a total of 7,468 individual specimens (NISP), 5,576 of which were identified to at least class. Caribou contributed 72% of the identified mammal. Of the identified fish, Arctic char predominated, yielding 95% of the sample; the remaining 5% was identified as lake trout. Although a variety of bird species were identified at the site, goose and duck contributed the majority, comprising 73% of identified bird bones.

The faunal composition suggests that the occupation at Bell House 6 (including the house interior and midden) was specialized towards hunting caribou and fishing Arctic char. High frequencies of both Arctic char and caribou indicate a late summer/fall occupation. Today, during August there is a large char run in the adjacent Ekaluk River and caribou are plentiful during the fall when the herds travel through the area (Friesen 2002). Although bird accounts for a small proportion of identified bone, the presence of migratory birds such as goose and duck further supports a late summer occupation. However, use during additional seasons cannot be ruled out.

Discussion: The Bell Site in Context

In this section the faunal composition from Bell House 6 is compared to other Late Dorset faunal samples. Figure 11 presents the fauna from eight

Figure 10. Survivorship of caribou bone from the Bell site midden.

Late Dorset sites or groups of sites from across the eastern Arctic (Bendix 2000; Darwent 2001, Helmer 1981, Schledermann 1990; Mary-Rousseliere 1976; Murray 1996; see Fig. 1). The varying distribution of fauna at the different sites can be attributed in part to differences in recovery and sampling methods, identification methods, and taphonomy; however some general trends can be extrapolated.

Table 6 lists the NISP and %NISP of identified mammal species, as well as identified fish and bird for the eight different localities. Identified fish and bird species could not be obtained for all of the sites, therefore fish and bird analyses are done by class. Data from several sites were available from Hatherton Bay (Bendix 2000), Bache Peninsula (Schledermann 1990), Kalivik Island (Helmer 1981), Little Cornwallis Island (Darwent 2001), and the Foxe Basin (Murray 1996). In each location the faunal assemblages from different sites were combined in order to present a general regional subsistence pattern. Table 6 includes the NISP for each site, and the total NISP and %NISP for each region. The faunal assemblages used for comparison were excavated from semi-subterranean houses and associated middens, with the exception of the Hatherton Bay sites, which include bones excavated from the David Site, a longhouse site. Only the regional total NISP and %NISP from the Hatherton Bay sites were available for comparison (Bendix 2000).

As noted in previous studies (Damkjar 2005; Darwent 2001) and shown in Figure 11, in most regions seals predominate Late Dorset faunal assemblages. With the exception of the Bell site, sea mammals (including various seal species and walrus) contribute over 30% of the NISPs in all samples (Table 6). On the other hand, caribou were only found to contribute significantly in three of the eight regions presented in Figure 11. High frequencies of caribou were found at the Foxe Basin

Figure 11. Late Dorset faunal samples from across the eastern Arctic: Hatherton Bay, Greenland (Bendix 2000), Lea Point, Ellesmere Island (Darwent 2001), Bache Peninsula, Ellesmere Island (SiFi-4, Sffk-18, SgFm-3[H1]; Schleder-mann 1990), Kalivik Island sites (QjLd-25:1,2, QjLd-17:1,2,3; Helmer 1981), Little Cornwallis Island (QjJx-1, QjJx-10; Darwent 2001), Nungavik 71, Baffin Island (Mary-Rousselière 1976), Foxe Basin (NiHf45, NiHf4:4, NiHf4:9; Murray 1996), and the Bell site, Victoria Island. Large pinniped refers to specimens that could not be differentiated between seal and walrus species.

Table 6. Faunal assemblages from eight different regions across the Arctic, Hatherton Bay, Greenland (Bendix 2000), Lea Point, Ellesmere Island (Darwent 2001), Bache Peninsula, Ellesmere Island (SiFi-4, SgFm-3[H1]; Schledermann 1990), Kalivik Island Sites (QjLd-25:1,2,3; QjLd-17:1,2,3; Helmer 1981), Little Cornwallis Island (QjJx-1, QjJx-10; Darwent 2001), Nunguvik 71, Baffin Island (Mary-Rousselière 1976), Foxe Basin (NiHf45, NiHf4:4, NiHf4:9; Murray 1996), and the Bell site, Victoria Island.

	Hatherton Bay Sites		Lea Point		SiFi-4		Sffk-18		SgFm-3 (H1)		Bache Peninsula Sites		QjLd-25;1,2		QjLd-17;1,2,3		Kalivik Island Sites	
	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%
Fish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bird	3173	29	31	3.8	0	0	0	0	3	3	3	1.5	4	7	11	0.1	11	0.1
Arctic hare	203	1.9	11	1.3	0	0	0	0	24	24	24	11.9	0	0	0	0	0	0
Whale	22	0.2	0	0	0	0	0	0	0	0	0	0	1	15	16	0.2	16	0.2
Large canid	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	0	2	0
Wolverine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fox	2930	26.8	60	7.3	27	27	1	6	6	34	34	16.8	4272	58	4330	47.2	4330	47.2
Bear	86	0.8	8	1	0	0	0	0	0	0	0	0	20	56	76	0.8	76	0.8
Large pinniped*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Walrus	2153	19.7	23	2.8	11	11	8	5	5	24	24	11.9	6	121	127	1.4	127	1.4
Seal	1415	12.9	671	81.9	10	10	21	85	85	116	116	57.4	863	3694	4557	49.7	4557	49.7
Caribou	23	0.2	3	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Muskox	936	8.6	12	1.5	1	1	0	0	0	1	1	0.5	42	7	49	0.5	49	0.5
Total	10941		819		49		30	123	123	202	202		5209	3959	9168		9168	
	Arvik QjJx-1		Tasiarulik QjJx-10		Little Cornwallis Island Sites		Nungavik 71		Bell Site		NiHf45		NiHf4:4		NiHf4:9		Foxe Basin Sites	
	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%
Fish	79	1	94	0.8	0	0	0	0	1	1	0	0	0	0	0	0	0	0
Bird	1087	647	1734	14.9	19.1	19.1	313	7.7	313	7.7	52	52	56	13	121	3.2	121	3.2
Arctic hare	0	3	3	0	0.7	0.7	2	0	2	0	0	0	0	0	0	0	0	0
Whale	17	13	30	0.3	3.2	3.2	0	0	0	0	0	0	0	0	0	0	0	0
Large canid	0	0	0	0	0.2	0.2	0	0	0	0	0	0	7	8	15	0.4	15	0.4
Wolverine	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
Fox	1464	1909	2373	20.4	3.9	3.9	293	7.2	293	7.2	103	103	223	117	443	11.7	443	11.7
Bear	34	10	44	0.4	0.5	0.5	0	0	0	0	0	0	1	0	1	0	1	0
Large pinniped*	135	80	215	1.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Walrus	193	137	330	2.8	6.3	6.3	0	0	0	0	104	104	39	62	205	5.4	205	5.4
Seal	3414	3034	6780	58.3	27.9	27.9	88	2.2	88	2.2	1270	1270	189	140	1599	42.2	1599	42.2
Caribou	8	16	24	0.2	37.9	37.9	991	24.4	991	24.4	1241	1241	42	68	1351	35.6	1351	35.6
Muskox	1	5	6	0.1	0	0	9	0.2	9	0.2	0	0	0	0	0	0	0	0
Total	6432	5855	11633		0	0	4060		4060		2775	2775	608	408	3791		3791	

*Large pinniped includes walrus and seal species, specimens were placed in this category if they could not be distinguished between the two species.

sites and Nungavik 71, but in both these regions, unlike the Bell site, seal is also found in high frequencies.

In order to show the range of taxa utilized in each region, Figure 11 includes identified mammal species as well as bird and fish. However, biases of recovery methods and taphonomic processes potentially affect fish and bird disproportionately due to their small size. When fish and bird are removed from the total NISP in each region, the Bell site shows the highest proportion of caribou, comprising 72% of the identified mammal bones. At the Foxe Basin sites caribou is 37% of the mammal remains, and at Nunguvik 71, caribou accounts for 47% of the identified mammal remains. In the remaining five regions, caribou accounts for less than 1% of the identified mammal remains.

The most frequently occurring terrestrial species throughout the eight regions compared in Figure 11 is Arctic fox. Darwent (2001, 2002) has suggested that during the Late Dorset period Arctic fox was taken more often in regions where larger artiodactyls were infrequent. As shown in Figure 11, Arctic fox is found in the assemblages which contain significant frequencies of caribou, including the Bell site, Nunguvik 71, and the Foxe Basin sites, but Arctic fox is generally found in higher frequencies at the sites where caribou is less frequent. However, the Lea Point site from Ellesmere Island is an exception as both caribou and Arctic fox are infrequent.

The comparison of faunal assemblages from the eight different regions suggests that additional terrestrial resources contributed little to the Late Dorset diet. However, a relatively higher frequency of muskox is found in the Hatherton Bay faunal assemblage, where muskox contributes 9% of the identified mammal remains in comparison to all other regions where muskox accounts for under 2% of the identified mammal remains. The faunal assemblage from the Hatherton Bay sites is set apart from the other regions, as walrus, not seal, is the most frequent mammal, and bird also contributes significantly to the diet. The higher proportion of walrus likely reflects an abundance of this resource in that region. However, the inclusion of the David site, the longhouse site, is responsible for the high frequency of bird, and therefore cannot be compared directly to the other regions (see Damkjar 2005 for a discussion of Late Dorset fauna from longhouses).

The high frequency of fish found at the Bell site also differentiates the site from the other regions. While fish bone makes up 58% of the identified bone at the Bell site, fish is only found in two other regions, the Little Cornwallis Island sites, and the Foxe Basin sites, and in both locations less than 2% of the identified bone is fish (Table 6). As

mentioned earlier, the Bell site was screened with 3 mm mesh, which would have increased the recovery of this resource in comparison to sites where screening was not used, such as at Nungavik 71. As was noted earlier, fish is also very susceptible to taphonomic processes, which often results in an under-representation of this resource in archaeological samples (Whitridge 2001). However, fish accounts for more than half the fauna identified at Bell House 6, a pattern that cannot be fully explained by variation in screening methods and taphonomy, but suggests that fish was a major contributor to the diet at the site.

While sea mammals, mainly seal, are the most frequently occurring mammal category at most Late Dorset sites, and a range of species have been exploited in different Arctic regions, the Bell site is unique in that seals contribute under 3% of the identified fauna and the economy is clearly focused on hunting caribou and Arctic char. As mentioned earlier, Darwent (2001, 2002) suggested that over-predation in earlier periods may have led to a decline in artiodactyls in various Arctic regions, resulting in a greater dependence on smaller terrestrial resources such as Arctic fox. This pattern appears to be true for sites located in the high Arctic, however, caribou is found in significant proportions at the three sites in the central Arctic locations including the Bell site, Nunguvik 71, and the Foxe Basin sites. In addition, at least at the Bell site, over-predation does not appear to have occurred, as the faunal assemblages from Early, Middle, and Late Dorset as well as Thule features are dominated by caribou and Arctic char (Friesen 2002).

The Bell site demonstrates that, at least in the region of southeastern Victoria Island, Late Dorset were actively hunting caribou, and maintaining an economy primarily focused on terrestrial and riverine resources with little dependence on seal. It is possible that the pattern identified at the Bell site is unique to the region, however, the tendency for past research to focus on coastal sites biases the reconstruction of Late Dorset economy towards marine mammals. In order to fully understand the extent of terrestrial and riverine exploitation by Late Dorset hunters, future research should be directed towards sites located in interior locations or in additional locations where seals are infrequent.

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