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Bison Ethology and Native Settlement Patterns

During the Old Women's Phase on the Northwestern Plains

by

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ABSTRACT

On the northwestern Plains of North America, most archaeologists have indicated that the movement of bison, whether seasonal or otherwise, influenced the movements of the Native people. Most researchers have argued that bison spent the summer on the plains but, as cooler weather approached, they sheltered themselves in the parkland, river valleys, and wooded uplands. The movement of Native people was expected to parallel that of the bison. Yet, some researchers persist in their convictions that bison were erratic and unpredictable in their movements. Still other researchers have argued that large scale movements did not occur and bison were numerous on the plains throughout the year. Thus, Native people could only procure bison based on an 'encounter strategy' or by remaining in close proximity to a given herd or a 'herd following strategy'. In contrast, the first model suggests that bison migrated in relatively predictable patterns and, thus, could be procured using an 'intercept strategy'.

To address the lack of consensus concerning bison movements and their effect of human movements this research evaluated models of bison movements by way of: 1) a review of modern understandings of bison ethology, 2) a review of historical literature, ethnographic data, and oral tradition regarding bison, and 3) the implementation of a technique (i.e., dental cementum increment analysis) used in the seasonal evaluation of modern and archaeological bison dentition. The review of bison ethology produced a model in which bison go through five predictable stages in their annual cycle. The model was used to interpret the historical literature, etc. This interpretation suggested that bison rutted at the edge of the parkland, wintered in the parkland, calved back at the edge of the parkland, and

summered on the plains proper. The analysis of dental cementum increments from bison jaws recovered from twenty-one Old Women's phase sites on the northwestern plains suggested the distribution of sites exhibited a similar trend to that of the bison in that winter sites were located around the periphery of the plains and in large river valleys while summer sites were located on the plains.

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DEDICATION

For my Family

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CHAPTER ONE: INTRODUCTION

> The seasonal nature of communal bison procurement is a problem that must be resolved before a complete understanding of Plains prehistory can be realized.
>
> (Walker 1974:1)

On the northwestern Plains of North America, most archaeologists agree that the movement of bison, whether seasonal or otherwise, influenced the movements of the Native people who subsisted upon them (e.g., Arthur 1975, 1978; Bamforth 1987; Epp 1988; Gordon 1979; Hanson 1984; Malainey and Sherriff 1996; Moodie and Ray 1976; Morgan 1979, 1980; Roe 1951; Walker 1974). This close relationship between predator and prey is clearly represented in the preponderance of bison bone in plains sites and the extensive observations of bison hunting recorded in historic and ethnographic documents. Still, given that bison movements are expected to provide a determining effect on human movements it is frustrating that researchers do not agree on the nature of herd movements and the corresponding response by Native people.

Most commonly, researchers have argued that bison herds spent summer on the open grasslands but, as cooler weather approached, the herds moved to wintering grounds in the sheltered parkland, river valleys, or wooded uplands. The movement of Native people is expected to parallel that of their prey species. In contrast, a number of researchers persist in their conviction that bison were erratic and unpredictable except, perhaps, in terms of very local movements. Still other researchers have argued that large scale movements did not occur and bison herds were most numerous on the plains throughout the year. In these last two scenarios, Native people would be limited to procuring bison based on an 'encounter strategy' or by remaining in close proximity to a given herd or a 'herd following strategy'. In sharp contrast to these scenarios are models in which bison migrated in relatively predictable patterns and, thus, could be procured using an 'intercept strategy'.

Arguably the most thorough attempt to understand bison ethology was Frank Gilbert Roe's (1951) The North American Buffalo. Archaeologists commonly refer to this work when discussing bison herd movements and, in this sense, it provides a starting point for discussion. Roe (1951:594) was adamant that bison movements were 'erratic' and 'unreliable'. Similarly, Francis Haines (1970:14–15), a historian by training, concurred with Roe about the unpredictability of bison and further noted the complete inability of the Native inhabitants of the plains to discern a pattern in the animal's behaviour. More recently, Jeffery Hanson, an archaeologist in North Dakota, found support for the erratic behaviour of bison in a review of historical documents. He produced a reconstruction of bison behaviour using an ecological model that suggested predictable behaviour was only possible at the local level (Hanson 1984).

Most recently, Mary Malainey and Barbara Sherriff (1996) have suggested that historical documents and archaeological data demonstrate that large bison herds wintered in the open plains; it is implicit in their argument that no movement in the bison herds occurred as the plains were expected to have the greatest number of bison, summer or winter. This reconstruction of bison behaviour necessitated that Native people camp on the plains in order to exploit the overwintering bison.

The majority of researchers, however, have long maintained that bison spent the summer on the plains and the winter in the parkland (e.g., Arthur 1975, 1978; Epp 1988; Morgan 1979, 1980; Gordon 1979; Moodie and Ray 1976). Moodie and Ray (1976) used historical documents to illustrate that bison migrated from the plains to the parkland as winter arrived. Arthur (1975, 1978), again using historic documents, argued that Native people from the plains pounded bison in the parkland throughout the fall, winter, and spring. Morgan (1979, 1980) described the cycles of vegetative communities on which bison fed and argued that the cycle indicated the environment could be best utilized if bison herds wintered in the parkland in relatively large clustered herds and summered on the plains in relatively scattered small herds. Gordon (1979) concurred with Morgan's (1979, 1980) ecological model of bison movements which he complemented with historical references. Most recently, Epp (1988) tried to bridge the gap between the migrationists and the non-migrationists in suggesting the dual dispersal of bison. Epp argued that most bison herds migrated to the grasslands seasonally from their wintering grounds in the parkland while other herds remained on the plains closely associated with wooded uplands and river valleys on the plains.

The purpose of this research is to address the lack of consensus concerning the nature of bison herd movements and their effect on human movements on the northwestern Plains. This objective will be achieved through an evaluation of the models of bison herd movements and their effect on human movements by way of: 1) a review of modern studies of bison ethology, 2) a review of historical and ethnographic literature regarding bison, and 3) the refinement and implementation of a technique (i.e., dental cementum increment analysis) used in seasonality analyses of modern and archaeological bison dentition. Then, in light of these independent lines of evaluation, the models of bison movements and their influence on Native people will be re-evaluated.

The remainder of this chapter describes the study area and the cultural history of the Late Prehistoric Period including the Old Women's phase and its contemporaries. The Old Women's phase is singled-out for closer seasonal assessment of its sites by dental cementum increment analysis. Chapter Two reviews, in greater detail the literature concerning archaeological models of the movements of bison and humans in the past. Chapter Three presents current theoretical approaches that archaeologist have taken to understanding the movement of people in prehistory. Theoretical concepts including seasonal round, mobility strategies, and settlement patterns are specifically examined. Chapter Four presents an evaluation of modern bison ethology and ethnographic/historical literature concerning the nature of bison movements. The ethnographic and historical literature is examined in the context of modern bison behaviour in order to provide a model for the nature of bison movements in prehistory. Chapter Five provides the background research for the seasonal assessment of archaeological sites using dental cementum increment analysis. Chapter Six provides site background for the Old Women's phase assemblages used in this analysis and presents the seasonal assessment of dental cementum increment analysis of bison dentition from these sites. The sites are then interpreted in terms of a settlement pattern analysis. In Chapter Seven the aforementioned analyses are used to provide a reconsideration of bison herd movements and their effect on human hunters.

Chapter Eight summarizes this re-evaluation of bison herd movements and their influence on Native people's movements during the Old Women's phase.

THE STUDY AREA

For the purposes of this research, the study area falls within the geographic area defined by Waldo Wedel as the northwestern Plains (1961:240). Wedel (1961:240) defined the northwestern Plains as covering:

> ...south of the forty-ninth parallel, the drainage basins of the Yellowstone and the Upper Missouri, as well as much of the North Platte drainage. Beyond the International Boundary, they sweep northward for another 150 miles to or a little beyond the fifty-second parallel, taking in most of the Palliser Triangle and the drainage of the South Saskatchewan. They terminate on the west where the short grass reaches the pine-clad slopes of the Rocky Mountains, except in Wyoming. Here, for present purposes, they extend to the Continental Divide, and include the Bighorn, Wind River, Laramie, and other basins partially enclosed by the eastern-most ranges of the Rockies.
>
> (Wedel 1961:240)

More specifically, this research focuses on the geographic distribution of the Old Women's phase within the northwestern Plains. The geographic distribution of the Old Women's phase has an early expression (ca. 1200 BP to 600 BP) across south-central and southwestern Saskatchewan, southern Alberta, and possibly northern Montana and a later expression (ca. 600 BP to the Historic Period) in southwestern Saskatchewan, southern Alberta, and north-central Montana (Meyer 1988; Peck 1996; Peck and Ives 2001; Walde et al. 1995).

CULTURAL HISTORY OF THE NORTHWESTERN PLAINS

A brief introduction to the regional culture historical sequence is appropriate to place this research within the context of the archaeological record on the northwestern Plains. Traditionally, the archaeological record on the northwestern Plains has been divided into three segments of time called 'periods', each of which are further subdivided into smaller segments of time called 'phases'.

Historically, each period is differentiated by changes in projectile point morphology which are inferred to reflect changes in weapon technology (e.g., Mulloy 1958:204-223; Wormington and Forbis 1965:183-198; Forbis 1970; Dyck 1983; Reeves 1983:35-37, Vickers 1986:35-27). Mulloy's (1958:204-223) early classification system approaches what is used today on the northwestern Plains. Based on the aforementioned technological changes, he used a five period system including: Early Prehistoric, Early Middle Prehistoric, Late Middle Prehistoric; Late Prehistoric, and Historic periods. Wormington and Forbis (1965:183-198) were the first to propose the three-fold system in the immediate study area. Subsequently, Forbis (1970) changed the nomenclature of his divisions for prehistory by introducing a little followed scheme: Early Lithic, Middle Lithic, and Late Lithic. The systematics currently in use in the study area began developing when Reeves (1970, 1983) adopted Mulloy's (1958) approach to the culture historical divisions and nomenclature: Early, Middle, and Late Prehistoric Period.

Vickers (1986:10-13) provides a recent synthesis of the periods used in the culture history sequence for the study area. Paraphrasing Vickers (1986), the Early Prehistoric Period (11,500 BP to 7,500 BP, BP = Before Present; i.e., AD 1950) is distinguished by the presence of large, lanceolate projectile points inferred to have been hafted as tips on thrusting spears. The Middle Prehistoric Period (7,500 BP to 1,750/1,250 BP) is distinguished by medium-sized side-notched, corner-notched, and stemmed projectile points understood to have been hafted as tips on darts and propelled by atlatls. The Late Prehistoric Period (1,750/1,250 BP to 250 BP) is distinguished by small side-notched, corner-notched, and triangular projectile points inferred to have been hafted as tips on arrows and propelled by bows. The Protohistoric Period (250 BP to 76 BP) is characterized by the addition of European trade goods to Late Prehistoric material culture with the former ultimately replacing the latter in many material culture spheres.

Each of the aforementioned 'periods' is further subdivided into smaller segments of time called 'phases'. Willey and Phillips (1958:22) defined a phase as "...an archeological unit possessing traits sufficiently characteristic to distinguish it from all other units similarly conceived, whether of the same or other cultures or civilizations, spatially limited to the order of magnitude of a locality or region and chronologically limited to a relatively brief time". In the study area, Reeves (1983:39) indicates that:

> ...a phase does not necessarily correlate with a locality, region, or even an area. The area occupied by a phase may change through time and it may in fact be found in two environmentally distinct areas.
> (Reeves 1983:39)

Each 'phase' comprises one or more artifact assemblages. The assemblages are assigned to phases based largely on the presence of 'diagnostic' projectile points and/or pottery (Vickers 1994:7).

As alluded to above, this research focuses on the Old Women's phase which occurs in the Late Prehistoric Period and the Protohistoric Period. Therefore, this discussion will be limited to the Old Women's phase and its contemporaries in the Late Prehistoric Period and the Protohistoric Period.

OLD WOMEN'S PHASE (ca. 1200 BP to the Historic Period)

The Old Women's phase is defined by distinctive pottery and projectile points. The pottery consists of Saskatchewan Basin Complex: Late Variant pottery (Byrne 1973) and the projectile points consist of Cayley Series projectile points (Peck 1996; Peck and Ives 2001). The phase commences as early as 1400 BP (Reeves 1978; Morlan 1988) -- its earliest radiocarbon dates overlapping with both terminal Avonlea and Besant dates (Brumley and Rushworth 1983; Morlan 1988; Vickers 1983, 1986) -- and continues into the Protohistoric Period. Following Meyer (1988), the geographic distribution of the Old Women's phase has an early expression (ca. 1200 BP to 600 BP) across south-central and southwestern Saskatchewan, southern Alberta, and possibly northern Montana and a later expression (ca. 600 BP to the Historic Period) in southwestern Saskatchewan, southern Alberta, and north-central Montana (see also, Peck 1996; Peck and Ives 2001).

The technology represented in Cayley Series projectile points indicates the use of the bow and arrow. The points themselves are generally side-notched although corner-notching is present especially in specimens from the early part of the phase. Basal edge shapes are usually straight but can be convex or concave. Notch forms are largely rounded or v-shaped.

Overall base outline shapes are usually fish-tail, flattened hexagonal, or rectangular (Peck and Ives 2001).

Regarding the lithic utilization, Old Women's phase assemblages emphasize the use of locally available lithics such as cherts, pebble cherts, quartzites, petrified wood, and chalcedonies. As well, lithic materials from Montana (e.g., Madison Formation and Avon cherts) are fairly common (Brumley and Dau 1988:52). More exotic materials, including Knife River Flint from North Dakota, obsidian from Yellowstone Park in northwestern Wyoming, and cherts from British Columbia, all are less common, but far from absent.

The technology exhibited in the Saskatchewan Basin Complex: Late Variant pottery (Byrne 1973) displays poorly consolidated paste and thick walls, usually, in an overall coconut or globular shaped vessel form (Byrne 1973; Meyer 1988:56). "Shoulders are quite common and pronounced frequently reflecting internal or external thickening in the vicinity of the ridge, and necks, when present, are generally shallow and short" (Byrne 1973:334). Most vessels exhibit some form of surface treatment (e.g., vertical cord impression or fabric impression, often smoothed) while the minority are completely smooth or plain and some show decoration in which "...punctates are common, and impressions [are] made with coarse, cord wrapped tools and incisions with pointed tools..." (Meyer 1988:56). Simons (1979:39-57), using ethnographic evidence, has suggested the pottery was manufactured using moulds in the ground, however, this evidence has been looked upon with scepticism (e.g., Byrne 1973:509-510; Griffin 1965:241).

The Old Women's phase continues into the Protohistoric Period which begins, in this area, about 250 BP with the introduction of European trade items (via indirect routes) to the Native inhabitants, and ends with the beginning of direct written historical reference to the area and its inhabitants between 200 and 150 BP. (Vickers 1986:103). Common items traded into the west include guns, gun powder, tobacco, metal knives, cloth, and kettles (e.g., Pyszczyk 1997). Similarly, horses, also introduced at this time, arrived from the south as a result of Spanish settlement in what is now Mexico and the southern United States (e.g., Ewers 1955:15-19).

During this period, the Old Women's phase continued much as it had during the Late Prehistoric Period. That is, Saskatchewan Basin Complex: Late Variant pottery and

Cayley Series projectile points continue to define the phase. As alluded to above, the most obvious change is the inclusion of European trade items in the archaeological assemblages; such items include metal points, files, axes, assorted metal fragments, glass beads, clay pipe bowls, and horse bones.

A number of lines of evidence suggest that the Old Women's phase is the archaeological representation of the Blackfoot or Blackfoot Confederacy. For example, Reeves (1983:20) believed the Old Women's Phase could be: "...regionally and temporally segregated into variants which represent the various 'tribal' constituents - North Peigans, Blood, Atsina, and Gros Ventre...". In view of linguistic, oral tradition, and historic accounts, Byrne (1973) also argued that the Blackfoot were the most likely descendants of the people of the Old Women's phase. As well, Magne and contributors to the Saskatchewan-Alberta Dialogue (1987:220-232) produced a composite map of the distribution of Native people at AD 1700 that illustrated the Blackfoot roughly co-distributed with the Old Women's phase. Similarly, spiritual items called 'Iniskim' (i.e., fossil ammonites) used among modern Native people are most commonly found among the Blackfoot and archaeologically are almost invariably recovered from Old Women's phase sites (Peck n.d.). Vickers (1986:101) best summarized the situation stating that: "...while most local archaeologists would probably not dispute a Blackfoot-Old Women's correlation, [unequivocal] demonstration of that correlation has remained frustratingly elusive."

MORTLACH PHASE (ca. 650 BP to the Historic Period)

The Mortlach phase succeeds the Old Women's phase on the plains of eastern Saskatchewan (Meyer 1988:60, Peck and Ives 2001:182, Walde 1994, Walde et al. 1995:32-33). The Mortlach phase also occurs in southwestern Manitoba, northwestern North Dakota, and northeastern Montana (Walde 1994:101-102, 243, 282). The phase is characterised by Mortlach Group projectile points, exhibiting rectangular bases and deep-narrow side notches (Peck and Ives 2001), and Mortlach pottery, exhibiting attributes derived from the Middle Missouri region (Joyes 1973, Meyer 1988:62; Walde 1994).

Determining the age of the Mortlach phase has presented numerous problems owing to the paucity of absolute dates (Walde 1994:105-106). Nevertheless, a tentative time span from about 650 BP into the Historic Period has been suggested (Peck and Ives 2001). Recently, Walde (1994) has identified the Mortlach phase as ancestral to historic Assiniboine based on a comprehensive analysis of Mortlach phase sites in Saskatchewan, Manitoba, Montana, and North Dakota.

SADDLE BUTTE PHASE (ca. 1000 BP to 550 BP [?])

The Saddle Butte phase was first defined by John Brumley and Barry Dau (1988:56) to describe aceramic assemblages of Prairie and Plains Side-notched projectile points in north-central Montana. The definition of the phase was based largely on material from the Wahkpa Chu'gn site in north-central Montana. The Wahkpa Chu'gn site is a multi-component kill/camp site that exhibits Besant, Avonlea, and Prairie/Plains Side-notched projectile points. More recently, Brumley and Rennie (1993:46) redefined the Saddle Butte Phase by expanding the features it encompasses. First, they added corral post-pits associated with relatively complete bison crania (possibly reflecting ceremonial activity) as a characteristic. Second, they cited numerous bison jaws with socketed teeth exhibiting clear evidence of use as tools as a unique feature of the Saddle Butte phase.

Originally, Brumley and Dau (1988:51) developed the Saddle Butte phase in response to the restrictive definition of the Old Women's phase as containing both Prairie/Plains Side-notched points and Saskatchewan Basin Complex: Late Variant pottery. However, the recent recovery of pottery from the most recent levels of the Wahkpa Chu'gn site has lead Brumley and Rennie (1993:47) to accept pottery as a characteristic of the Saddle Butte Phase. The pottery associated with the Saddle Butte phase cannot be readily differentiated from the Saskatchewan Basin Complex: Late Variant pottery of the Old Women's Phase (Brumley and Rennie 1995:49-50). With the inclusion of pottery, it becomes difficult to differentiate the Saddle Butte phase from the Old Women's phase. As well, the projectile points labeled Prairie and Plains Side-notched fall within the variability of the recently defined Cayley Series projectile points of the Old Women's phase (Peck 1996; Peck and Ives 2001). Thus, since the attributes defining the Saddle Butte phase appear little different from those defining Old Women's phase, a separate phase may not be justified and is not used in this research [Similarly, the Plains/Prairie complex (Brumley and Dau 1988), consisting of Plains and Prairie Side-notched points attributable to the Cayley Series, is considered part of the Old Women's phase).

HIGHWOOD PHASE (ca. 600 BP into the Protohistoric Period)

The Highwood phase is a poorly understood phenomenon that is focused in central Montana between the Missouri and Yellowstone Rivers (Brumley and Dau 1988:48). The Highwood Phase is named after the Highwood bison kill site located in central Montana (Brumley and Dau 1988:57). It has been characterised as containing high frequencies of Buffalo Gap Single-Spurred and Emigrant Basal-Notched varieties of the Plains Side-notched projectile point type (Brumley and Rennie 1993:53-56; see also Kehoe 1966). The projectile point assemblages are commonly made of obsidian, porcellanite, and Madison Formation chert (Brumley and Rennie 1993:44) and are often said to exhibit superior craftsmanship (Brumley and Rennie 1993:57). Firm evidence of the Highwood phase farther north in Alberta might eventually be found as a few scattered finely crafted projectile points of Madison Formation chert, porcellanite, or obsidian have been recovered there (Brumley and Dau 1988:58). In addition, Intermountain Tradition pottery (Mulloy 1958:196), in association with the aforementioned projectile points, is assumed to characterize the Highwood phase (Brumley and Rennie 1993:43). These vessels are distinct from Saskatchewan Basin Complex: Late Variant pottery of the Old Women's phase in that they tend to be vase-like in shape with flat circular bases, no handles, and show a general lack of decoration (Mulloy 1958:197).

Originally, the Highwood phase was dated between ca. 650 BP and 450 BP (Brumley and Dau 1988:58). More recently, Brumley and Rennie (1993:44) have revised the dating of the phase by suggesting it begins ca. 600 BP and persists, possibly, into the Protohistoric Period. Based on previously suggested relationships between basal-notched projectile points and/or Intermountain pottery with a historically known ethnic group (e.g., Mulloy 1958; Frison 1991), Brumley and Rennie (1993:43) affiliated the Highwood phase with historic Shoshonean people.

SUMMARY

Currently there are three general approaches to understanding bison herd movements on the northwestern Plains. Most importantly, each approach exhibits different ramifications for the movements of the people that subsisted on the herds. One model of bison herd movements suggests that the majority of animals remained on the plains throughout the year; thus, people were required to remain on the plains year-round as well. Other researchers suggest that bison behaviour was so erratic and unreliable that people could not predict their movements and were forced to rely on 'encounter strategies' and 'herd following strategies' for subsistence. The other suggestion is that bison herds spent summer on the plains and winter in the parkland. The movements of bison were relatively predictable and the animals could be relied on as a source of subsistence in specific areas at specific times of the year.

Frustration concerning this important topic has arisen over the lack of agreement regarding the nature of bison herd movements. This frustration is coupled with an inability to understand the movement of past people. All researchers concur that bison seasonal habits must have influenced people's subsistence, and therefore, how they moved across the landscape and where they settled on the landscape.

CHAPTER TWO: SEASONAL ROUND MODELS

> In view of the recognized importance of the buffalo to Plains life, it is rather curious that anthropologists have not concerned themselves more with the habits of these animals. A great deal of folklore has insinuated itself into anthropological thinking about the buffalo, and in particular about the supposed vast annual migrations of the buffalo.
>
> (Oliver 1962:15)

INTRODUCTION

Models illustrating how people moved and positioned themselves on the landscape are voluminous for the northwestern Plains. Unfortunately, overt models that include theoretical considerations of settlement patterns and mobility strategies are rare. This is likely owing to the general lack of explicitly theoretical discussions in the anthropological literature concerning the plains (e.g., Bamforth 1999). Most of the models, however, are largely ecologically oriented so they are grouped together here under the rubric of 'seasonal round models'.

For the purpose of organization, these models can be further grouped into three general approaches to the interpretation of the movement and positioning of people in the past. The first approach involves reviewing historic and ethnographic information focusing on the movements and activities of people in various seasons as part of a seasonal round (e.g. Uhlenbeck 1912; Ewers 1955, 1958). This approach overlaps with the second approach, the study of bison ecology, in that these same documents contain information about the movements of bison. The reconstruction of bison movements is viewed as important owing to its influence on prehistoric hunting patterns. The third approach involves a set of techniques that are used to examine material from the archaeological sites themselves. These techniques evaluate faunal remains in terms of morphological changes in animal (esp., bison) anatomy and/or the presence or absence of species which establish the age and/or season of death of an animal. Knowing the age or seasn of the animals death allows one to infer seasonality for the associated archaeological remains. Taken together, a number of contemporary sites of known seasonality can illustrate patterns in the past use of the landscape.

By-and-large all three of these approaches are used in concert. The information in ethnographies, historical documents, and studies of bison ecology tend to be used to model people's movements in prehistory, while the seasonality measures inferred for archaeological sites, as determined from faunal remains, are used to test these models. In order to evaluate the existing seasonal round models used for the northwestern Plains, a review of the literature is appropriate.

MODELS BASED ON ETHNOGRAPHIC DOCUMENTS

The advantage of deriving seasonal round models from ethnographies is that: "...the seasonal round reflects recollections of real persons who lived the life of a mounted buffalo hunter in the Alberta Plains" (Vickers 1991:58). The disadvantage, at least from the perspective of an archaeologist, is that the seasonal round reflects the lifestyle of an historic equestrian people which must differ, to some degree, from prehistoric pedestrian people (Vickers 1991:58). And the circumstances under which the material was originally collected may not be directly applicable to the questions they are being used to address now.

A review of the literature shows there are two exceptional ethnographic accounts of the Blackfoot seasonal round. In 1911, Uhlenbeck (1912) recorded a Blood informant's information on the Blackfeet Reserve regarding the seasonal round. Similarly, Ewers (1955, 1958), largely working in the 1940s, recorded information from a number of informants on the Blackfeet Reserve concerning the seasonal round. These accounts are discussed below.

UHLENBECK

In 1911, C.C. Uhlenbeck (1912:iii) collected a description of a seasonal round from a Blood informant (Kainaikoan) on the Blackfeet Reservation. This account is fairly detailed and describes a wide range of activities that occurred at various times throughout a year.

In this account, the Blackfeet spent the winter on the Marias River where they stayed until the spring (Uhlenbeck 1912:1). Then they set out to over take bison at either the Sweet Grass Hills or the Cypress Hills (Uhlenbeck 1912:1-2). Hides procured at this time were used for lodge covers (Uhlenbeck 1912:2-3). Next, a major summer equestrian bison hunt took place near Pakowki Lake (Uhlenbeck 1912:3) followed by a move to

Manyberries and Buffalo-Head in order to gather berries (Uhlenbeck 1912:4-5). Then, lodge poles were procured from the Cypress Hills followed by a move to Writing-on-Stone to gather more berries. As fall approached the Blackfeet returned to Cut-Bank Creek, a headwater of the Marias River, and cured lodge poles. At first snow fall they moved down the Marias River to see where the bison were wintering (Uhlenbeck 1912:7-8). As above, the Blackfeet split into smaller groups and stayed at various locations along the Marias River valley until spring thaw.

In 1981, Graspointner (1981) provided an interpretation of Uhlenbeck's (1912) record of a Blackfeet seasonal round. He noted that the distance covered by the equestrian Blackfeet seasonal round described by Uhlenbeck was between 400 and 500 miles (Graspointner 1981:87). He suggested pedestrians move half as fast as equestrians, and inferred seasonal round movement by prehistoric pedestrians encompassed between 200 and 250 miles (Graspointner 1981:87).

Also, Graspointner (1981:87-95) attempted to 'convert' Uhlenbeck's (1912:1-9) description of a Blackfeet seasonal round into an analogue for explaining archaeological remains. For example, he felt: "In the Milk River area alone specific archaeological remains have been located which correlate with ethnohistorical seasonal cycles as portrayed by Uhlenbeck" (Graspointner 1981:94).

EWERS

John C. Ewers (1955, 1958) also described the seasonal round of the equestrian Blackfeet in two publications. His ethnographies were based on discussions with elderly informants from the Blackfeet Reservation, Montana, and the Blood Reserve, Alberta (Ewers 1955:xii-xiv, 1958:viii-ix). Importantly, these elderly informants provided Ewers (1955, 1958) with lively accounts of their personal experiences of equestrian Blackfoot life in the late years of the buffalo days.

According to Ewers' informants, the Blackfoot broke into bands and moved to their winter camps, which were staggered along major river vallies, in late October or early November (Ewers 1955:124). "For a Blackfoot camp to have remained on the open plains in winter would have been suicidal" (Ewers 1955:124). Ideally, a winter camp location provided firewood, feed for horses, and water (Ewers 1955:124, 1958:88). The exhaustion of firewood, horse feed, or game necessitated moving the winter camp (Ewers 1955:124). The winter camps moved in late March or early April as river ice broke up and bison were calving (Ewers 1955:126).

Ewer's (1955:126) informants also indicated that March was the month the bison drifted away from the winter camps to the east and northeast. The bands went their separate ways as this was often a period of scarcity; a time when smaller game and late spring roots (i.e., bitterroot and camass) were relied upon to avoid hunger (Ewers 1955:126-127). Bison calves, normally born between the end of winter and the annual May storm, were killed for children's robes and soft skin bags.

Besides the period of winter camps, the longest period of time the Blackfoot tribes assembled all the bands together was during the summer hunt (Ewers 1955:127). In late spring, when berries were in blossom, an announcement concerning the Sun Dance was circulated through the dispersed camps (Ewers 1955:127). The summer hunt began once all the bands had assembled which was usually about early June (Ewers 1955:127). The hunt, of course, provided the bison tongues required for the Sun Dance as well as meat and hides for lodge covers (Ewers 1955:127). The Sun Dance, usually held in the month of August, was timed to coincide with the ripening of sarvisberries and dogfoot berries (Ewers 1955:128).

In the fall, Ewers (1955:128) noted that the Blackfoot focused on bison cows owing to their superior condition compared to the bulls. Fall was the time of the 'great buffalo hunt' when large numbers of animals were killed (Ewers 1955:129). Berries were collected to mix with the meat to make pemmican in preparation for the more severe times of winter when weather conditions restricted activities (Ewers 1955:128). The more successful the hunt the less frequently camps moved (Ewers 1955:128-129).

In summary Ewers (1955:129) stated:

> Some five months were spent in winter quarters. Nearly a month was required for assembly of the tribal encampment in early summer during which the bands that arrived early remained in one locality for several weeks (if the food supply permitted). Eight or ten days were spent in the Sun Dance encampment in

> late summer. The Blackfoot were most 'nomadic' in spring, mid-summer, and fall.
>
> (Ewers 1955:129)

Vickers (1991) applied Ewers' (1955, 1958) ethnographic seasonal round at face value to seasonal assessment data from archaeological sites in Alberta . He concluded that the Late Prehistoric seasonal round was not as simple as commonly assumed (Vickers 1991:65).

For the spring, Vickers' (1991:65) pointed out that the quantity of remains from many archaeological sites suggest small populations, while a few sites indicate aggregations of people at spring kill sites (Vickers 1991:65-66). Given that this pattern did not match Ewer's (1955; 1958) ethnographic model, Vickers asked: "Do these two patterns form part of a single strategy, that is, are they perhaps structured to early and late spring? Or do they represent alternative strategies, triggered by environmental or social factors?" (Vickers 1991:65).

For the summer, Vickers (1991:66) noted that tribal aggregations observed in historic times (i.e., Sun Dance) apparently do not appear in Alberta's prehistoric record. He suggested that the "running" of buffalo by horses utilized level ground not commonly occupied in prehistory (Vickers 1991:66). Further, Vickers (1991:66) observed that medicine wheels, which he considered likely physical manifestations of aggregations for such rites as those found in the Sun Dance, appear to have encampment sites surrounding them that are comparable in size to that of only a band or smaller group.

In discussing events for the fall, Vickers (1991:66) noted the apparent lack of fall kill sites in Alberta while acknowledging Arthur's (1975) evidence for continued communal hunting during the winter, and questioned the role of fall kills in Alberta's prehistory.

For the winter, large winter camps were noted along major river valleys and smaller camps along tributary rivers; Vickers (1991:66) indicated that the large camps tended to be isolated while the smaller camps were more continuously distributed.

MODELS BASED ON BISON ECOLOGY

Attempts to address the seasonal round on the northwestern Plains have often implicated studies of bison ecology (Vickers 1991:55). The interest, of course, is not in the bison themselves but rather the impact their movements had on past people's mobility strategies and settlement patterns (Epp 1988:10; Vickers 1991:55). Because the movement of bison has been illustrated as very influential in past people's livelihoods, the following first briefly reviews literature concerning bison from the natural sciences that is commonly cited by archaeologists, and second reviews the applications of bison behavioural studies in archaeological models. The archaeological models, of course, are designed to model bison migration and, hence, predict the associated movement of people in relation to herd movement.

BEHAVIOURAL STUDIES CONCERNING BISON MOVEMENTS

As alluded to above, a major issue in discussing bison movements concerns the very nature of the movements themselves. In the biological sciences, there has been a debate as to whether bison truly migrated -- moved from one range to another and back (Carbyn et al. 1993:104) -- in the past. There are two basic camps regarding this issue: migrationists and anti-migrationists. Migrationists argue that bison migrated in a largely regular and predictable fashion usually inhabiting the open plains in the warmer seasons and moving to the covered parkland during the cooler seasons. Anti-migrationists argue that bison were very erratic in their movements which, of course, inhibited predicting their location at any one time. The following briefly summarizes the core of the literature in the natural sciences that archaeologists have drawn from to address the issue of bison movements.

MIGRATIONISTS

An early advocate of bison migration was Joel Allen. While Allen (1876) refuted the idea of long migrations between southern Alberta-Saskatchewan and Texas, he did argue that small local migrations occurred. He stated:

> ...a slight movement northward in summer and southward in winter is well attested as formerly occurring in Texas; the hunters report the same thing as having taken place on the plains of Kansas; further north the buffaloes still visit the valley of the Yellowstone in summer from their winter quarters to the southward; along the forty-ninth parallel they also pass north in summer and south in winter; there is abundant evidence also of a similar north and south migration on the Saskatchewan Plains. Yet it is very improbable that the buffaloes of the

> Saskatchewan ever entered on the plains of Texas; and absolutely certain that for twenty-five years they have not passed as far south even as the valleys of the Platte. Doubtless the same individuals never moved more than a few hundred miles in a north and south direction, the annual migration being doubtless merely a moderate swaying northward and southward of the whole mass with the changes of the seasons. We certainly know that buffaloes have been accustomed to remain in winter as far north as their habitat extends.
>
> (Allen 1876:59 in Walker 1974:2)

Importantly, from the perspective of an archaeologist, he also noted:

> The local movements of the buffalo are said to have been very regular, and the hunters conversant with their habits knew very well at what points they were most likely to find them at different seasons. Of late, however, the buffaloes have become much more erratic, owing to the constant persecutions to which they have been for so long a time subjected.
>
> (Allen 1876:61)

Another advocate of bison migrations was William Hornaday. Hornaday (1887:420) proposed marches of 200 to 400 miles between summering and wintering grounds. Hornaday's (1887:424) understanding of bison migrations was that:

> At the approach of winter the whole great system of herds which ranged from the Peace River to the Indian Territory moved south a few hundred miles, and wintered under more favourable circumstances than each band would have experienced at its farthest north. Thus it happened that nearly the whole of the great range south of the Saskatchewan was occupied by buffaloes even in winter.
>
> (Hornaday 1887:424)

Hornaday's response to George Catlin's belief that bison did not migrate, is telling: "Had Mr. Catlin resided continuously in any one locality on the great buffalo range, he would have found that the buffalo had decided migratory habits. The abundance of proof on this point renders it unnecessary to enter fully into the details of the subject" (Hornaday 1887:423). Unfortunately, Hornaday (1887) never did present his evidence for the migratory nature of bison.

Martin Garretson (1938:52) agreed with Hornaday's (1887:424) perspective on bison migrations. Garretson stated:

> The buffalo is classed as a migratory animal. At certain seasons of the year there was a slight general movement north, south, east, and west. Many accounts of these movements are entirely misleading, because greatly exaggerated. There is no reason to believe that the buffalo which spent the summer on the Saskatchewan wintered in Texas. In one portion of the northern country bordering on the mountains there was a decided seasonal migration east and west, the herds tending in the spring away from the mountains while in the autumn they would work back again, no doubt seeking shelter in the rough broken country of the foothills from the cold west winds of winter.
>
> (Garretson 1938:52)

Taking the middle ground was McHugh (1972); he was highly critical of Hornaday's (1887:175) views concerning bison migration which he felt failed to 'stand up to investigation' (McHugh 1972:175). Still, McHugh (1972:177) argued for short seasonal migrations on the northwestern Plains when severe weather 'forced' bison to abandon the open plains and seek the shelter of scrub islands and wooded areas. He noted an account by Henry the Elder (Bain 1969:286) of a sudden winter storm that incited a herd of bison to move to the shelter of a wooded 'island' on the open plains (McHugh 1972:177). McHugh summarized his views:

> On these western Canadian plains, buffalo seeking shelter in wooded zones made a paradoxical fall migration some distance north, and west, in stark contrast to the alleged migrations of plains herds toward the temperate south. Scrub islands bordering open prairie on the north side provided the only significant tree shelter, and thus herds seeking protection from numbing snow squalls were forced to migrate northward.
>
> (McHugh 1972:178)

Even with this concession, McHugh (1972:174) still argued strongly for the unpredictable nature of bison movements.

> And surely the Plains Indians, skilled hunters that they were, would have been the first to discern such rhythmic alterations between summer and winter ranges. Stationing themselves along routes of migrating buffalo herds, they could have slaughtered enough during spring and fall treks to supply their yearly need....But we know that the tribes did not hunt in such a seasonal manner, and furthermore, that they were decidedly nomadic, wandering in irregular patterns across

> the plains, it was the very unpredictability of herd travel that had given rise to their nomadism in the first place.
>
> (McHugh 1972:174)

ANTI-MIGRATIONISTS

Frank Gilbert Roe (1951) is likely the most oft-cited author, at least by archaeologists, concerning the topic of bison movements. This is true whether the archaeologist is arguing 'in favour of' or 'against' migration as Roe's (1951) tome on bison is an invaluable source of historic data on the animal.

On the matter of bison migrations, Roe (1951:521-600) was firmly set against any such proposition. Specifically, Roe (1951:531-542) gave Hornaday and his views of bison migrations a thorough tongue lashing. To summarize his views, Roe (1955:594) stated:

> The mass of evidence presented in this and the foregoing chapters at large is in my opinion fatal to any supposition of a regular or general migration among the species as a whole. The one resultant factor that emerges from our inquiry is the direct antithesis of any conception of regularity; an imponderable, incalculable wholly erratic and unreliable caprice.
>
> (Roe 1951:594)

Roe reiterated this view in a subsequent publication:

> Actually the buffalo were one of the most irregular, erratic, incalculable species that ever trod the earth: most amazingly so, when their truly vast numbers are considered...A regular migration of such vast hosts, following the same great buffalo trail routes each year, crossing the rivers at the same well-known fords, and so forth in the shibboleths of the orthodox, is absolutely unanswerably irreconcilable with the frequent historical occurrence of privation and even famine in the lives of the plains tribes.
>
> (Roe 1955:197)

More recently, Francis Haines (1970) provided a history of the bison and its near demise. He shares Roe's perspective that bison were erratic, so much so that even 'Indian Hunters' were unable to discern their movement habits. He stated:

> Many of the early white explorers and hunters thought the buffalo were migratory animals, moving along definite routes with the changing seasons, northward in summer, southward in winter, but they could not agree on which direction the herds moved at any given time, nor where the migration paths could be found. Other observers were

> equally convinced that the herds did not migrate, for buffalo would have beat out broad roads over their regular routes.
>
> The Indian hunters were intelligent observers of the animal life around them and they paid particular attention to the buffalo, which furnished them with meat and hides so necessary for their basic living. With their very lives depending on a thorough knowledge of the buffalo, the Plains tribes were never able to discover a definite pattern for the herds. They learned that the buffalo were scattered over the entire range throughout the year and that a herd might be found at almost any place at any time.
>
> (Haines 1970:14-15)

Interestingly, the more recent the interpretation, the more likely the author was to propose that bison moved erratically. I will not address these articles any further at this time, however, as the purpose of this section was merely to briefly describe the literature tapped by archaeologists in developing seasonal round models.

ARCHAEOLOGICAL MODELS BASED ON BISON ECOLOGY

As alluded to above, the influence that bison movements had on the human inhabitants of the plains has lead archaeologists to develop numerous models of bison herd movements (e.g., Vickers 1991; Epp 1988). The following presents the nature of ideas in archaeology regarding bison movements and their influence on human settlement patterns.

The tradition of examining bison movements on the northwestern plains with respect to their influence on human subsistence and settlement, although not often explicit, has substantial time depth (e.g., Arthur 1962; Forbis 1960:69, Kehoe 1973; Schaeffer 1962). In the 1960s, questions concerning the influence of bison on Native people's subsistence and settlement were limited as few techniques had been developed to address such issues. For example, in 1961, a 'Symposium on Buffalo Jumps' was held in Billings, Montana. During a round table discussion consisting of some of the most notable archaeologists working on the northwestern Plains (including D.C. Taylor, Joseph Medicine Crow, Claude Schaeffer, Carling Malouf, Richard Forbis, and George Arthur) the question was asked: "Were the buffalo jumps used indiscriminately throughout the year, or were they used more in the spring or the fall, or just whenever they could get a buffalo close?" (Taylor 1962:45). The sole respondent to the question, Joseph Medicine Crow, indicated the Crow Indians often organized jumps at the first snow fall to capitalize on animals in prime condition before 'herds started going south' (Taylor 1962:45). With this precedent, the following reviews models developed since that time concerning the relationship between bison movements and the seasonal round.

OLIVER

In the early 1960s, Symmes C. Oliver (1962) wrote a seminal paper concerning the investigation of the importance of the habits of the bison and their effect on socio-cultural systems of the plains tribes. Oliver (1962:15-18) described the bison's annual cycle and commented on its effect on the socio-cultural systems of the plains tribes. Importantly, Oliver (1962:15) expressed his concern that little attention had been paid to an animal as important as the bison was among plains tribes. In particular he singled out 'the supposed vast annual migrations' of the bison as a poorly understood characteristic. After a review of the annual cycle of the bison, Oliver (1962:17) proposed a model of plains subsistence/settlement:

> The Indian Tribes had to be dispersed in winter and concentrated in the summer. The buffalo were too scattered in the winter months to permit large numbers of people to band together, and the opportunities provided by the dense herds in the summer months were too good to miss, since food was stored at this time for the rest of the year. Moreover, the compact summer herds drew the Indians together for the simple reason that large parts of the buffalo range were without buffalo at this time.
>
> (Oliver 1962:17)

He continued by pointing out that the need for social contraction and then dispersal required a certain amount of societal fluidity (Oliver 1962:17). Solitary hunting allowed people to take the scattered bison in winter, while communal hunting occurred in summer when the bison congregated (Oliver 1962:17).

WALKER

Ernest Walker (1974:1) reiterated Oliver's (1962) suggestion to develop a better understanding of the seasonal nature of bison movements with regards to plains tribes since he regarded it as: "...a problem that must be resolved before a complete understanding of

Plains prehistory can be realized". Walker's (1974) primary concern, however, was to address the common interpretation that large scale bison hunting occurred mainly in the fall (i.e., Frison 1967, 1968, 1970a, 1970b, 1971, 1973). In contrast, he showed that there are numerous ethnographic sources concerning communal kills on the northern Plains that documented winter events (Walker 1974:1-4).

Importantly, Walker's (1974:2) interpretation of bison herd movements emphasised topography. He argued that evidence from ethnographic records suggested: "...that any winter movements [by bison] that did take place were not in any specified direction but rather into a specific type of country -- regardless of direction but wherever shelter might be obtained" (Walker 1974:2).

To further illustrate his point, Walker (1974:4) noted problems with the methodology commonly used for determining site seasonality (i.e., tooth eruption and foetal bone). He also noted that proponents of the fall kill hypothesis had only conducted 'populational studies' to demonstrate their case for two of the five sites they cite as evidence of this trend (Walker 1974:5). He ended his criticisms by suggesting three areas which might shed light on the 'seasonality question' (Walker 1974:5). The study of dental cementum increments was not among his suggestions.

ARTHUR

George Arthur (1974, 1978) reviewed issues concerning bison movements in order to evaluate the notion that the congregation of bison during the rut, in the late summer and early fall, limited large bison kills to this part of the year. Arthur (1978:236-237) noted that numerous authors had suggested the occurrence of fall restricted bison kills including Audubon and Bachman, Wissler, Schaeffer, and Ewers. Like Moodie and Ray (1976), Arthur (1978) relied on fur trade documents to illustrate his position that bison kills occurred throughout the fall, winter, and spring. Arthur used these same documents to address a related issue; whether bison dispersed after the rut, inclining Native people to disband to follow their subsistence base.

Arthur (1978) presented numerous examples from historic documents of winter kill sites witnessed by the likes of William Tomison, Matthew Cocking, Duncan M'Gillvray, Thomas Simpson, and Sir John Franklin. In terms of herd dispersal after the rut, Arthur (1978:239-240) noted examples of large sedentary herds in historic documents by Fidler, Henry, and Steele, in ethnographic accounts by Grinnell, and in observations of modern herds by Cahalane, Soper, and Nelson. Having illustrated that bison drives occurred throughout the winter and that herds did not disperse after the rut, Arthur (1978:240-242) also illustrated that large winter camps existed amongst the Native people of the northwestern Plains. As before, historic documents by Fidler, Henry, McDonnell, Cocking, and DeSmet were used to illustrate Native winter encampments.

He concluded:

> Therefore, among the Assiniboine, Blackfoot, Cree, and Gros Ventre, we may conclude that:
>
> 1) Bison jumps and pounds were used by these tribes not only in the fall, but throughout the winter as well.
>
> 2) In early fall, the bison moved onto their winter range where they tended to form larger, sedentary herds, although smaller herds were also scattered over the range.
>
> 3) These larger sedentary herds permitted the formation nearby of large Indian encampments of 1000 to 2000 people who exploited these herds during the fall and winter months using the traditional bison drives.
>
> (Arthur 1978:242)

MOODIE AND RAY

D.W. Moodie and A.J. Ray (1976) addressed the nature of bison movements as an avenue to solving the problems of prehistoric settlement patterns. Like Oliver (1962:15) before them, they noted the importance of bison to human life on the plains and the paradoxical lack of consideration of the animal's movements as an influence on the plains tribes who largely subsisted on the bison (Moodie and Ray 1976:45, see also Oliver 1962:15).

They proceeded to address this oversight. First, they reviewed previous historical investigations of bison movements by 'anti-migrationists' Roe (1951) and Haines (1970) and 'migrationist' McHugh (1972). Moodie and Ray (1976:46-51) continued by presenting additional historical documentation, including records from the Hudson's Bay Company and missionaries, that illustrated regular bison movements. They argued that while there were local variations in bison movement, there were much larger regional patterns of movement, and these local levels of movement led some scholars to view bison movements as erratic (Moodie and Ray 1976:46).

The regional pattern supported by their research: "...involved a generally northward movement into the parkland belt in winter and, in spring, a southerly exodus into the open prairie" (Moodie and Ray 1976:46). Moodie and Ray (1976:49-51) documented local variation in this regional pattern caused by winter temperature conditions, snow conditions, fires, and hunting pressures. Mild temperatures allowed bison to remain on the open plains; too much snow prevented bison from reaching the parkland; the massing of Native people for an attack prevented bison from reaching the parkland; and prairie fires initially destroyed pastures leaving them void of food only to later be attractive to bison during re-growth (Moodie and Ray 1976:49-51). They conclude that there was little doubt that bison movements were regular enough to be considered migratory as the animals moved into the parkland in winter for shelter and back onto the plains in summer (Moodie and Ray 1976:51).

QUIGG

Based on foetal bone excavated from sites in the Belly River area of southern Alberta, J. Michael Quigg (1978) contended that winter was an active season for communal hunting. He concurred with migrationists in that the evidence suggested: "...that bison populations moved toward the foothills regions along the western border of southern Alberta when the weather became progressively colder" (Quigg 1978:53). Following Arthur (1978), Quigg (1978:54) argued that bison herds did not disperse after the rut and that large encampments of Native people were possible.

Interestingly, however, Quigg (1978:55) noted evidence for both large and small aggregates of Native people in the ethnographic literature. He concluded by providing evidence of both large and small winter kill sites, based on foetal bone, along the foothills of southwestern Alberta (Quigg 1978:55-57).

KEYSER

James Keyser (1979) examined numerous sites (n=106) around the Fresno Reservoir, north-central Montana. He interpreted economic activities at these sites as including communal bison procurement, generalized hunting and collecting, and travel through the area (Keyser 1979:140). Based on the functional interpretations of the sites, Keyser (1979:140-146) proposed a seasonal round model for the north-central plains of Montana.

Most importantly, from the perspective of the current research, he suggested:

> ...in north-central Montana as in other areas of the Northwestern Plains (Frison 1973a:79-80), fall communal bison procurement was the most significant annual economic activity, since it was by communal procurement that groups obtained provisions for winter survival. Although bison were exploited year round, bison hunting during most of the year was an individual or small group activity. Only during the fall was communal bison procurement a practical alternative.
>
> The pattern of archaeological sites in the Fresno Reservoir study area indicates that fall communal bison procurement was the major attraction of this portion of the Milk River for prehistoric groups. The numerous bison kill sites situated in the badland river breaks along the southwestern side of the Milk River valley attest to its importance.
>
> (Keyser 1979:140-141)

Seasonal estimates for sites were arrived at through the assessment of bison mandibles using tooth eruption patterns (Keyser 1979:141). A brief review of local ecology was presented to explain the congregation of bison in this area of the Milk River during the late summer and early fall (Keyser 1979:143).

Keyser (1979:144) further suggested that during the bison "off-season", between December and August, small single- or multiple-family economic units would hunt non-bison animals and gather plant food resources. These small groups would move: "...regularly but not too often..." focusing their efforts in treed coulees and foothills (Keyser 1979:144). For Keyser (1979:145), the open plains were mainly exploited as a result of travelling along watercourses from upland areas; still, on occasion an area had sufficient resources for prolonged encampment.

MORGAN

Grace Morgan (1979, 1980) approached the issue of bison movements from an ecological perspective. For her, "...bison behaviour does not operate independently but is a predictable response to a range of ecological influences" (Morgan 1980:143). Reconstructing the prehistoric environment on the northern Plains based on the modern vegetation, Morgan (1979:113-164; 1980:147-155) modelled the annual cycle of bison populations as predictable responses to growth patterns in vegetation.

The implication for bison movements of Morgan's research on vegetative communities is that:

> Generally on a year-long basis, the availability of superior forage appears to be the major stimulus of pronounced bison movement patterns. In spring, the availability of new spring grass prompts major movements of herds onto the exposed grassland areas of the wintering range. The emergence of new spring growth of *Bouteloua gracilis* stimulates major movements onto the summer range. In fall, movements onto the winter range are initiated by the attraction of grasses that are still green and highly nutritious. A co-determinant of fall movement patterns is the availability of water. After winter snows, if weather conditions are favourable, significant herd movements onto the open grassland area occur as water resources are no longer a restrictive factor. Major winter movements are prompted primarily by the need of shelter, but, the availability of grasses of high forage capacities in association with these areas is an essential requirement.
>
> (Morgan 1980:156)

In concluding, Morgan (1979:143-146; 1980:158) stated that the aforementioned annual cycle produced a convergence of bison on the summer range, with bison dispersing into smaller herds such that there was relatively little space between herds, and a divergence of bison on the winter range, with herds amalgamating into larger groups leaving large intervening areas with no bison.

GORDON

In his monograph entitled <u>Of Men and Herds in Canadian Plains Prehistory</u>, Bryan Gordon (1979) attempted to provide evidence for the association of individual bands with individual bison herds. Relying heavily on Morgan's (1978) ecological evidence for the migratory and, therefore, predictable behaviour of bison, Gordon (1979:21-39) augmented this evidence for bison migration with historical evidence and analogies from other herd animals (esp. caribou).

In short, his model suggested: "Bison had to migrate for survival, their range and timing governed by the types and locations of grasses" (Gordon 1979:38). Bison summered on the Xeric Mixed Prairie, then travelled through the Mesic Mixed Prairie in the fall on their route to their wintering grounds in the Fescue Prairie, and returned in the spring to the Xeric Mixed Prairie via their previous fall route through the Mesic Mixed Prairie (Gordon 1979:21-39). At one point in his reconstruction of bison behaviour, Gordon (1979:22) interestingly stated: "In August and September the western population [of bison] is assumed to have rutted in a large arc along the Fescue and Mesic Mixed Prairie interface from southwestern Alberta east, between the North and South Saskatchewan Rivers to southeast Saskatchewan". Unfortunately, Gordon (1979:22) did not elaborate his reasoning concerning this topic. Similarly, in terms of calving locations he suggested "...each bison population had a large general territory based upon winter calving at chosen locations in juxaposition to the Mixed grass prairie in summer" (Gordon 1979:23, 34).

While his goal to illustrate discrete-band/discrete-herd associations was not fully realized, Gordon (1979:75-81) noted numerous approaches that might assist in resolving this issue. Most notably he outlined the need for the analysis of site seasonality including foetal analysis, tooth eruption and wear, and dental cementum increment analysis (Gordon 1979:75). He stated: "Seasonality studies on sites and the seasonal makeup of toolkits on these sites may provide the tools to revise and correct the prehistoric bison migration model presented here" (Gordon 1979:81).

HANSON

Working from North Dakota, Hanson (1984) regarded previous research concerning the bison migration problem as: "...advancing a cultural ecological approach [in which] the behaviour and seasonal dynamics of bison were intricately connected to specific manifestations of Plains Indians settlement patterns, subsistence patterns, and social structure" (Hanson 1984:93). Hanson (1984:1984) used modern ecological studies of bison, historical documentation of bison in their natural habitat, and modern environmental studies to model prehistoric bison ecology in North Dakota.

Hanson's (1984:111) reconstruction of bison ecology for North Dakota suggested that the tallgrass, transition, and mixed grass prairies held the potential for year-round bison subsistence. He argued that bison made unpredictable migrations between these different prairie regions as a response to both natural and cultural stimuli (Hanson 1984:111).

CHISHOLM, DRIVER, DUBE, and SCHWARCZ

Chisholm et. al (1986:193) provided a reconstruction of bison movements on the northwestern Plains: "...through collection and analysis of empirical data from a large region". Their hypothesis was: "If the isotopic characteristics of forage vary from one vegetation type to another [i.e., parkland vs. open grasslands], and if the tissues of consumers reflect those characteristics, then this model can be tested through isotopic analysis of bison from archaeological sites located within different vegetational zones" (Chisholm et al. 1986:196). They found that bison kills in Alberta had isotopes indicating consumption of C^4 plants with little or no C_4 plants. They inferred the bison had moved from an area with C_4 plants to a kill site lacking C_4 plants.

BAMFORTH

Bamforth (1987) isolated two problems regarding recent attempts to understand bison ecology. First, he indicated that attempts to understand bison migration had not acknowledged factors which lead bison to migrate (Bamforth 1987:1-2). Second, he suggested that the encroachment of Western Civilization in the eighteenth and nineteenth century had not been seriously considered as a disruption to bison behaviour. He discussed these two issues from the perspective of ecological data gathered from studies of modern ungulate adaptations on the Serengeti of Africa (Bamforth 1987:2).

Bamforth (1987:3) noted three reasons that large herbivores migrate, including: 1) to search for other members of their species, 2) to search for food and water, and 3) to escape dangerous or uncomfortable circumstances. In terms of the search for food and water, Bamforth (1987:4) established that the distribution and quality of forage are important factors influencing large ungulate migrations. Further, he suggested aggregations of animals would be expected when forage productivity is highest and dispersion of animals would be expected when forage productivity is lowest (Bamforth 1987:4). Similarly, he suggested aggregations of animals would be expected when water distributions were restricted while a dispersed distribution of water (e.g., snow) would disperse animals (Bamforth 1987:3, 1988:42-52).

Bamforth (1987:12) also suggested that encroachment of Western Civilisation during the Historic Period disrupted bison herd sizes and migration patterns. He illustrated this disruption with historic data suggesting bison tended to aggregate in larger, more widely spaced, more mobile herds, which possibly migrated erratically and avoided areas of permanent white settlement..." (Bamforth 1987:12). Bamforth (1987:13) warned that historic documents can be misleading if not placed in the proper context (i.e., white settlement disrupted bison migrations).

EPP

Based on observations made on gregarious bovines, Henry Epp (1988:310) proposed a dual dispersal model in which small bison herds remained sedentary in woodland and ecologically varied habitats while the majority of bison migrated from a winter habitat in the woodland to a summer habitat on the grasslands. Epp (1988:312-315) briefly described how the dual dispersal model of bison behaviour could account for both Morgan's (1979, 1980) migration model and Hanson's (1984) non-migration model. He then discussed the cultural implications of this model. He inferred that: "Knowledge of this dispersion behaviour leads directly to a human settlement hypothesis which stresses the advantages of locating habitations in topographically anomalous, wooded environments on the Plains grasslands in order to take advantage of a reliable bison supply and a high variety of vegetal and other animal resources which tended to concentrate in such places" (Epp 1988:317).

REEVES

Brian Reeves (1990:171) considered: "Life in the Northwestern Plains was tethered to the seasonal movements and behaviour of the bison, on which natives relied for most of their material needs". He noted that October to May was the overwintering period during which time the bison herds ranged along the western and northern edges of the plains and uplands such as the Cypress Hills in southeastern Alberta and the Black Hills in westcentral South Dakota (Reeves 1990:171). Reeves (1990:171) contended that historical and ethnographic evidence indicated communal hunting occurred in these areas throughout the fall, winter, and spring. Importantly, Reeves (1990:172) noted that firewood was a critical resource around which campsites were located in the overwintering period; depletion of firewood required the campsite to relocate. Interestingly, Reeves (1990:172) considered spring to be an important time for laying up 'stores' such as pemmican for times of scarcity or scheduling conflicts.

In contrast, for the summer Reeves (1990:172) considered water to be the critical resource as bison were located out on their summer range on the shortgrass plains. The most important economic activities in summer involved plant and lithic collecting; he noted scheduling becomes an issue as the location of these items were not always within close range of bison herds (Reeves 1990:172). The Sun Dance, the most important spiritual activity of the year occurred about mid-summer (Reeves 1990:172).

CLOW

Clow (1995) addressed the fact that, in the spring of 1832, Lakota hunters apparently took fourteen hundred bison tongues in a single kill along the Middle Missouri River valley (Clow 1995:259) and that this event lead many to suggest overhunting was a principle cause in the absence of bison the following winter in the Middle Missouri valley (Clow 1995:259). Clow (1995:259) contended that weather patterns, not over-hunting, caused the scarcity of bison along the Middle Missouri in the winter of 1832/1883.

Clow (1995:260) subscribed to the idea that, in a normal year, bison moved to the river valleys in winter for shelter from the cold. He supported this notion by citing numerous historic documents (Clow 1995:260-261). He stated:

> For hunters, cold, snowy, windy winters provided the best bison hunting opportunities. The cold and snow forced the bison to congregate and drove them toward the shelter of the river bottoms.

> Under conditions that prevailed during most winters, the hunters were able to plan their hunts with some degree of certainty.
> (Clow 1995:262)

The return of bison to this area of the Middle Missouri River valley was marked by a seasonably cold winter in 1834 (Clow 1995:266). Clow (1995:267) also noted that the Lakota and Yankton practiced an 'intercept approach' to hunting bison as they did not break into small winter camps but gathered into larger camps awaiting the bison at the Middle Missouri River valley.

BRUMLEY

John Brumley (1995) addressed the problem of subsistence and settlement on the northern plains by determining the seasonal use of archaeological sites using tooth eruption and wear and foetal bone. The sites used in the analysis were located in southern Alberta (with a focus at the Oldman River Reservoir) and northcentral Montana. Significantly, he noted that: "...the dataset presented represent the largest single body of seasonality data presently available for the study area (Brumley 1995:64).

In total, Brumley documented seasonally sensitive bison elements from twenty-nine sites of which twenty-two were interpreted to be communal kills. Geographically, river valleys contained 13 of the sites, major wooded streams contained 16 of the sites, mountain range isolates contained 1 site, rough broken terrain contained 4 sites, and the open plains contained 4 sites (Brumley 1995:6).

Most interestingly, Brumley's analysis of Pelican Lake phase material from the Oldman River Dam area suggested there were two different cultural groups with complementary seasonal uses of the area. He stated: "Based on the pattern of seasonal use, high frequencies of distinctive lithic raw material derived from sources in southeastern British Columbia, and ethnographic analogues [i.e., Kutenai], the writer here interprets the Smythe site deposits as largely reflecting groups primarily resident in southeastern British Columbia who travelled seasonally through the Crowsnest Pass to hunt bison on the plains [in the summer] immediately east of the mountain front within the area of the Oldman River Dam" (Brumley 1995:66). Other Pelican Lake phase material was attributed to local groups whose seasonal movements took them away from this area in the summer (Brumley 1995:67).

Importantly, Brumley (1995:67) noted that the largest sample of seasonality data in the Oldman River Dam project came from the Old Women's phase (and the Prairie/Plains Complex). He noted that the area was extensively used by the aforementioned cultural group fairly intensively in all seasons except summer, when use was apparently low. However, the summer use of the Oldman River Dam area did appear to be more common in the Protohistoric Period. Brumley (1995:68) also indicated that the use of the Oldman River Dam area showed a marked or abrupt increase with the onset of fall and an abrupt termination in late spring. He contrasted this with the Saddle Butte phase (considered Old Women's phase here) at the Wahkpa Chu'gn site, in north-central Montana, which he interpreted to represent the gradual and consistent increase in site use through fall and winter. A number of hypotheses regarding this difference were expounded (Brumley 1995:68).

Lastly, Brumley (1995:69) recognized that from late fall to mid spring communal kill sites were used at similarly high frequencies while from late spring to late summer such sites were used much less frequently. Still, he realized that the sample was biased towards communal kill sites and that campsites, etc., were poorly represented (Brumley 1995:69). An expanded version of this analysis has been produced with similar interpretations (see, Brumley and Peck 2000)

MALAINEY AND SHERRIFF

Malainey and Sherriff (1996:336, see also Malainey et al. 2001:142-144) used historic documents and archaeological site data to illustrate that bison, and the hunters that stalked them, wintered on the plains. Their position is contrary to most scholars who have argued that both bison and bison hunters moved to the shelter of the parkland in winter (see above).

Malainey and Sheriff (1996:336-341) first use historic documents to establish the extent of the parkland belt prior to substantial European settlement in the late 1800s (Malainey and Sherriff 1996:336-341). Having delimited the plains and parkland, historic records were then presented to support the idea that bison wintered on the plains. The authors concurred, however, that in instances of severe storms bison would retreat from the open plains and enter more sheltered areas (Malainey and Sherriff 1996:346). Malainey and Sherriff (1996:346-348) further supported their position by providing evidence from historic documents of winter encampments of Native people on the plains. Archaeological site data, as evidenced in tooth eruption studies and the presence of foetal bone, was also presented to illustrate that Native people camped on the open plains in winter (Malainey and Sherriff 1996:348-351).

PECK

In 2000, Trevor Peck, the author of the current research, presented a conference paper suggesting that prehistoric bison produced the majority of their wallows (i.e., circular to oval depressions in the ground) during physical displays associated with their mating period (i.e. the rut). Then, Peck (2000) suggested that it followed that the location of the bison wallows indicated the position of bison herds during the rut which occurred between mid July and the end of September (Branch 1929:6-7; McHugh 1958:23, 1972:191; Meagher 1973:76-77). Thus, by working on the inference that bison wintered in the parkland and summered on the plains, the location of wallows, either historically documented or remnants currently in the modern landscape, should be located around the periphery of the plains where bison engaged in the rut as they began leaving the plains and headed towards the parkland in late summer and early fall.

This approach is a departure from the other studies of prehistoric bison movements as it focuses on a specific bison behaviour in relation to an annual cycle of bison behaviours. Because this approach provides a different perspective from previous attempts to present bison movements, and because this is pursued for the remainder of this research (see, Chapter Four), Peck's (2000) hypothesis will be presented and further developed.

Previously, Gordon (1979) alluded to the possible significance of the geographic distribution of the bison rut. Working on the inference that bison wintered in the parkland and summered on the plains he stated: "In August or September the western population [of bison] is assumed to have rutted in a large arc along the Fescue and Mesic Mixed Prairie interface from southwestern Alberta east, between the North and South Saskatchewan Rivers to southeast Saskatchewan" (Gordon 1979:22). Unfortunately, Gordon (1979) did not explain his reasoning nor did he elaborate on this hypothesis.

A review of historic documents suggests the distribution of bison wallows do form an arc around the periphery of the northern plains. The geographic distribution and proposed timing of formation of these features supports models in which large herds of bison moved into the foothills and parkland during cooler months, stopping at the edge of the plains during the rut, moved back onto the plains proper in warmer months, and perhaps gave birth to young in the same geographic area in which the young were conceived.

To substantiate this model, first, the predominance of wallowing during the rut will be established in the behaviour of modern bison by reviewing current literature in the biological sciences. Then, the distribution of bison wallows and rutting behaviour recorded in historic documents will be reviewed to illustrate the aforementioned patterned geographic distribution of wallows. Then, a review of Native oral tradition indicates that wallows are often associated with rebirth. Thus, the distribution of bison calving locations are illustrated to roughly co-occur with the distribution of wallows at the plains-parkland interface.

Modern Bison Studies and the Correlation Between Wallowing and Rutting

From studies of modern animals, substantial information concerning bison wallows exists that supports the proposed model of bison behaviour during the rut. Numerous authors have noted that bison like to scratch against objects or by rolling on the ground (e.g., Grinnell 1892:273-274; McMillan et al. 2000; Park 1969:61-62; Roe 1951:842). Not surprisingly, a large amount of scratching occurs at the end of winter as bison are shedding their winter coats (Reinhardt 1985) and insects are becoming numerous (McMillan et al. 2000). Some research correlates this behaviour with increased wallowing (Reinhardt 1985; McHugh 1972:197; McMillan et al. 2000; Park 1969:62-65; Roe 1951:100: Hornaday 1887:418).

Yet, there are two flaws with this view. First, as McHugh (1972:197) notes: "Only the bull buffalo engages in this increased wallowing at this season. Since insects hover over the entire herd, one wonders why the molting cows should be exempt from the attack". A number of researchers concur with this interpretation (e.g., Bowyer et al. 1998; Garretson 1938:34; Park 1969 62-65; Seton 1953:286; Mooring and Samuel 1998:699). For example, Bowyer, Manteca, and Hoymork (1998) observed that: "All age classes of bison wallowed, but only large males ('/. 5 years old) wallowed more often than their proportional occurrence in the population" (see also Hornaday 1887:418). Second, three independent studies (i.e., McMillan et al. 2000; Mooring and Samuel 1998; Reinhardt 1985) and numerous more anecdotal lines of evidence (e.g., Seton 1953:286; Park 1969:77) suggest the maximum frequency of wallowing occurs during July and/or August and/or September. This is a time well after the shedding of the winter coat and the hatching of insects (Roe 1951:100).

The nature of bison wallowing during the rut is reasonably well described in the literature. Concerning the initiation of the rut, McHugh (1972:191) states: "The excitement begins slowly, as a restlessness spreads through the herds. First the cows clump together in larger gatherings, to be joined by bulls straggling in from their own bachelor herds, which are now beginning to dissolve." Then: "Normally aloof, the bulls now tend to push one another around a lot, sniff at cows, bellow often, wallow much more frequently than seems necessary, repeatedly horn the ground or trees and bushes, and in general act aggressive with or without cause" (Park 1969:77).

"During each summer's rutting season, the bulls of a herd, by bluff or battle, arrange themselves into an order of dominance that serves to divide the 'spoils' of the rut. To the top ranking male goes the first cow in heat; bulls with lower status get a chance at breeding only if more than one cow is available at a time. Bull one is dominant over bull two, who is dominant over bull number three, and so on down the scale, until the organization becomes a distinct class structure" (McHugh 1972:160).

"When a dominant bull faces a challenger, a ritual seemingly determines the actions of both animals. First the dominant bull stands and gives the challenger a hard look" (Park 1969:15-16). "If this challenger is not intimidated, the bull then begins to shake his head, as if reminding his opponent that he has horns and knows what to do with them, much as a boxer shadow-boxes or a wrestler flexes his muscles. The next step is snorting and pawing the ground, and possibly a certain amount of wallowing..." (Park 1969:15-16).

Variations on this rutting behaviour are known. For example:

> [Ed Park]...once watched a lone bull in Wood Buffalo National Park exhibit typical rutting season behaviour. He was definitely in an aggressive mood as he walked along the border of the timber; now and then he would hook a small tree or bush with a horn, easily breaking it or stripping the limbs off. Periodically he would tip his head up and bellow as he went, moving faster than the normal lazy gait of the bison. At one point he paused at a recently used wallow, sniffed the ground a few seconds, urinating on the spot, and then proceeded to kneel and rub his head and horns in the damp area ...
>
> (Park 1969:79)

During these encounters it is important to note where the animals actually produce their wallowing displays. Rutting bulls will use established wallowing craters if they are on hand. For example, Meaghers (1973:104) reported that buffalo are well known to reuse old wallows, they will wallow almost anywhere, for the desire to wallow apparently outweighs the choice of location. "Thus when advancing toward a competitor, a bull will wallow right on his line of march instead of searching for a suitable patch of bare ground" (McHugh 1972:198)

As alluded to above, another strange quirk of wallowing activity of rutting bulls is the tendency to feebly urinate during displays (McHugh 1972:198; Bowyer et al. 1998:84; Park 1969:79). McHugh (1972:198) argues this is a typical response triggered by conflict associated with a pattern of pawing, wallowing, and horning, he states: "So far as we know, urinating in the buffalo bulls remains primarily related to conflict and tension, as does the whole pattern from a rival while courting his mate, confronting a strange herd, or approaching another bull. So automatic is the response that the moment two solitary bulls wander into each other's view, they may paw and wallow simultaneously" (McHugh 1972:198). Bowyer et al. (1998:86) suggest that urination may allow dominant males to signal their good physical condition and intimidate rivals and/or it may initiate the priming of oestrus females.

As an aside, Bowyer et al. (1998) also note that female bison rub trees, or scent mark trees, much more frequently than other bison during the rut (see also, Coppedge and Shaw 1996). They suggest that as females enter the rut they advertise oestrus by rubbing trees. The function of the rubbing activity, they suggest, is to aid males searching for a mate.

Furthermore, the male urination in wallows may form a return signal to the females. Bowyer et al. (1998:88) then ponder: "Why trees are an important component of scent marking in a species adapted to a grassland environment is uncertain. Certainly, bison would have encountered scattered trees in the prairies (Higgins 1986), and perhaps the rarity of trees help to further attract the attention of conspecifics to the mark." Under the current model, the significance of scent marking trees is related to the expectation that the rut occurred in locations geographically around the periphery of the plains near to outcrops of trees which provide females places to advertise their receptiveness. That is to say, the model presented here predicts that bison rut in an arc around the periphery of the plains next to the parkland, thus, in a position for females to use the nearby trees for scent marking.

Once males have competed for access to the females, McHugh (1972:192) notes: "Certain bulls court their cows so attentively that the couples ramble about the meadows like so many clockwork toys. Rival bulls hover, irritable and restless, at the fringes of the activity, wallowing at intervals, stirring up plumes of dust that spiral hazily into the hot, still air". Similarly, Callenbach (1996:14) notes the wallowing of rival or defeated animals.

Valerius Geist (1996:52) provides a synthesis of rutting behaviour amongst bison. Geist (1996:52) argues that:

> Whatever protection from biting flies the mud gives the bull's near-naked rear-half, wallowing was primarily a social ritual among the bison bulls. If one bull started to wallow, the most dominant bull was sure to come and displace him. In essence, wallowing before a rival or females is a method of "display". Hence, a dominant bull leaving his wallow was followed by another bull, and another, until the whole herd had used the same wallow [see also, Bowyer et al. 1998:83-84; Catlin 1995:281-282; Grinnell 1892:273]. The wallow was enlarged and deepened as each bull carried mud in its coat, and wallows became prominent features of the landscape that outlived the expiration of bison by decades.
>
> (Geist 1996:52)

Modern wallows produced by captive herds tend to be fairly small in size, roughly oval. ranging from a minimum of six ft. along the long axis but can be eight to ten times this large (e.g., Lott 1974:388, see also Meagher 1973:77). However, wallows reported in historic documents, when bison were free ranging tended to be larger in size. George Catlin (1995:281-282) described wallows of fifteen to twenty feet in diameter and two feet in depth created within a half an hour by a hundred or more animals. Similarly, Grinnell (1892:273) stated that: "...wallows were formed by the rolling of a succession of buffalo in the same moist place, and were often quite deep. Gard (1960:17) noted that: "The ordinary wallow that the buffalo bulls pawed and gouged out was eight to twelve feet across and but two feet deep. Some depressions, used by many of the animals in turn and scooped out by the winds, might be twenty feet or more across and considerably deeper than smaller ones".

Historic Documents Concerning the Geographic Location of Wallows

The following presents historic documents in which wallow locations are noted on the northwestern Plains (see Figure 1, see Figure 4 for a map of historic locations).

In July of 1869, north of Last Mountain Lake, Isaac Cowie noted the formation of wallows by innumerable bison.

> We followed the trail leading to Touchwood Hills for about half a day and then headed northwesterly towards the north end of Last Mountain Lake, round which we went and then fell with buffalo innumerable. They blackened the whole country, the compact, moving masses covering it so that not a glimpse of green grass could be seen. Our route took us into the midst of the herd, which opened in front and closed behind the train carts like water round a ship, but always leaving an open space about the width of the range of an Indian gun in our front, rear and flanks. The earth trembled day and night, as they moved in billow-like battalions over the undulation of the plains. Every drop of water on our way was foul and yellow with their wallowing and excretions.
>
> (Cowie 1913:373-374)

On August 1, 1806, near the Missouri Coteau between the Missouri River and the Souris River, Alexander Henry noted bison 'tearing up the ground' in the rut. This is not unequivocal evidence of wallowing, as it could refer to pawing which is often a prelude to wallowing, or other behaviours.

> The buffalo, now at the height of the rutting season, kept bellowing all night. During this season they are in continual motion day and night, scarcely allowing themselves time to feed; several herds passed quite near our camp, bellowing and tearing up the ground. The bulls at this period are very fierce; they often turn upon a man and pursue him for some distance.
>
> (Coues 1965 Vol. I:407)

On September 5, 1774, on the North Saskatchewan River, Anthony Henday noted the movement of bison away from the river: "The Buffalo have taken the route upwards, and is the reason we have not yet met the Archithinue Natives" (Burpee 1973:25). To this his editor added: "This was always a favourite route of the buffalo, whose deep-worn trails and wallows may still be seen along the banks of the North Saskatchewan" (Burpee 1973:25)

On October 9, 1772, near the Eagle Hills, Matthew Cocking remarked on numerous places where bison had wallowed which he specifically stated as formed during the rut: "All over the country where the Buffalo resort are many hollow places in the ground, made by the Bulls in the covering season" (Burpee 1908:108). The end note concerning the phrase "hollow places in the ground" reads: "Buffalo wallows-they rolled in the wallows until caked with mud and so found protection from the assaults of flies and mosquitoes" (Burpee 1908:108). Cocking's travels on the plains largely kept him within the Forks of the Saskatchewan and around the Eagle Hills and Bear Hills area. Thus all his comments likely rely on this experience. Importantly the area Cocking covered in his travels is located around the periphery of the plains.

In August or September, near the mouth of the Teton River on the Upper Missouri, George Catlin observed typical bison rutting behaviour. He stated:

> The 'running season', which is in August and September, is the time when they congregate into such masses in some places, as literally to blacken the prairies for miles together. It is no uncommon thing at this season, at these gatherings, to see several thousands in a mass, eddying and wheeling about under a cloud of dust, which is raised by the bulls as they are pawing in the dirt, or engaged in desperate combats, as they constantly are, plunging and butting at each other in the most furious manner (Fig. 105: pg 226-227). In these scenes, the males are continually following the females, and the whole mass are in constant motion; and all bellowing (or "roaring") in deep and hollow sounds; which, mingle altogether, appear, at the distance of a mile or two, like the sound of distant thunder.
>
> During the season whilst they are congregated together in these dense and confused masses, the remainder of the country around for many miles, becomes entirely vacated; and the traveller may spend many a toilsome day, and many a hungry night, without being cheered by the sight of one; where, if he retraces his steps a few weeks after, he

will find them dispersed, and grazing quietly in little families and herds, a fair representation will be seen in Fig 106 (pg 226-227), where some are grazing, others at play, or lying down, and others indulging in wallows. A bull in his wallow is a frequent saying in this country; and has a very significant meaning with those who have ever seen a buffalo bull performing ablution, or rather endeavouring to cool his heated sides, by tumbling about in a mud puddle.

In the heat of summer, these huge animals, which, no doubt, suffer very much with the heat profusion of their long and shaggy hair or fur, often graze on the low grounds in the prairies, where there is a little stagnant water lying amongst the grass, and the ground underneath being saturated with it, is soft, into which the enormous bull, lowered down on one knee, will plunge his horns, and at last head, driving up the earth, and soon making an excavation in the ground, into which the water filters from amongst the grass, forming for him in a few moments, a cool and comfortable bath, into which he plunges like a hog in his mire.

In this delectable laver [sic, lather], he throws himself flat upon his side, and forcing himself violently around, with his horns and his huge hump on his shoulders presented to the sides, he ploughs up the ground by his rotary motion, sinking himself deeper and deeper in the ground, continually enlarging his pool, in which he at length becomes nearly immersed; and the water and mud about him mixed into a complete mortar, which changes his colour, and drips in streams from every part of him as he rises to his feet, a hideous monster of mud and ugliness, too frightful and too eccentric to be described!

It is generally the leader of the herd that takes upon him to make this excavation; and if not (but another one opens the ground), the leader (who is conqueror) marches forward, and driving the other from it, plunges himself into it; and having cooled his sides, and changed his colour to a walking mass of mud and mortar; he stands in the pool until inclination induces him to step out, and give place to the next in command, who stands ready; and another, and another, who advance forward in their turns, to enjoy the luxury of the wallow; until the whole band (sometimes a hundred or more) will pass through it in turn; each one throwing his body around in a similar manner; and each one adding a little to the dimensions of the pools, while he carries away in his hair an equal share of the clay, which dries to a grey or whitish colour, and gradually falls off. By this operation, which is done, perhaps, in the space of half an hour, a circular excavation of fifteen or twenty feet in diameter, and two feet in depth, is complete, and left for the water to run into, which soon fills it to the level of the ground.

(Catlin 1995:280-282)

The following presents historic documents in which the occurrence and location of rutting activity is noted but wallowing is not specifically noted (see Figure 1). In some of the examples below, the occurrence of bellowing is used as a cue that the rut had commenced. This inference is not unreasonable given Catlin's (1995:280-282) association of bellowing and the rut coupled with recent research that indicates the rut is usually accompanied by unmistakable bouts of fighting and bellowing (Berger and Cunningham 1991; Gunderson and Mahn 1980:379).

On July 15, 1810, on the North Saskatchewan River, Alexander Henry relayed information from a co-worker who spotted rutting bison a distance to the south in the Beaver Hills. Henry wrote: "He [La Boucane] saw plenty of buffalo on his way [from the Beaver Hills], now rutting and perpetually in motion" (Coues 1965 Vol. II: 614).

On September 9, 1800, near the confluence of the Red River and the Park River, Alexander Henry heard the bellowing of rutting bison: "Everything was quiet during the rest of the night, except the bellowing of buffaloes in every direction and the whistling of Red Deer" (Coues 1965 Vol. I:93).

Again, on July 15, 1806, southeast of Moose Mountain, Alexander Henry noted the bellowing and rutting of bison: "We had seen buffalo in great numbers westward of us, and as they were just entering the rutting season, they made a terrible bellowing during the night" (Coues 1965 Vol. I:308).

On July 10, 1805, near the confluence of the Shishequaq and the Medicine River, Captain Lewis noted vast numbers of bison and remarked that 'in this season' they are continuously bellowing. He stated: "We saw vast numbers of buffalo below us, which kept a dreadful bellowing during the night." (McMaster 1904 Vol. III:172-3). The next day, July 11, 1805, he made a similar statement: "...but in this neighbourhood the buffalo are in such numbers, that on a moderate computation, there could not have been fewer than ten thousand within a circuit of two miles. At this season, they are bellowing in every direction, so as to form an almost continued roar, ..." (McMaster 1904 Vol. III:172-3).

On July 27, 1806, near the mouth of the Bighorn River, Captain Clark's party noted the occurrence of large numbers of bison, the occurrence of the rut, and continued bellowing. Importantly, this description of the rut is accompanied by a vivid description of the location it occurred in -- near the plains-parkland interface.

> On the left side the river runs under cliffs of light, soft, gritty stone, varying in height from seventy to an hundred feet, behind which are level and extensive plains. On the right side of the river are low extensive bottoms, bordered with cottonwood, various species of willow, rose bushes, grape-vines, the red-berry or buffalo grease bushes, and a species of sumaac; to these succeed high grounds, supplied by pine, and still further on are level plains. Throughout the country are vast quantities of buffalo, which, as this is the running season, keep a continued bellowing.
>
> (McMaster 1904 Vol. III:232)

Again confirming the timing of the rut, Lewis and Clark noted in an appendix to their journal, for September 21, 1804, that: "The Elk is now rutting, the buffalo is nearly ceased; the latter commence the latter end of July or the first of August" (McMaster 1904 Vol. III:352).

Lastly, on July 31, 1858, northeast of Calgary, Captain Palliser had travelled for days without seeing bison until he noted the occurrence of males and females together in large numbers and the accompanying roaring or bellowing which strongly suggests the rut:

> We were now more than two miles' distance from the buffalo, who were not in sight, as we had taken care to take up a position as that they could neither see us or get wind; they were in such numbers that their peculiar grunt sounded like the roar of distant rapids in a large river, and causing a vibration something like a trembling in the ground.
>
> (Spry 1968:258)

Native Oral Tradition and Bison Wallows

There is evidence from Native oral tradition that supports this interpretation of bison wallows. For example, McClintock (1968:99) recorded the opening of a Blackfoot Beaver Bundle. Imbedded within the rituals is information regarding the timing of the rut, its association with wallowing, and the behaviour of bison during the rut. He recorded:

> The Indians found both interest and amusement in this dance, because it represented the mating of buffalo by women choosing their men. Gives-to-the-Sun and Natokema knelt before the bundle with lowered heads, making motions of hooking the ground in imitation of buffalo cows digging wallows in the autumn. They pawed the ground and bellowed, simulating buffalo throwing dirt and catching it upon

> their backs, then shaking themselves and making the dust rise into the air.
>
> Gives-to-the-Sun and Natokema then danced, imitating the capers of mating buffaloes. They stood before their mates pawing the ground and hooking at them with their horns. Mad Wolf and O-mis-tai-po-kah then joined in the dance. The men followed the women around the fire like buffalo bulls following cows.
>
> (McClintock 1968:99)

Another Blackfoot story relays the rebirth of a child through the actions of some male bison imitating wallow creation. Wissler and Duvall (1908:121-122) recorded the story as follows:

> A long time ago, we don't know how many years ago, the daughter of a Blackfoot Indian Chief was a very handsome looking girl. She was a very true girl. Many young men who had asked her to marry them were refused. Now this girl had not been with any man at any time. All at once she became in a family-way, and, when her time came to give birth to a child, she went out away from the camp, for she was very much ashamed. Then she gave birth to a baby-boy which she buried in the earth. Then she went back to camp. The next day, four buffalo-bulls came along where she had buried this child. They saw it. One of the bulls said to the others, "we will bring this child to life again, and keep him for our own". The others all agreed to this. They had power to restore life. One of the bulls began to paw and hook the dirt away from the child until it was uncovered. The second bull hooked the child around until it came to life and started to crawl away. The third hooked the child until it was a half-grown boy. The last did the same until the boy became a full-grown man.
>
> (Wissler and Duvall 1908:121-122)

Kroeber (1907:94-95; see also Isenberg 2000:76) recorded a similar story for the Gros Ventre. He noted:

> There was a camp. A boy and girl were lovers. The girl became pregnant. Her mother asked her what made her belly swell. She would not acknowledge, but said she was sick. When she was about to deliver, she told her mother, "I have had a lover and am pregnant. I am ashamed. Let us throw the child away." The camp moved, and she and her mother fell behind. She was in great pain. When the rest of the camp was out of sight, they stopped and the girl gave birth to a boy. Her mother dug a hole in a buffalo-wallow, put the child in, and covered it with earth. Then they left it. The child cried and struggled and partly uncovered itself. Seven old Buffalo-bulls were near by. They were following the trail of the camp. One went to the wallow in order

> to wallow in it. He heard a sound he did not know. Then the others came, until all seven were there. They found the child and looked at it. They pitied it. One of them said, "Let us raise it. We will have it for our son." The first Buffalo began to wallow. As he wallowed, he licked the baby all over. Then another one licked him. When all seven had licked him, he was no longer a baby but a boy...
>
> (Kroeber 1907:94-95)

The notion of 'abandonment' and 'rebirth' of young in association with bison, bison wallows, and wallowing behaviour is interesting. Bison often seek secluded locations to give birth, such as a buffalo wallow, when on the open plains. Thus, if the majority of bison wallows are located around the periphery of the plains, using these features as birthing locations requires calving areas to be located in the same general area as that of the rutting grounds. It also provides a tenuous, but pragmatic, link between the aforementioned traditional stories and the real-life functions of wallows (i.e., rutting and calving locations).

Historical Accounts of Calving

Some background information concerning bison calving is required before examining the historic locations of bison calving. As noted above, based on historical documents, Roe (1951:94) states that bison cows give birth between mid-April and almost the end of June. McHugh (1958:30) notes a calving season from mid-April to the end of June with a peak the first two weeks of May among bison in Yellowstone National Park. Meagher (1973:75), also working in Yellowstone National Park, records a similar calendric range for births among bison. She, too, notes a peak in births during the first two weeks of May (Meagher 1973:75). Soper (1941:391) infers a peak calving period about mid-May. For the rest of the year, from June through March, instances of calving are rare but not entirely absent (McHugh 1958:30, see Chapter Four).

Importantly, with regard to the birth environment, Seton argues that: "True to Universal instinct, she slinks off by herself to some slight hollow -- for such as there are on the levellest prairie -- and there is born the calf, or, on some rare occasions, twins" (Seton 1953:695). Hornaday (1887:425) notes the same: "It was the habit of the cows to retire to a secluded spot, if possible a ravine well screened from observation, bringing forth their young, and nourish and defend them until they were strong enough to join the herd".

Likewise, Soper (1941:391) notes that, for northern bison, the female becomes quite solitary during calving.

Roe (1951:98), however, suggests that bison cows were 'shameless' creatures and calved anywhere and everywhere. Lott and Galland (1985) wed these disparate views; they noted that cows may shift their birthing behaviour from calving in 'the herd' to calving 'in isolation'. Calving in the herd occurs in open places where the group can be used for cover to conceal the calf (Lott and Galland 1985:69). However, calving in the herd can weaken the cow-calf bond (Lott and Galland 1985:69-70). The alternative is to calve in isolation when there is vegetation or terrain which conceals the calf and strengthens the cow-calf bond (Lott and Galland 1985:70).

In terms of the geographic location of calving sites, for the Yellowstone herds calves are born on the wintering grounds (Meagher 1973:75). In fact, for areas where previous records were available, the same area was repeatedly revisited for calving (Meagher 1973:75). Similarly, Soper (1941:378) also notes a strong tendency for bison to return to the same area for calving in Wood Buffalo National Park. He notes that: "Place of birth of the great majority of calves is in the eastern part of the Alberta Plateau" (Soper 1941:378). Hornaday (1887:425) indicates that on the Montana ranges calves were often born on the summer range, but that many were born en route from the wintering grounds.

The following uses historic documents to confirm that bison gave birth at the plains-parkland interface (see Figure 2). As such, the calving ground could well have been the rutting ground about nine months earlier.

Henry the Younger observed calves on April 11, 1801 at Park Post at the eastern edge of the plains (Coues 1965 Vol. I:175). Henry the Younger stated: "Fine warm weather. Buffalo are now mostly with calves of this spring" (Coues 1965 Vol. I:175). Similarly, Henry the Younger observed a calf in the Hair Hills on April 13, 1805: "I came off alone; chased several herds of buffalo, and killed three cows and several calves..." (Coues 1965 Vol. I:241).

As an aside, calves born earlier in the season occurred but usually did not survive. For example, on February 28th, 1801, Henry reported 'a calf of this year' found dead (Coues 1965 Vol. I:171). Still, on March 23rd, 1801, Henry recorded that his men had returned from Reed River where they had seen two calves of this year (Coues 1965 Vol. I:173). It is assumed that they survived.

On April 19, 1802, Henry the Younger at the Pembina River Post noted: "Red River began to give away, and the ice moved; snow all melted on the plains, I went hunting; calves are very numerous, and I brought one home with me alive." (Coues 1965 Vol. 1:195). By the 15th of May of that same year Henry the Younger was inclined to note: "Men bring home calves daily" (Coues 1965 Vol. I:197).

Similarly, while at the Pembina Post, Henry the Younger recorded a horseback hunt on May 10, 1804, during which he noted calves: "I returned home; chased buffalo, and killed three cows and several calves..." (Coues 1965 Vol. I:244).

Near Fort Vermilion, on April 15, 1810, Henry the Younger's hunters did not see any calves although, based on the following quote it is clear they were expecting to see young bison. He wrote: "Mr. Rocque and others went hunting, for diversion, and killed two cows, but not a calf was to be seen." (Coues 1965 Vol.II:597). In a more affirmative manner, James Bird noted taking calves during a trip down the North Saskatchewan River. On May 23, 1800, down stream from the confluence of the North Saskatchewan and Turtle Lake River, he stated in his journal: "Killed one cow buffalo and several calves" (Johnson 1967:245). Similarly, Matthew Cocking (Burpee 1908:117), writing just west of the Forks of the Saskatchewan on April 20, 1773, observed a young bison. He stated: "River broke up and much ice came down. A young buffalo seen but too swift to be overtaken on foot" (Burpee 1908:117).

As well, in general support of the geographic location of bison calving locations, Alexander Ross contributed the following observation, while near the base of the Rocky Mountains, sometime between 1810 and 1825. He observed:

> The cow calves generally at one period and that period later by a month than our tame cattle, when they all as if with one accord withdraw themselves from the mountains and rocks into large families and resort to the valleys, where there is open ground with small clumps of wood affording shelter and preservation, as there they can from afar see the approach of an enemy. The cows in the centre. The bulls graze in the distance, all in sight of each other.
>
> (Ross 1956:284)

Geographically, it is not difficult to interpret this passage as depicting the plains-parkland interface between the mountains and open plains. Thus, Ross' (1956) observations of bison calving on open ground in front of the mountains correspond with the expectations for the location of calving grounds.

Summary

The preceeding has presented an argument for the geographic co-occurrence of rutting and calving areas. First, the nature of the rut in modern bison was examined for clues that signify rutting activity. Notably, the distribution of the animal becomes very clumped geographically, the males wallow and bellow more frequently, and males and females co-occur in herds.

Then, having established the signs of the rut in modern animals, historical documents were reviewed for evidence of the rut in the past. Numerous documents illustrate that the rut occurred around the periphery of the plains near the plains-parkland interface. The occurrence of Native oral traditions relating wallows and/or walllowing behaviour and rebirth and/or birth were noted. It was suggested that given the correlation of wallows and re-birth/birth perhaps calving was associated with wallows. A review of historical documents concerning calving locations places them along the plains-parkland interface roughly correlating with rutting locations. Providing evidence for the location of rutting and calving locations helps to corroborate the interpretation of bison movements on a larger scale. In short, this suggested that the animals summer on the plains, move to the plains periphery in fall for the rut, they winter in the parkland, and calve at the plains-parkland periphery in the spring.

SUMMARY

Ethnographic models provide vivid and detailed accounts of the Plains Indian seasonal round but provide archaeologists interested in prehistory with the disadvantage of describing an equestrian lifestyle. More recent models have largely attempted to understand the seasonal round of prehistoric Native people based on their close association with bison. An understanding of the nature of bison movements is expected to reflect the movements of past people. To this end, authors have used studies of grassland ecology, historical documents, isotopic analyses, and large ungulate ecology. The voluminous work on this subject is beyond close examination. Still, a departure point from such studies regards the annual cycle of bison behaviour as key to interpreting the occurrence of bison in historic documents. This departure point is further pursued in Chapter Four.

CHAPTER THREE: HUNTER-GATHERER SETTLEMENT PATTERNS AND MOBILITY STRATEGIES

> The fact is that *all* societies have a mobile component; the issue is what the form of that mobility is, not whether it exists.
>
> (Bar-Yosef and Rocek 1998:1)

INTRODUCTION

Over the past fifteen years, an increasing number of archaeologists have turned their attention to human-land relationships using a variety of approaches to landscapes (e.g., Binford 1980; Bettinger and Baumhoff 1982; Wiessner 1982; Politis 1996). Recently, Preucel and Hodder (1996:32-34) distinguished four different approaches to 'landscape' in archaeology. The first view of landscape addresses 'landscapes as environment'. This view emphasizes the reconstruction of specific environments with the goal of demonstrating aspects of paleoeconomy. The second approach views 'landscapes as systems' and attempts to integrate sites into an overall pattern of subsistence and settlement. The third approach regards 'landscapes as power'. This view presents landscapes in terms of ideological manipulation owing to its relationships of dominance and resistance. The fourth approach concerns 'landscape as experience'. Here researchers are concerned with how landscapes are perceived and imbued with meaning.

Cross-cutting all four approaches to landscape is research concerning hunter-gatherer settlement patterns and mobility strategies and the implications of these approaches for interpreting the archaeological record. Yet, in trying to understand how hunter-gatherers move and position themselves on landscapes, archaeologists have most commonly resorted to using only the first two of the aforementioned approaches to landscape (Preucel and Hodder 1996; see also Trigger 1968). For the most part, research presented here does not go beyond these two approaches, viewing 'landscapes as environment' and 'landscapes as systems', but has contributed substantially to our understanding of how people position themselves across the land to obtain resources (i.e., natural resources, energy, and information) (e.g., Bettinger and Baumhoff 1982; Binford 1980, 1982, 1983). Still, research that addresses social and ideological reasons (i.e., 'landscapes as power' and 'landscapes as experience') for how people position themselves on the land deserve more attention.

The reason for this difference in emphasis may be found in an oft-cited article. Hawkes (1954) maintained that the construction of prehistoric lifeways could be placed on a scale of ascending difficulty, with technology and economy providing the least difficulty, sociopolitical organization an intermediate difficulty, and ideological and religious beliefs providing the most difficulty. It is not unreasonable to suggest that 'Hawkes' Hierarchy' is reflected in research concerning hunter-gatherer settlement patterns and mobility strategies across landscapes. Even with the trend to emphasize environmental and systemic approaches to landscape, this does not mean that sociopolitical and ideological aspects of past life did not affect or were not reflected in settlement patterns and mobility strategies (e.g., Kent and Vierich 1989; Mauss 1979).

In this chapter the contributions that viewing 'landscapes as environment' and 'landscapes as systems' has made to understanding the nature of hunter-gatherer movements and positioning on landscapes will be reviewed. This review will place the different approaches in perspective relative to one another and will also illustrate the underlying epistemologies within each model. Sociopolitical and ideological influences on settlement patterns and mobility strategies will only be touched upon. To begin, however, some terminology is presented followed by some background information concerning key developments that preceded the formation of explicit models.

TERMINOLOGICAL CONSIDERATIONS

A number of terms need to be defined more explicitly in order to improve their usefulness and clarity in subsequent discussions. Specifically, definitions for seasonal round, settlement pattern, settlement archaeology, mobility, and mobility strategy are presented below.

The term 'seasonal round' is frequently used in hunter-gatherer research but is rarely defined. Therefore, following Kelly (1995:111-115), the term 'seasonal round' is used here to refer to the cyclical movements of people, within a year, between locations as resources become seasonally available. Of interest in defining the seasonal round for a people is the relative order of different activities, within a year, and the general locations in which these activities take place as dictated by seasonal changes in the environment.

The term 'settlement pattern' was introduced to archaeology by Gordon Willey (1953) in his monograph entitled Prehistoric Settlement Patterns in the Virú Valley, Perú. The goal of this study was to: 1) describe a series of prehistoric sites with reference to geographic and chronological position, 2) outline a developmental reconstruction of these settlements with relation to function as well as sequence, 3) reconstruct cultural institutions insofar as these may be reflected in settlement configurations, and 4) to compare the settlement interpretation to other regions (adapted from Willey 1953:1). More recently, Willey (1999:9) noted the study of prehistoric settlement or settlement archaeology: "...studies the way humankind disposed itself over a given landscape, and its constructions upon and modifications of that landscape" (Willey 1999:9).

More explicitly, Suzanne Fish (1999:203) defined the term 'settlement pattern' as:

> ...a set of culturally significant locations each of which occupies a specified position within an array that makes up a coherent distribution. We visualize these distributions in the context of maps that summarize the natural features of the landscapes on which they occur. Thus settlement patterns are spatial matrices marking the intersection of human activities and the natural environment. As such, they provide a basis for examining the relationship between cultural loci and relevant geographic variables. Settlement patterns simultaneously mark the intersection of human activities and their cultural environment.
> (Fish 1999:203)

Methodologically, settlement archaeology should ideally consist of a surface survey of the study area in conjunction with ethnographic and historic land use studies, landscape and environmental reconstruction, and site excavation (especially stratigraphic and household excavation) (Sanders 1999:12-21; Billman 1999:2, 4). For some, the next methodological step in settlement archaeology lies in the development of macroregional surveys (Billman 1999:5). That is, the creation of large regional site databases and the development of analytical tools (i.e., middle range theory and general theory) that can tap these emerging settlement databases.

In contrast to the seasonal round, the settlement pattern is concerned with the precise locations of specific sites and the various functions those sites had in relation to each other whether the relationship is temporal (i.e., such as seasonal round) or spatial (i.e., such as administration across a 'state' society). A seasonal round model would emphasize the sequential relationship of generalized activities conducted in generalized geographic areas in response to seasonal environmental change.

'Mobility' is a rarely defined term in archaeology. This research uncovered a single definition by Chatters (1987:339) who suggested mobility be defined as "...the nature of the movements of people across a landscape". Importantly, Close (2000:49) noted that most authors differentiate 'types' of mobility (e.g., residential mobility, logistical mobility) with adjectives but fail to define the term itself. Further, she notes that: "The Oxford English Dictionary (1971, p. 1825) defines mobility as the 'ability to move or be moved; capacity of change of place; movableness' (*inter alia*), which is not the sense in which it is now used in archaeology" (Close 2000:49-50). For Close (2000:50), 'mobility' studies of archaeologists deal with the: "...actual movement of people and face such questions as how far, in what direction, how often, and even why".

Thus, the term 'mobility strategy' is defined as: "...the nature of the seasonal movements of hunter-gatherers across a landscape: mobility strategies are one facet of the way in which hunter-gatherers organize themselves in order to cope with problems of resource acquisition" (Kelly 1983:277). An important distinction to note between 'mobility' and 'mobility strategy' rests in the fact archaeology can rarely focus on the act of moving (i.e., mobility) but must reconstruct palimpsests of individual moves not individual movements, or acts of moving, themselves (Close 2000:50). As well, mobility strategies provide the rationale, with reference to resources, social relations, etc., for the nature of the palimpsests of individual moves.

Methodologically, an understanding of past mobility strategies requires knowledge of: 1) the many aspects of mobility including the frequency of moves, number of people moving, distance covered by moves, degree of site reuse, and the interaction of these variables (e.g., how many people traveled during each move), 2) the economic reasons of movement, 3) the social, reproductive, ritual, or otherwise cultural reasons for moving, 4) and the context of the recovered archaeological assemblage including artifacts and inferred activities and seasonality (Bar-Yosef 1998:2-3). Thus, mobility strategy can be differentiated from the seasonal round or settlement patterns as it is not specifically interested in sites but rather the nature of movements between sites and the reasons for that movement.

Lastly, Ingold (1987:179-197) recently reviewed the literature concerning the nomenclature used in studies of mobility. While many of his terminological suggestions are beyond the scope of this research a number of terms are applicable. He considered migration to be: "...movement not within but between distinct ecological zones, designed to take advantage of the resources available in each zone at different times of the year" (Ingold 1987:188). Further, transhumance migrations, or migration after a single resource, are differentiated from trans-resource, or migration between resources (Ingold 1987:190).

BACKGROUND

In his seminal paper, Willow Smoke and Dogs Tails: Hunter-Gatherer Settlement and Archaeological Site Formation, Lewis R. Binford (1980) distinguished between two dimensions of hunter-gatherer mobility (i.e., logistical and residential). Subsequently, a fair amount of the literature on hunter-gatherer mobility has been built upon this precedent (e.g., Binford 1982; Bettinger and Baumhoff 1982; Chatters 1987; Kelly 1983, 1992; Wiessner 1982). Before this time, however, theoretical discussions of mobility were largely absent; settlement archaeology provided the main methodological thrust of such studies. With Binford's (1980) influential paper on the study of hunter-gatherer settlement patterns, settlement pattern studies regarding hunter-gatherers became largely subsumed under the rubric of mobility strategies. Not surprisingly, two areas that stand out in their contributions to the development of hunter-gatherer mobility strategies are settlement archaeology and hunter-gatherer studies (e.g., Willey 1953, Lee and Devore 1968).

Prior to the 1940s little attention was paid to settlement patterns in American archaeology (e.g., Trigger 1968:53; Chang 1958:299). This changed in the late 1940s, however, as: "It was felt that the way man arranged himself upon the landscape, with relation to its natural features and with relation to other men, held important clues for the archaeologist in his understanding of socioeconomic adaptations and sociopolitical organizations" (Willey and Sabloff 1980:131). It was at this time that Julian Steward urged

Gordon Willey to undertake a survey of the 'settlement pattern' of prehistoric sites in the Virú Valley, Perú (Willey 1953, 1999). Among other research interests was the goal of determining how the various sites in the valley functioned together at any one period in time. Hence, one of the foci of Willey's study concerned the determination of site function. Inferring the function of a site allowed him to suggest "...how different kinds of sites were integrated into overall patterns of living at the different time-periods" (Willey and Sabloff 1980:146-148).

Studying the inter-relatedness of sites set a precedent for perspectives that were later used in research concerning mobility strategies. The idea of examining the function of a site and inferring the manner in which it was integrated within a larger 'system' of sites is a significant feature of the 'landscapes as systems' approach to hunter-gatherer mobility studies (e.g., Flannery 1968; Binford 1980). An important difference, however, between Willey's approach and that of the aforementioned hunter-gatherer mobility studies is that Willey examined specific functions of a variety of sites that were integrated to make a whole community at a moment in time, while hunter-gatherer mobility studies were, and still are, concerned with how site functions were related to each other through time as a result of mobile people moving through a seasonal round. There is not a tremendous mental leap between the two approaches making the genetic link fairly obvious.

In the 1950s, a typology was produced which classified cultures based largely on mobility (Beardsley et al. 1956). Categories for hunter-gatherers included: free wandering groups with no territorial boundaries; restricted wandering groups constrained by territorial boundaries, center-based wandering groups who seasonally return to a central village, and semi-permanent sedentary groups who seasonally occupy a village year-round but move it every few years (Beardsley et al. 1956; Kelly 1992:44).

Other researchers presented less functional/ecological approaches. For example, Vogt (1968) tried to trace the relationship of Mayan settlement patterns to ceremonial organization. Similarly, Sears (1968) suggested that the analysis of settlement patterns might allow some degree of reconstruction of the prehistoric 'state'. Chang (1962) expressed concern over the multiple manners in which the term settlement pattern was being used, thus, he suggested a typological scheme in which spatial analysis with cultural ecological connotations would retain the term settlement pattern, and spatial analysis with sociological and social psychological connotations using the term community pattern.

Besides settlement pattern studies, hunter-gatherer research has also been intimately intertwined with mobility strategies research. Perhaps the most influential example of this relationship was Lee and DeVore's (1968) highly referenced Man the Hunter volume. The authors made two basic assumptions about hunter-gatherers: one, that they live in small groups, and two, that they move around a lot (Lee and DeVore 1968:11). From these two assumptions Lee and DeVore (1968:11-12) proposed a number of characteristics of hunter-gatherer societies which have implications for archaeology. First they suggest that since hunter-gatherers move around a lot in order to get food, they are restricted in the amount of material culture they can take with them (Lee and DeVore 1968:12). The implications of this constraint on property is that differences in wealth are minimalized thus promoting an egalitarian existence. Second, the nature of food resources keeps the size of living groups small (Lee and DeVore 1968:12). Third, groups living in an area do not ordinarily maintain exclusive access to resources but rather, due to annual fluctuations in resource availability, exist in fluid social organizations that promote reciprocity as a result of inter-group obligations (Lee and DeVore 1968:12). Fourth, while there is a lack of concern that the food supply will fail, there is also a general lack of food surplus (Lee and DeVore 1968:12). Fifth, the interaction between different groups and various resource areas prevents any one group from becoming too attached to any single area; exceptions the authors note to this characteristic are ritual sites which do tend to be commonly associated with specific groups (Lee and DeVore 1968:12). This association occurs even though the biological livelihood of the people does not rest in such sites.

Lewis Binford was in attendance at the symposium on Man the Hunter. In fact, he was a respondent to the article by Lee and DeVore (1968:12). Not surprisingly, a number of issues raised by the symposium (Lee and Devore 1968) are reflected in Binford's (1978, 1980, 1982, 1983) influential writings on mobility. Interestingly, the use of ritual sites, an obvious characteristic of hunter-gatherers not easily explained in terms of function or adaptation, is never addressed by Binford (as alluded to earlier, the use of ritual sites, among other non-ecological/functional topics, and their influence on people's movement across landscapes are generally absent as issues in the literature on mobility).

A second influence from hunter-gatherer studies on mobility strategies research comes from Binford's (1980) use of Murdock's (1967) Ethnography Atlas. Binford (1980) was the first person in archaeology to use mobility as a multi-scalar variable and he was able to do so largely due to Murdock's (1967) previous compilations concerning hunter-gatherer lifestyles.

HUNTER-GATHERER MOBILITY STRATEGIES

As alluded to at the beginning of this chapter, studies concerning hunter-gatherer mobility strategies can generally be grouped into two categories: 'landscapes as environments' or an evolutionary ecological approach, and 'landscapes as systems' or an ecosystems approach (Preucel and Hodder 1996). These two approaches will be considered below in terms of their epistemologies and their contributions to hunter-gatherer mobility strategies.

ECOSYSTEMS APPROACHES

The use of the ecosystems approach in archaeology has significant antecedents in the work of Leslie White (1949, 1959) and Julian Steward (1955). Building on these earlier works, Binford (1965) helped lead the movement to replace historical explanations of culture change with an approach that emphasized process. Following Leslie White, Binford (1962:218) defined culture: "...as the extrasomatic means of adaptation for the human organism." and suggested that material culture be divided into three subsystems: technological, social, and ideological. Kent Flannery (1968) provided an early example of applying systems theory to ecology in presenting a model that described how changes in mobility and scheduling patterns may have led to agriculture in Mesoamerica.

Important concepts implicit in, but not exclusive to, ecosystems include the notion that: "Changes in one part of the system automatically trigger changes in other parts as the system attempts to return to steady state by increasing a series of negative feedback loops" (Preucel and Hodder 1996:24). Another concept implicit in ecosystems approaches is that no attention is paid to natural selection as change occurs as a result of 'deviant-amplifying effects' within the system (Preucel and Hodder 1996:24).

Articles by Binford (1980) and Kelly (1983) are good examples of ecosystems approaches to hunter-gatherer mobility. The other articles discussed in this section (i.e., Wiessner 1982; Chatters 1987) are not presenting ecosystems approaches but have built on Binford's (1980) article and, hence, are included at this juncture.

BINFORD

Lewis Binford (1980) was concerned with the nature of variation within hunter-gatherer mobility strategies and the implications of this variation for archaeology. He approached the issue from a systemic perspective:

> That is, human systems of adaptation are assumed to be internally differentiated and organized arrangements of formally differentiated elements. Such internal differentiation is expected to characterize the actions performed and the locations of different behaviours. This means that sites are not equal and can be expected to vary in relation to their organizational roles within the system.
>
> (Binford 1980:4)

Then, Binford (1980:4-5) argued that in order to understand the 'static' patterns of association in the archaeological record one must have a sophisticated knowledge of how such patterns were manifested from dynamic systems. Ethnoarchaeological research on the Nunamiut and the G/wi San was used to develop models of hunter-gatherer mobility strategies; respectively, this model includes 'collectors' and 'foragers' (Binford 1980). The distinction between foragers and collectors was that: "Foragers move consumers to goods with frequent residential moves, while collectors move goods to consumers with generally fewer residential moves" (Binford 1980:15).

More specifically, foragers are said to practice a residential mobility strategy within which the movement of the residential base camp allows the group to map onto resource patches (Binford 1980:5-10). Consequently, the length of a stay by a residential group depends on the carrying capacity of the resource patch and the size of the group; storage cannot assist this situation as foragers are said to typically not practice such techniques (Binford 1980:5). Another characteristic of foragers is that on a roughly daily basis, group members range out from the residential camp to gather food based on an 'encounter strategy' (Binford 1980:5, 8). Daily procurement occurs within the foraging range which is the distance one can walk out and back from the residential camp in a single day (Binford 1980:5). One possible alternative strategy might involve the establishment of an overnight camp, or 'locations', while in search of game or to dry meat from a successful kill, etc. (Binford 1980:9). Regardless, as alluded to above, as soon as one or more critical resources have been exhausted within a resource patch the group must move its residential base (Binford 1980:5-7).

In terms of the archaeological manifestations of the forager strategy, Binford (1980:7) argued that the high mobility and lack of redundancy in land use by 'foragers' meant that these sites would not be very visible; an exception might be around an especially vital resource location such as a permanent waterhole (Binford 1980:7, 9). The specialized activities of a hunting party would be expected to be reflected in the archaeological record as specialized tools and remains of activities not commonly conducted at the residential camp (Binford 1980:8-9). As well, 'off-site' encounters which result in immediate extraction of resources would produce poorly visible sites (Binford 1980:9).

Collectors, on the other hand, employ logistical strategies whereby small specialized task groups procure specific resources from distances outside the foraging range and bring them back to the residential camp (Binford 1980:10-12). The specialized task groups do not hope to 'encounter' these resources, rather, they expect to procure specific resources in specific contexts (Binford 1980:10). Task groups leave the residential camp to establish field camps and stations, or information gathering locations, from which extraction tasks are executed (Binford 1980:10). This strategy allows the organized use of labour to counterbalance the spatially incongruent distribution of critical resources (Binford 1980:12).

The implications of such a mobility strategy for the archaeological record are substantial. In contrast to foragers, who produce few site types (i.e., residential bases and locations), collectors produce many site types (i.e., residential bases, field camps, stations, and kill sites). In addition, sites can be differentiated further based on seasonality; that is, seasonal variation affects the species available to be killed, which influences the tools used in capture and processing which, in turn, structures the archaeological record (Binford

1980:12). Quite often, when a specific resource has been procured, the shear bulk of it prohibits immediate transportation back to the residential camp (Binford 1980:12). The resource is usually cached producing yet another site type (Binford 1980:12).

In an attempt to explain the variability in mobility strategies, Binford (1980:16) correlated storage practices and effective temperature. Although his argument was more complex than this, Binford basically compared the aforementioned variables and concluded that: "...we should therefore see a reduction in residential mobility and an increase in storage dependence as the length of the growing season decreases" (Binford 1980:15). A number of other correlations between environment and archaeological sites and assemblages were also noted (Binford 1980:13-19). In concluding, he cautioned the reader: "...that logistical and residential variability are not to be viewed as opposing principles (although trends may be recognized) but as organizational alternatives which may be employed in varying mixes in different settings" (Binford 1980:19).

In a subsequent article, Binford (1982:5) built on to his model of mobility by proposing a series of hypotheses concerning: "...the organizational relationships among places which were differentially used during the operation of past systems". For example, he suggested that a shift in the location of the residential site produced a similar shift in the 'use potential' of other places in the region (Binford 1982:11-14).

> When a residential site is in one place, another site within the range may be regularly used as a temporary camp or a logistically organized extractive camp. On the other hand, a move in the residential site sets up a new set of spatial relationships relative to the new residence, and the use potential of the old sites may be radically altered.
>
> (Binford 1983:46)

Thus, a winter residential camp may have 'formed' in a river valley. Movement out of the valley to the valley's edge in the spring creates a new residential site at this new location. However, the former residence site may be used as a kill site owing to the ease with which animals can cross the river at the location. Archaeologically, evidence of both the initial residential camp and the kill site may be recovered. Yet, since there is no relationship between the natural depositional episodes and the cultural depositional episodes the assemblages of artifacts may or may not be intermixed (Binford 1982:15-16).

WIESSNER

Binford's (1980) original presentation concerning mobility drew a relatively immediate response from Polly Wiessner (1982). Wiessner, while appreciating many points of Binford's (1980) article, argued that people not only organized themselves around resources but they also organized themselves around other people. Basically she felt Binford failed to acknowledge that some differences in hunter-gatherer organization are produced by adaptive strategies relating people via the social relations of production (Wiessner 1982:172).

She made her case by noting: "In any society, economic strategies are twofold: those aimed at bringing in the mean subsistence income needed to sustain a household throughout the average year, and those aimed at reducing the variance around the mean" (Wiessner 1982:172). In order to reduce the risk involved in food procurement, Wiessner (1982:172-173) offered four different strategies: 1) prevention of loss, 2) transfer of risk or loss from one party to another, 3) storage or self-assumption of risk, and 4) pooling of risk or risk sharing.

'Prevention of loss' concerns preventive measures such as a) rituals against misfortune, b) resource control (e.g., burning to encourage growth of need to draw animals), and c) land right allocation to prevent overlap in use of critical resources (Wiessner 1982:172). 'Transfer of risk' refers to amassed surpluses being transferred to the less fortunate (Wiessner 1982:173). 'Storage' is a method by which shortages are covered by previous accumulation (Wiessner 1982:173). 'Pooling of risk', or generalised reciprocity, "...operates under the terms that he who has gives to him who is in need, donors and recipients alternating, as the conditions of have and have not may be reversed" (Wiessner 1982:173).

Wiessner (1982:173) then discussed the archaeological implications of reducing risk. Aspects of the archaeological record that are expected to be effected include internal site structure, the distribution of faunal remains, inter-site variability, the distribution of exchange items, the stylistic variation in artifacts, etc. (Wiessner 1982:171, 175). The paper concluded by noting that both herself and Binford are trying "...to specify a spectrum of organizational strategies which hunter-gatherers use to adapt to various environments, and to relate these strategies to regular and predictable patterns of material remains" (Wiessner 1982:176).

KELLY

Elaborating upon Binford's (1980) ecosystems approach to hunter-gatherer mobility, Kelly (1983) further examined residential and logistical mobility strategies as he felt this: "...would allow us to see under what conditions consumers are moved relative to food resources and under what conditions food resources are moved relative to consumers" (Kelly 1983:278). Kelly (1983:277) defined 'mobility strategy' as: "...the nature of the seasonal movements of hunter-gatherers across a landscape". In an attempt to quantify mobility strategies he provided a number of measures of residential and logistical mobility (Kelly 1983:278-279). To compare different environments he examined the variables of effective temperature and primary biomass which are considered to measure environmental differences in terms of resource accessibility and resource monitoring (Kelly 1983:279-289).

Kelly noted numerous correlations upon comparing each of the mobility variables with each of the environmental variables. For residential mobility (i.e., a move that changes the residential location during the seasonal round), Kelly (1983:291) found that the rate of residential moves is positively correlated to the primary biomass of an area (exceptions included people dependent on aquatic resources or company stores). Similarly, the average distance moved per residential move is inversely correlated with effective temperature; this is not true, however, for horse equipped peoples or Northwest Coast villagers (Kelly 1983:294). As well, there is a positive correlation between the total area a group exploits and the contribution that hunting makes to the group's diet (Kelly 1983:297).

For logistical mobility (i.e., the movement of individuals/small groups in and out of the residential site for the purpose of daily or more extensive forays), Kelly (1983:298-299) noted that the fewer the residential moves the longer the logistical trips (for those groups heavily dependent on fauna). It is interesting to note that only briefly does he mention that other non-food resources (i.e., lithics and information) can be acquired as a result of residential and logistical mobility (Kelly 1983:298).

Having formulated an ecological model of hunter-gatherers, Kelly (1983:301) warned that: "Hunter-gatherers do not adapt to their environment with a single settlement-subsistence system..." rather a large range of these strategies are utilized over time. With this the author felt he had set the ground work for a theory of mobility and noted: "It is essential that we understand the variables conditioning different mobility strategies and how these variables are themselves conditioned by directional environmental change" (Kelly 1983: 302).

CHATTERS

Even with Binford's (1980) caveat that his mobility models be used as alternatives and not opposing opposites, Chatters (1987:336) noted that: "There is a growing tendency to conceive of hunter-gatherer adaptation as points on a yardstick, with foragers at one end and collectors on the other". Still, as illustrated by Kelly (1983) above, some researchers have recognized that mobility strategies represent only one way that hunter-gatherers organize themselves relative to resources, but use the residential-logistical mobility strategy dichotomy to examine when resources are moved to people and when people are moved to resources.

In an attempt to better represent Binford's (1980) model, Chatters (1987:339) argued that human adaptation has three primary, but overlapping, dimensions: interaction with the humans, prevention of hypo- and hyperthermia (i.e., clothing, shelter, etc.), and resource exploitation. He noted the forager-collector model is concerned with resource exploitation and continued to examine only those dimensions subsumed by resource exploitation. Resource exploitation, according to Chatters (1987:339) has three dimensions: mobility, predation, and technology.

Although he discusses all three dimensions of resource exploitation, for the purposes of this research, I will focus on mobility which Chatters further divides into six dimensions: 1) mobility types, which refers to Binford's (1980) residential and logistical mobility strategies, 2) frequency, which refers to the number of residential moves during the seasonal round (but needs to evaluate the number of annual moves and the duration of residency between moves), 3) stability, which refers to the degree to which people use the landscape in a redundant manner, 4) demography, which refers to how people are distributed across the landscape, 5) scheduling, which refers to the plan for group organization and distribution to promote harvesting efficiency (see also Flannery 1968), and 6) range, which is the area a group consistently uses over a given period of time (Chatters 1987:339-349). In addition, Chatters provides archaeological measures for each of the aforementioned variables. By examining multiple dimensions of resource exploitation (i.e., mobility, predation, technology), Chatters (1987) presented a model that illustrated the complex nature of adaptive behaviour. He was optimistic that even such complex adaptive behaviour does leave material correlates in the archaeological record (Chatters 1987:368-370).

EVOLUTIONARY ECOLOGICAL APPROACHES

Evolutionary ecological approaches to mobility strategies differ from ecosystems approaches to mobility strategies in that natural selection is a primary concern of the former but not the latter. A key concept is that individuals/groups seek to maximize their amount of energy capture (Preucel and Hodder 1996:26). Hence, the decisions made by individuals/groups are shaped by natural selection thus influencing the individual's/group's reproductive success. Theories currently included in this field include foraging strategies, mating systems, group size and formation, and spatial organization (Preucel and Hodder 1996:26). A good example of this approach within discussions of mobility strategies is offered by Bettinger and Baumhoff's (1982) traveller-processor model [Precursors of this approach often fall among research grouped under the rubric 'optimal foraging strategies' (e.g., Jochim 1976; Winterhalder and Smith 1981)].

BETTINGER AND BAUMHOFF

Bettinger and Baumhoff (1982; Bettinger 1991:100-103) presented what is basically an optimal foraging model (i.e., combined diet and patch models) of hunter-gatherer mobility that superficially resembles Binford's (1980) forager-collector model. As mentioned above, Bettinger and Baumhoff's model differs from the forager-collector model in terms of its underlying epistemology (i.e., an evolutionary ecological approach versus an ecosystems approach). As well, Bettinger and Baumhoff (1982) believe their model: "...has the advantage of specifying precise relationships between populations and resources, on the one hand, and settlement subsistence patterns, on the other" (Bettinger 1991:101).

The model presented by Bettinger and Baumhoff (1982) attempted to explain the displacement and/or replacement of Prenumic peoples by Numic peoples in the Great Basin around 500-700 years BP. They argued that different adaptations (i.e., the relative reliance on large game and small seeds) between these people provided the mechanism for Numic peoples to consistently gain ground at the expense of the Prenumic peoples (Bettinger and Baumhoff 1982; Bettinger 1991:101).

In this model the Prenumic people, or the travellers, rely on a low-cost strategy that is more reliant on high quality resources requiring more travel time but less cost in extraction and processing time (Bettinger and Baumhoff 1982:487). The Numic people, or the processors, use a high-cost strategy that is more reliant on resources of low quality that require less travel costs and more costs in extraction and processing time (Bettinger and Baumhoff 1982:487). Any competition between travellers and processors (i.e., an increase in relative population density) raises travel and search time for both groups but more so for the travellers, who exhaust relatively more time processing. The key is that, "...the processor will compete for all the resources of the traveller, while the traveller competes for only a fraction of the resources of the processor, ignoring the low-ranked ones" (Bettinger and Baumhoff 1982:488).

Unfortunately, the traveller-processor model provides only a few generalized consequences for mobility strategies. Travellers are expected to move more frequently and over longer distances, while processors are expected to move less frequently and over shorter distances (Bettinger and Baumhoff 1982; Bettinger 1991:100-101). Finally, it is important to note that this model made the explicit assumption that hunter-gatherer populations are resistant to change to the extent that travellers cannot counter processor competition by switching to a processor strategy themselves (Bettinger and Baumhoff 1982; Bettinger 1991:100-101).

OTHER APPROACHES

The paucity of theoretical studies concerning mobility that go beyond ecological and evolutionary approaches has been noted. Still, there are some approaches which illustrate that social and ideological realms affect mobility.

POLITIS

Gustavo Politis (1996), based on his studies of the Nukak in the Columbian Amazon, illustrated the significance of mobility in the tropical forest. He stated that the Nukak need to 'move to produce' as they were responding to principle factors of their mobility strategy. Politis (1996) argued that the Nukak avoided overexploiting local resources using a sophisticated strategy of management and use of resources. One important purpose of Nukak mobility was to concentrate edible plant species at a given site by biased seed deposition and discriminatory thinning, etc. He concluded that: "For Archaeology there is an obvious connotation: residential camps are not established at resource patches, the patches are 'created' by the establishment and subsequent abandonment of residential camps" (Politis 1996:507). This strategy was expected to produce a high redundancy in archaeological occupations at 'created' patches of edible plant species.

KENT AND VIERICH

Kent and Vierich (1989) illustrated concern over the: "...prevalence of ecological deterministic thinking [which] has resulted in mobility being conceived of primarily in terms of ecology". Thus they present the proposition that 'anticipated mobility', or the time people expect to inhabit a site, explains a lot of site variability -- such as the square meters per person values within structures, hut diameters, and presence of formal storage facilities -- but explains little in terms of the number of huts or feature types at a site (Kent and Vierich 1989).

While their main caveat concerned the non-ecological affects of mobility on internal site structure, the ramifications for inter-site variability was recognized. For example, if site structure occurs largely due to anticipated mobility, the archaeological record is not recording site 'types', in a sense, as the site represents what was anticipated by the inhabitants to some extent. The material culture still reflects what actually happened at the site.

SUMMARY

A review of the approaches to hunter-gatherer mobility strategies (i.e., ecosystems and evolutionary ecological approaches) illustrates how study in this field has largely restricted itself to the lower levels of 'Hawkes' Hierarchy" (i.e., technology and economy). At the same time these articles supply substantial evidence that environment *is* a key factor influencing hunter-gatherer mobility strategies. Still, an understanding of socio-political and ideological affects on hunter-gatherer mobility is important.

CHAPTER FOUR: BISON ETHOLOGY

> Although we cannot study modern herds for evidence to settle the question of the Great Migration, we still know of herds that make seasonal treks into wooded areas as their forebears did, and the habits of these animals shed light on the short-range movements of bygone herds. Our most detailed observations on such behaviour come from Wood Buffalo National Park, where herds journey some distance to escape the discomfort of wind and cold. When zero and below-zero temperatures are combined with active winds, the animals may travel several miles into wooded areas in search of shelter.
>
> As these buffalo besieged by blizzard conditions move into the cover of trees, they are behaving just as old-timers said they did -- and the fortunate student of buffalo migration comes upon a rare harmony of current fact and historical record. He is watching the herds of bison journeying as they journeyed centuries ago.
>
> (McHugh 1972:178)

INTRODUCTION

The near extermination of modern Plains bison (*Bison bison bison*) has made it impossible to derive the nature of prehistoric plains bison movements from herds in their natural environments. Quite simply, there are no Plains bison left on the open plains from which to construct a model. McHugh (1972:178), in the quote above, did not believe that the study of admixed bison ranging free in the expansive Wood Buffalo National Park supplied researchers with appropriate models to reconstruct prehistoric bison movements beyond the local level.

This research departs from previous research by inferring that modern bison (*Bison bison*) are appropriate models for understanding prehistoric bison movements. It will be argued that within the seasonal cycle of the modern bison -- the 'buffalo year' -- the cycle of the prehistoric Plains bison can be reconstructed. Importantly, in the reconstruction of the 'buffalo year' it will be shown, regardless of whether one examines bison from Wood Buffalo National Park [which, since 1925, has derived from an admixed group of an estimated 1500 wood bison *(Bison bison athabascae)* and over 6000 plains bison (*Bison bison bison*) from the Wainwright Buffalo Park (Soper 1941:375; Fuller 1960:3; Reynolds and Hawley 1987:10)] or bison from Yellowstone National Park [which, since 1902, has represented the intermingling of two bison subspecies: plains bison from Montana

(Pablo-Allard herd) and Texas (Goodnight herd) with a remnant of original wild population of mountain bison (McHugh 1958:2; Meagher 1973:17)], that behaviours are consistent between the populations.

THE BUFFALO YEAR

Given that the focus of this research concerns the affects of bison movements on the Native inhabitants of the northwestern Plains, it is important to provide an account of bison activities as they occur throughout any given year. For this purpose, studies in the natural sciences concerning the annual cycle of modern bison, or the 'buffalo year' (from Roe 1951:94), will be examined. A number of events and/or activities occur in the 'buffalo year' including calving, shedding, rutting, and movements, all of which need to be described. But first, the following presents some general information regarding bison herd composition and structure.

BISON HERD COMPOSITION AND STRUCTURE

Bison are gregarious animals that can be found in relatively small to fairly large groups depending on the season (Meagher 1973:46; McHugh 1958:14-16). There are historic accounts of bison 'herds' in the millions (e.g., Roe 1951:507-511; McHugh 1972:13-17). These vast herds, recorded by historic observers, likely represented numerous herds in close proximity and such congregations are definitely not seen today in modern herds on preserves (e.g., Meagher 1973:46). In contrast to tremendously large herds, group size can range from a solitary animal to hundreds of animals (Meagher 1973:46; McHugh 1972:204-205). In short, there is much variation in group membership and in group size through time and across space (Fuller 1960:15).

In general, however, bison herd composition is classified into two types: Bull groups and mixed (or cow) groups. Bull groups often consist entirely of bulls; usually such groups consist of a few to several bull bison but can consist of up to ten bulls and sometimes include a few cows and their calves (Soper 1941:393-393; McHugh 1958:14; Fuller 1960:10-11; and Meagher 1973:46). Mixed (or cow) groups can consist of a few females to hundreds of mature females and young of both sexes and nearly always contain some mature males (Soper 1941:391-392; McHugh 1958:14; Fuller 1960:10-11; Meagher 1973:46).

The exception to the pattern is the rut. Numerous authors indicate that bison form the largest herds during the rut (Soper 1941:389-391; McHugh 1958:14; Meagher 1973:46; and Lott 1974:383). Other authors note that the largest herds form during calving and that the herds break up during the rut (Calef and Van Camp 1987:15). These same authors, however, note: "The trend toward smaller group size during the rut and asynchronous breeding distinguish bison of the SLR [Slave River Lowlands] from other bison herds and may have been attributable to characteristics of the habitat and/or stress in the population" (Calef and Van Camp 1987:15).

CALVING

Seton (1953:695) suggests a gestation period of 9 ½ months for bison cows. Soper (1941:391), observing animals in Wood Buffalo National Park, also indicates a gestation period of 9 to 9 ½ months. Soper (1941:391) suggests that on the basis of a nine month pregnancy, with mid August as the medial point of the breeding season, calving would be expected to occur about mid May.

Based on historical documents, Roe (1951:94) states that bison cows give birth between mid-April and almost the end of June. McHugh (1958:30) noted a calving season from mid-April to the end of June with a peak the first two weeks of May among bison in Yellowstone National Park. Meagher (1973:75), also working in Yellowstone National Park, recorded a similar calendric range for births among bison. She, too, noted a peak in births during the first two weeks of May (Meagher 1973:75). Soper (1941:391), as noted above, inferred a peak calving period about mid-May. For the rest of the year, from June through March, instances of calving are rare but not entirely absent (McHugh 1958:30).

When it is time for the bison cow to give birth, Seton argues that: "True to Universal instinct, she slinks off by herself to some slight hollow -- for such as there are on the levellest prairie -- and there is born the calf, or, on some rare occasions, twins" (Seton 1953:695). As noted before, Hornaday (1887:425), Stone and Cram (in Roe 1951:97), and

Soper (1941:391) noted the tendency of bison to retire to secluded spots to give birth. Yet, Roe (1951:98) indicated that bison cows gave birth anywhere and everywhere.

Again noted earlier (Chapter Two), Lott and Galland (1985) indicate that cows may shift their birthing behaviour from calving in 'the herd' to calving 'in isolation'. The cow calves 'in the herd' when there is little vegetation, thus concealing the calf with numbers but weakening the cow-calf bond. Calving 'in isolation' when there is vegetation and/or terrain, conceals the calf using the surroundings and strengthens the cow-calf bond (Lott and Galland 1985).

Recall that Meagher (1973:75) recorded that the geographic location of calving localities of the Yellowstone herds were on the wintering grounds. As well, when previous records were available, they indicated that the same area was repeatedly revisited for calving (Meagher 1973:75). Likewise, it was previously mentioned that Soper (1941:378) noted a strong tendency for bison to return to the same calving areas in Wood Buffalo National Park. Similarly, Hornaday (1887:425) indicated that calves born on the Montana ranges, while largely born on the summer range, were often born en route from the wintering grounds.

Interestingly, bison calves in Wood Buffalo National Park form pods -- groups of young bison banding together for play and/or predator avoidance -- beginning in May and peaking in June (Carbyn and Trottier 1987:2072-2073). Such post-calving activities are apparently interrupted by the rut (Carbyn and Trottier 1987:2073).

SHEDDING

Shedding, another important event in the 'buffalo year', occurs in spring (e.g., Meagher 1973:38; Hornaday 1887:412). In fact, bison may start shedding their coats as early as the last week in February (Hornaday 1887:412). By May or June the removal of old hair is, for the most part, complete (Hornaday 1887:413).

For a period of a few weeks, roughly about May, bison are literally naked on parts of their bodies (Hornaday 1887:413; Roe 1951:99-100).

> After the shedding of the body hair, the naked skin of the buffalo is burned by the sun and bitten by flies until he is compelled to seek a pool of water, or even a bed of soft mud, in which to cool and make himself

> comfortable. He wallows, not so much because he is fond of either water or mud, but in self-defence; and when he emerges from his wallow, plastered with mud from head to tail, his degradation is complete.
> (Hornaday 1887:413)

Similarly, Roe (1951:100) has argued the near-naked state of the bison roughly coincides with the peak of biting insects such as mosquitoes. As illustrated in the quote above, it has been argued that to alleviate the irritation of the insects bison resort to wallowing (Roe 1951:100; Hornaday 1887:413). Some researchers feel that it is at this time of year that wallowing is most intense (e.g., Roe 1951:100; Reinhardt 1985). Still, substantial evidence exists to suggest this is not the case. As argued in Chapter Two, while concurring that wallowing occurs throughout the summer, a number of authors contend that wallowing peaks during the rut (e.g., Bowyer et al. 1998; Garretson 1938:34; Hornaday 1887:418; McHugh 1972:197; Park 1969:62-65; Seton 1953:286; Mooring and Samuel 1998:699).

THE RUT

The next important event in the 'buffalo year' is the rut. The rut is the bison's mating season and begins as early as mid-July and lasts until the end of September on the northern Plains (e.g., Branch 1929:6-7; McHugh 1958:76-77, 1972:191-205; Meagher 1973:76-77; Roe 1951:96). McHugh (1958:23) observed a peak in activity during the last week of July through to the first two weeks of September among the Hayden Valley herd in Yellowstone National Park. In Wood Buffalo National Park the rut does not appear to start until the beginning of August and does not finish until the end of August (Soper 1941:389-390).

The earliest indication that the rut is commencing is exhibited by an increased restlessness in the bulls as they uproot small trees (i.e., 3 to 5 feet high) and increase their vocalization (Fuller 1960:89; Berger and Cunningham 1991; and Bowyer et al. 1998; Gunderson and Mahan 1980:379; McHugh 1958:26). Apparently, these activities tend to take place mainly at night while in the day there is little or no change in the tenor of the herds (Fuller 1960:89). Then, mixed herds coalesce into large groups with the mature bulls joining them from their bachelor herds (McHugh 1972:191; Meagher 1973:76-77). At this time bulls dramatically increase the effort they expend on bellowing, wallowing, and fighting

(McHugh 1972:192,196-197; Meagher 1973:77; Branch 1929:6-7). Meagher (1973:77) noted that in all the areas in which mating took place during her study in Yellowstone National Park there were uprooted small conifers, many rubbed trees, and small areas of grass that had been repeatedly horned but not much used for wallowing. All of these displays are conducted in order to earn the right to mate with females as they come into heat (e.g., McHugh 1972:192).

As an aside, bellowing is a conspicuous characteristic of the bison mating season (Lott 1974:389). Bellowing is produced most commonly when rivals are present largely before copulation as an intraspecific display (Berger and Cunningham 1991). The significance of bellowing, for the purpose of this research, rests in the fact that early explorers often recorded hearing these vocalizations by bison.

Also, Bowyer, Manteca, and Hoymark (1998), again noted in Chapter Two, suggest that wallowing and tree rubbing are scent-marking behaviours. Specifically, they argue that male urination while wallowing advertises the animal's physical condition and primes females for oestrus. This agrees with the observations that reproductive effort increases with age and that large males mate more often the small males (Bowyer et al. 1998:86). As well, the wallowing of females may leave behind olfactory signals for males (Bowyer et al. 1998). Similarly, tree rubbing occurs most commonly among females and, as above, may relate to advertising the reproductive status of the animal (Bowyer et al. 1998:88). As noted earlier, Bowyer et al. (1998:88) note the similar behavioural function between wallowing and rubbing but fail to explain the significance of tree rubbing in a species adapted to a grassland environment. The current research suggests that, in the past, the rut occurred at the plains-parkland interface where the animals were in a position to use trees and shrubs growing in the vicinity (see Chapter Two).

Importantly, bison breeding in Yellowstone National Park occurs on the summer range (Meagher 1973:76-77). Similarly, Soper (1941:390) notes that for the bison in Wood Buffalo National Park, breeding occurs all over the summer range but the 'greatest demonstrations' are near a common location.

Following the rut in the late summer and early fall, the large groups break up into their former groupings of mixed herds and bull herds. The animals then move to their winter ranges where they tend to preferentially occupy fairly open forest-meadow and open wooded valleys rather than forested areas (Meagher 1973; Soper 1941). To speculate, there appear to be two main reasons why bison (esp., mixed herds) would preferentially occupy intermediate areas in the late fall and winter. First, such areas provide both the advantage of access to superior forage for large numbers of animals within close proximity to the shelter of trees (e.g., Morgan 1980:153-154). That is, the large transition zone where grasslands become more and more shrubbed and treed, the forest-meadow areas, or wooded river valleys, provide superior forage for bison while still being close to the shelter of trees, etc.

Second, the ability of bison to protect calves increases in open spaces. In studies of bison predation by wolves in Wood Buffalo National Park, the response of calves to danger involves: 1) running to a cow, 2) running to the herd, 3) running to the nearest bull, 4) getting out front and center of the fleeing herd, and 5) running through water bodies (Carbyn and Trottier 1988). When bison fail to stand their ground and flee, the protective formation of keeping the calves 'out front and center' of the herd provides adequate cover. However, this protection breaks down when bison are chased from the meadows or plains into the woods or parkland (Carbyn and Trottier 1988:301). Carbyn and Trottier (1988:300) state: "Heavy vegetation in the form of trees probably acts as a 'filter'. Large animals (i.e., bulls, cows) crash through the vegetation, while calves tend to fall behind and are exposed to trailing wolves." They conclude:

> For maximum protection in fleeing herds, calves should be forward of the center of the herd and flanked by adults. Although sample sizes are small, this was observed in herds in open prairies. Once fleeing herds are chased into forests, or otherwise more heavily vegetated areas, the positioning of calves probably changes. It appears that when herds of cows with calves enter forests, vulnerability of calves increases, in that they are less agile in areas where their movements are obstructed. Vegetation is likely a greater obstacle to the movements of calves than it is to that of adults. This results in the separation of young from adults and increases the probability of death of the calves.
>
> (Carbyn and Trottier 1988:301)

A case can be made in which the requirement for shelter in winter brings the animals to the parkland while the open spaces at the edge and/or within the parkland provide superior access to forage, especially for large numbers of animals, and open space for calves to outrun predators. Given this hypothesis, one would expect cow-calf herds to preferentially inhabit the open spaces at the edge of the parkland and bulls to be more randomly distributed. However, this hypothesis still requires testing.

MOVEMENTS

Before leaving the topic of the 'buffalo year', the issue of bison movements must be addressed. At least two large free-range bison herds have been studied for their movement patterns, these being the herds in Yellowstone National Park (Meagher 1973, McHugh 1958) and Wood Buffalo National Park (Soper 1941; Fuller 1960; Carbyn et al. 1993).

In the mid-1960s, Margaret Meagher (1973), studying herds in Yellowstone National Park, reported fairly regular movements of bison. She states: "Most of the bison in Yellowstone are migratory, moving in spring from the lower wintering valleys to higher summer ranges, and reversing this altitudinal migration in the fall" (Meagher 1973:77). The following discussion of bison movements is adapted from her work (see Meagher 1973:77-85) [McHugh (1958:13) provided similar, but less detailed, data on the herds in Yellowstone National Park].

In the spring, the animals generally move from a lower wintering valley, where they are relatively sedentary, to higher summer ranges, where they are more active (Meagher 1973:77). "Although all groups of a particular wintering area did not move at once in spring, they all moved within a few day's time" (Meagher 1973:77). Generally, the bison move between their wintering and summering grounds between late May and early June. Bulls usually vacate the range several weeks after the mixed herds leave the wintering grounds (Meagher 1973:78). Notably, the Yellowstone bison fail to 'follow any discernible vegetation and snow melt sequences', but rather appear to be prompted to move by the warmth of spring days (Meagher 1973:78)

Calving season starts in mid April and lasts to the end of June (Meagher 1973:75). Hence, calving overlaps with the movement of the herd to its summer range which occurs roughly between late May and early June (Meagher 1973:78). As noted above, Yellowstone herds tend to calve on their wintering grounds and the repeated use of calving areas has been recorded (Meagher 1973:75).

The rut takes place on the summer range between mid July and mid August (Meagher 1973:76). The altitudinal migration is reversed in the fall with the majority of animals arriving at the wintering grounds roughly between late October and mid November; however, this movement occurs as early as mid-September and as late as late November (Meagher 1973:78). However, movement to the winter range can be interrupted by shifts between summer and winter ranges during variable weather (Meagher 1973:78). Bulls usually arrive first at the wintering grounds (Meagher 1973:81). Generally, the movement to the wintering grounds is seen as less abrupt than the movement to the summering grounds. Meagher (1973:81) notes that cold temperatures, alone, do not cause the shift to the wintering grounds. Rather snow depth and exposure to harsh conditions appear to be the main impetuses to return to the wintering grounds.

In the mid-1930s, Dewey Soper (1941) reported very similar movements amongst bison in Wood Buffalo National Park. The following discussion of bison herd movements is adapted from his work (see Soper 1941:384-385).

> By far the greater number of bison execute two distinct seasonal movements, varying somewhat in time and length. These occur alternatively spring and fall, to and from the uplands of Alberta Plateau [summer range], and the plains and prairie west of Slave River [winter range], respectively.
>
> (Soper 1941:384)

In winter, the vast majority of bison are found in the southeast corner of the park just west of the Slave River (Soper 1941:384). In general, the herds are quite sedentary as: "...the same herds may be observed in the same extensive meadows and plains at intervals over months of time" (Soper 1941:380). Some herds are quite sedentary along the western fringes of the winter range and only travel 5 to 10 miles to reach their summering grounds; other bison, in more remote parts of the park travel distances of up to 150 miles to reach their summering ranges (Soper 1941:381, 384). The principal movement in spring occurs in late April and/or early May with all movement obscured by the gradual nature of the process (Soper 1941:384). This movement to the summer range, however, has been detected as early as the last week of February (Soper 1941:384).

Soper (1941:391) inferred a mid-May peak in calving among bison in Wood Buffalo National Park. The place that many of the calves are born is in the eastern margin of the summer range (i.e., the eastern edge of the Alberta Plateau) (Soper 1941:378, 384). Movement to the summering ground and calving likely overlapped with calving occurring on the edge of the summer range.

By June, the bison become numerous in the summer range (Soper 1941:385). The rut does not appear to start until the beginning of August and lasts until the end of August (Soper 1941:385, 389-390). Soper (1941:390) notes that for the bison in Wood Buffalo National Park, breeding occurs all over the summer range with the 'greatest demonstrations' near a single location -- Pine Lake. Importantly, Five-Acre Wallow, a notable wallowing location, is situated immediately north of Pine Lake (Soper 1941:386).

By the end of August, herds begin to move back to their wintering grounds (Soper 1941:385). By late October or early November the summer range is almost deserted (Soper 1941:385). From approximately November to March the bison remain on their wintering grounds (Soper 1941:385). Motivation for herd movements is stated to center on access to forage and not so much on climatic conditions, elevation, or orientation (Soper 1941:384).

More recently, Carbyn, Oosengbrug, and Anions (1993:104-109) have documented the bison movements in Wood Buffalo National Park. For animals in Area II, movement to summering grounds occurs in late March with calving occurring at intermediate areas between the edge of the wintering grounds and the summering grounds (i.e., One Lake Sweet Grass, Lousy Creek). The rut begins as early as the third week of June but does not peak until August (Carbyn and Trottier 1987:2074). As above, often the same areas that serve as calving grounds also serve as foci of the rut. For example, at Lake One, Carbyn and Trottier (1987) observed both calving (early May) and the rut (starting late June). Sweet Grass Meadows serves as a summering ground, and by September/October there is movement back to the winter grounds (Carbyn et al. 1993:109).

PREDICTIVE MODEL

Based on modern observations, the following model is presented concerning bison movements on the northwestern Plains. In general, herds moved from their wintering locations in broken terrain and parklands on the periphery of the plains, where they were generally sedentary, to their summer ranges on the plains proper, where they were generally move active.

Period I. The majority of bison moved from their winter range to their summer range between late May and early June; however, this process may have begun as early as late February. The cow-calf herds initially left the wintering grounds with bulls following a few weeks later. Calving occurred between mid-April and the end of June. Because of the timing of the spring movement, calving started on the wintering grounds but, because it overlapped with the movement of the herd to the plains during late May and early June, calves could also have been born en route to the summer range. That is, calves were likely to be born near the interface between their summering grounds and their wintering grounds as the animals moved between these two areas.

Period II. After having calved and moved on to their summering grounds bison spent a period of time "wandering' the plains. From the beginning of July to mid-July bison spent their time strictly grazing.

Period III. The initial movement from the summer range to the winter range coincided roughly with the beginning of the rut. The rut took place towards the edge of the summer range (i.e., plains) between mid-July and September. This hypothesis considers the congregation of these animals for the rut as the beginning of their return migration to their wintering grounds. The rut took place near the interface between their summering grounds and wintering grounds (Hence, calving locations could have coincided with rutting locations in space but not time).

Period IV. The migration continued between October and mid-November as bison moved more-or-less into their wintering grounds depending on weather.

Period V. Because bison go through fairly recognizable phases while on the wintering range, the 'buffalo year' was further subdivided into three parts. *A)* By mid-November the animals reached their wintering grounds. *B)* January and February were typically the coldest months of the year and bison were expected to be "farthest" into the woods in the largest numbers during these months. *C)* By March the animals rearranged themselves in preparation for their return to their summering grounds.

A schematic illustration of the 'buffalo year' as interpreted using modern bison ethology is illustrated in Figure 3. In essence, this embodies the predictive model.

HISTORICAL RECORDS AND BISON MOVEMENTS

This section uses the predictive model, established above, to structure an evaluation of excerpts from historic documents concerning the location of bison throughout the year on the northern Plains. The historic records are largely notes and journals of fur traders and, thus, contain views of bison movements largely from the periphery of the plains. Because of this 'forest-edge' perspective, this evaluation splits the northern plains into four geographic areas in order to simplify analysis. These four areas are the eastern parkland, the northern parkland, the western montane, and the Alberta-Saskatchewan Plains. A map showing commonly referred to areas in the historic documents, or modern localities used for geographic reference, can be found in Figure 4.

READING HISTORIC DOCUMENTS

The manner in which historical documents (i.e., daily fieldnotes, logbooks, diaries, and journals, etc.) are used in history and historiography has changed with the influences of postmodernism in the 1990s (Brown and Vibert 1996). The following is an attempt to summarize key points of this transformation as presented by Brown and Vibert (1996) and illustrate their importance to the current work.

A key influence of postmodernism was that it noted the objectivity of the interpreter or reader was an illusion. All readers engage texts with 'baggage' or preconceived ideas concerning the subjects about which they read; thus, objectivity was no longer considered possible. Related to this perspective is the notion that facts are socially constructed and are not objective either. While the context in which the text is being read is important, it is also important to place the text in the context within which it was written. Asking why the document was produced, by whom, and for whom, forces the reader to consider what was noted and what may have been omitted.

Consider the difference between a journal of a fur trader and that of a scientific expedition. Over the same course their records would almost certainly be different. Still, in the current research the concern lies in seasonal sightings of bison. It is relatively safe to suggest that bison, owing to their status as a primary subsistence item, are unlikely candidates for misrepresentation in their occurrences in journals whether scientific or otherwise.

The context of individual words must even undergo consideration within the postmodernists' review. Placing specific words into their appropriate contexts can have profound affects on interpretation. For example, many records indicate that in winters of scarcity the inhabitants of fur trade forts spent time on the 'plains' with the buffalo in order to feed themselves. Most readers of these texts take this at face value that the people were out on open plains. A case in point is Fort Alexandria, on January 4, 1801, when Daniel Harmon noted sending people into the 'plains' for the winter (Lamb 1957:41). He stated :"In the morning the greater part of our People (Men, Women & Children) were sent to go and pass the remainder of the Winter in the *Plains* about two Days march from this, and where they will live upon the flesh of Buffaloe which they will kill themselves, and during their stay there, their Dwellings Will be Tents or Lodges made of skins of either Buffaloe, Moose or Red Deer..."(Lamb 1957:41, italics mine). In placing this statement in context it is important to note that on December 2, 1800, Harmon recorded the environment within one day's march of Fort Alexandria as follows:

> The Country we past through in going there [the hunter's tent] is a large Plain with here & there a Grove to be seen, and this evening we returned to the Fort, the Peoples Horses loaded with Flesh of Moose & Deer. The Buffaloe are still a considerable distance farther out into the spacious Plains and nothing but severe cold weather, will drive them into the more woody part of the Country.
>
> (Lamb 1957:39-40)

Thus Daniel Harmon used the term 'Plains' to describe the environment two days from Fort Alexandria and he used the term 'a large Plain' to describe the area within one day's travel from the fort. But the latter contains fields 'with here & there a Grove to be seen'. This indicates Harmon's preference to label more open places as the 'plains' even when there is substantial tree cover around (i.e., groves).

Importantly, Harmon modified the term 'plains' when he travelled to the 'true' plains. For example, on July 30, 1803, after failing to write in his journal for about one month Harmon recorded a sojourn from Fort Alexandria:

> I am just returned from an excursion out into the *large Plains*, and I was accompanied by two of my Men, however in all our ramble we did not see an Indian, the most of whom (as they wont to do every Spring) are gone to War again. But we Saw, run down and killed Buffaloe, and we also saw Red Deer & Cabri (the latter a species of the Deer and about the size of a Sheep) bound across the plains..."
>
> (Lamb 1957:68, italics mine)

Also, Harmon previously used the term 'large plains' on June 1, 1801, when he noted: "In short there are nearly one hundred mouths to be filled out of our Store for the greater part of the Summer -- but we have two good Hunters and Moose and Deer are not scarce, but the Buffaloe are gone to the *large Plains* again." (Lamb 1957:48, italics mine). In the first instance, Harmon observed Antelope (Cabri) and was clearly in an area we would refer to as the plains today. Similarly, in the latter instance Harmon's words almost certainly meant the bison have left their wintering grounds for the 'large plains' or their summering grounds. In short, the modification of the term 'plains', with the adjective 'large', illustrates that the term 'plains' cannot be taken colloquially. In context, 'plains' could mean areas with less concentration of trees, bush, etc., not necessarily the treeless plains we recognize today.

Another consideration of interpreting historic texts lies in other voices in the texts. In the material under consideration for this research, the fur traders often transcribe information they receive from Native people they encounter. These 'quotes' must be evaluated as to whether the voice of the 'others' is coming through as intended, altered through numerous interpreters, or outright twisted to meet the transcriber's objectives. In the current research, since most of the journals are from scientific explorations or fur-traders working for themselves there is no obvious reason why the Native people in the records would be knowingly misrepresented.

Lastly, Brown and Vibert (1996) indicate that placing texts in context cannot lead to objective reality. The relationship is more complicated than this. The interpretation of texts is a product of the author's background and experience and any interpretation is not just a product of research and evidence but is constructed. Here, the biases that the current researcher has brought with him as baggage are of concern. To encapsulate the approach for this research it is noted that the analyses of historic documents rest on that assumption that they could be interpreted in terms of modern bison behaviour.

SYNOPSIS OF GENERAL TRENDS IN THE NATURE OF BISON MOVEMENTS

A consistent theme in the historical literature concerning the movement of bison is that bison moved toward wooded shelter as the annual weather cycle worsened. The following presents observations from the historic literature about the generalized movement of bison in this regard.

EASTERN PARKLAND

An early observer of bison behaviour on the eastern margins of the plains was Daniel William Harmon. Harmon was a fur trader who spent a number of years at Fort Alexandria, Manitoba, near the edge of the prairie tall grass-parkland interface (Lamb 1957:ix-xxviii). On December 2, 1800, after a day trip to his hunter's tent Harmon stated (as previously quoted): "The Country we pass through in going there [the hunter's tent] is a large Plain with here & there a Grove to be seen, and this evening we returned to the Fort, the Peoples Horses loaded with the Flesh of Moose & Deer. The Buffaloe are still a considerable distance farther out into the spacious Plains and nothing but severe cold weather, will drive them into the more woody part of the Country" (Lamb 1957:39-40).

Similarly, after another trip to his hunter's lodge, located within a day's march of Fort Alexandria, Harmon noted on January 15, 1801: "Beautiful weather. On the eleventh I accompanied Six of our People to the Hunters Lodge, and the Day following they returned to the Fort with their Sledges loaded with Meat, while I remained there to go farther into the Plains along with the Hunter, and where I am sure I saw in different herds at least a thousand Buffaloe grazing..." (Lamb 1957:42).

Harmon, now writing from a fort at Bird Mountain (northeast of Fort Alexandria on the Swan River) on January 9th, 1802, again illustrated the basic response of bison when confronted with good weather during the winter (Lamb 1957:53). He stated: "Several Days ago I sent a number of Men to Alexandria for Meat (as our Hunters do not kill anything yet there are no want of Moose and Deer hereabout) but they have just returned with nothing and say that the Buffaloe owing to the late mild weather have returned a considerable distance out into the large Plains..." (Lamb 1957:53). As noted above, the 'large plains' likely means the plains as we conceive it today.

A contemporary of Harmon, Alexander Henry the Younger, was a fur-trader stationed at Pembina Post along the Red River. Henry noted: "We experienced a run of terribly cold, stormy weather, that drove the poor old bulls every night to take shelter along our stockades" (Coues 1965 Vol. I:426). Similarly, Henry the Younger, writing on November 21, 1800, at Park Post along the Red River, noted the 'cruel weather' and the appearance of a bison cow herd that had moved close to the fort (Coues 1965 Vol. I:154-155).

On January 2, 1801, Henry the Younger, again writing at Park Post along the Red River, noted: "The cold was severe; weather cloudy and calm. The oaks made a continual cracking noise as they split with the frost, sometimes like the report of a gun. Buffaloes came within gunshot of the stockades..." (Coues 1965 Vol. I:163). Later that same month, Henry again observed bison movement in response to cold weather. He noted: "On the 9th [January] we had a terrible snowstorm. The buffalo now keep at a distance." (Coues 1965 Vol. I:166). He is not explicit as to whether the animals were sheltering further along the river or west in more open country, etc. But, the animals could not have been too far away since, on the 14th of January, Alexander Henry the Younger stated: "I had seen almost incredible numbers of buffalo in the fall, but nothing in comparison to what I now beheld. The ground was covered at every point of the compass, as far as the eye could reach, and every animal in motion" (Coues 1965 Vol. I:167).

Henry the Younger encapsulated his observations from Park Post on February 1, 1801: "Stormy weather causes the buffalo to approach the woods for shelter, and it no sooner abates than they return to the plain." (Coues 1965 Vol. I:169). A few days later Henry the Younger commented that: "On the 17th [February] we had a terrible snowstorm. I can count daily, from the top of my oak, from 20 to 30 herds of buffalo feeding in the plains. It is surprising how the cows resist the piercing N. wind, which at times blows with such violence over the bleak plains, and raises such drifts, that it cannot be faced; still those animals graze in the open field" (Coues 1965 Vol. I:169-170). In the last two quotes, the 'plains', of course, are the 'open fields' between the well wooded west-east running streams that fall into the Red River and not the true plains which are located farther to the west.

Now at Pembina House in 1802, Henry the Younger noted the beginning of an early winter with the freezing of the Red River on November 4, a heavy snow fall on November 24, and severe cold on November 27 at which time he noted: "Buffalo are very numerous" (Coues 1965 Vol. I:206). By December 26th, the buffalo having been so numerous Henry stated: "Buffalo passing in droves within 100 yards of the fort. My winter stock complete" (Coues 1965 Vol. I:206).

Lastly, on the November 15, 1805, after returning to Pembina River Post, Henry the Younger once again observed: "A terrible snow storm; buffalo passing northward in as great numbers as ever I saw them, and within 100 yards of the fort" (Coues 1965 Vol. I:273).

As an aside, the encroachment of Europeans into the eastern parkland and plains in the early to middle part of the eighteenth century affected bison numbers and behaviours (e.g., Hornaday 1887:487-488; Roe 1951:367-415, 447-466; Isenberg 2000:93-122). Thus, accounts of bison movements in the eastern parkland after the 1820s are not likely to be especially good representations of bison in their 'natural' habitat. The use of examples from this time period in the eastern parkland contain caveats to this affect.

NORTHERN PARKLAND

Owing to the relatively lengthy utilization of the northern parkland during the fur trade, historic documents from this area speak loudly to the generalized nature of bison movements. For example, Alexander Henry the Elder (Bain 1969:286) was a fur trader writing from the east-central Saskatchewan parkland (southwest of modern Humboldt). The following passage illustrates Henry the Elder's observation of the effect of inclement weather on bison movement; that is, he noted the bison's urge to move to shelter during poor weather. On the 7th of February, 1776, he stated:

> The storm continued all the night, and part of the next day. Clouds of snow, raised by the wind, fell on the encampment, and almost buried it. I had no resource but in my buffalo-robe.

> In the morning, we were alarmed by the approach of a herd of oxen [buffalo], who came from the open ground to shelter themselves in the wood. Their numbers were so great, that we dreaded lest they should fairly trample down the camp...
>
> (Bain 1969:286)

This statement illustrates that, whether bison were located on the plains or at the edge of the parkland in central Saskatchewan, they were no more than a day's journey from well wooded areas.

Peter Fidler was also a fur trader, known best for his documentation of overwintering with the Peigan in 1792/93. In this instance, however, on December 20, 1796 he wrote from Buckingham House located on the North Saskatchewan River well north near the parkland-forest interface: "We are but middlingly off for provisions, having only three weeks stock before hand, but hope the buffalo will be soon nearer us than before by reason of the severe weather that has of late prevailed" (Johnson 1967:79). Fidler noted this same trend in bison movement when serving at Chesterfield House on Oct. 2, 1800. He stated: "Buffalo very numerous just at the house", a statement qualified by a footnote that reiterated: "...that the buffalo had 'come out of the Barren ground for cold'..." (Johnson 1967:270). Of course, at Chesterfield House, located at the confluence of the Red Deer River and South Saskatchewan River, the animals were either in the deep river valley by the fort or above on the plains. The valley/uplands dichotomy perhaps encouraged the bison to use the river valley only during truly inclement weather.

Situated at Edmonton House, James Bird (Johnson 1967:235) recorded Blackfoot complaints, on February 24, 1800, that the unseasonably warm weather had kept the bison away. Bird stated: "The two parties [of Blackfoot] brought us 494 made beaver in wolves and small foxes but no provisions of any kind; indeed they complain of not being able to procure sufficient provision for their own families, there being a scarcity of buffalo everywhere owing principally to the amazing warmness of the winter" (Johnson 1967:235). He reiterated this same scenario in a letter dated April 18, 1800, which stated: "Owing to the amazing warmness of the winter, a scarcity of buffalo and other concurrent reasons, the Slave Indians [Blackfoot] have not killed near their usual quantity of furs..." (Johnson 1967:241).

Henry the Younger, having observed bison in the Red River area for many years, made similar observations of bison near the Forks of the Saskatchewan. On August 31, 1808, near Fort La Corne (old Fort St. Louis) on the Saskatchewan River just below the Forks he stated: "The plains on the S. approach the tops of the banks, but it cannot be called an open country, as spots of woods are frequent. Buffalo abound in winter, when the cold obliges them to leave the plains for shelter among the hummocks, where they find plenty of good long grass" (Coues 1965 Vol. II:483).

Members of the Palliser Expedition, an expedition of scientific discovery and reconnaissance, also made some general observations concerning the movement of bison and about the concomitant settlement pattern of the Native people that relied on them for subsistence. For example, Hector and Vaux (1861:249-250, in Verbicky-Todd 1984:91-92) stated: "During the winter, as the buffalo seeks the shelter of the partially wooded zone of country, the Plains Indians tent nearer the North Saskatchewan, or towards the Touchwood Hills and Fort Carlton".

Similarly, on December 17, 1857, Hector was travelling from Fort Carlton to Fort Pitt when he came across a pound near Whitewoods Lake (near Jack Fish Lake). He stated: "Soon after starting we passed a 'pound', into which the Indians drive the buffalo to slaughter them; however, they are very hard up this winter, as the mildness of the season has allowed the buffalo to stay much longer than usual out in the plains this year, severe weather always compelling them to seek shelter in the woods" (Spry 1968:189).

Evidence of bison movements toward wooded areas are not restricted to historic documents but are also apparent in ethnographies of Native people. For example, based on discussions with Plains Cree informants, David G. Mandelbaum (1979:52) stated: "The techniques of procuring buffalo varied seasonally. In autumn and early winter, when the herds were entering the wooded regions, the chute and pound methods were used."

WESTERN MONTANE

Fur trade posts were not established in the western Foothills until quite late in the fur trade era. As such, there are fewer accounts in the historic literature for this area.

Henry Youle Hind (1971 Vol. I:337-338), part of an exploring expedition in 1858, noted: "Migratory bands of Indians dependent upon wild animals for their support must diminish or increase with the area over which their sustenance extends, and it is apparent that the extension of absolutely treeless prairies and of sterile soil, the formation of 'Plains,' in a word, is unfavourable to the increase of the buffalo, the elk, the moose, the antelope and the bear, -- animals which always seek the protection of 'woods' during the terribly inclement winters of the north-western part of the American continent".

Similarly, Hind (1971 Vol. II:107) noted: "The ranges of the buffalo in the north-western prairies are still maintained with great exactness, and old hunters, if the plains have not been burnt, can generally tell the direction in which herds will be found at certain seasons of the year."

In addition, there is material from ethnographic sources that speak to this issue. Blackfoot informants, interviewed by George Bird Grinnell (1962:234) indicated: "As winter drew near, the buffalo would again move up close to the mountains, and the Indians, as food began to become scarce, would follow them toward the pis'kuns."

ALBERTA-SASKATCHEWAN PLAINS

For the Alberta-Saskatchewan Plains there are a few general references concerning the habits of bison with regard to season. In the Palliser Papers, Palliser noted that while near the confluence of the South Saskatchewan River and Sage Creek there was a shortage of grass for the horses due to overgrazing by bison. A footnote for this entry stated: "However, the timber on the small tributaries of the river kept off the buffalo, and so a little grass was obtained for the horses, for the buffalo shuns the timber until mid-winter" (Spry 1968:146).

Similarly, on August 14, 1858, at the Hudson Bay Company's Old Bow Fort just down stream from Seebee, Palliser noted: "This is now nearly the time, too when these Indians [i.e., Blackfeet and Blood] commence to arrive from the plains in the south-east, for the buffalo in winter approach the edge of the woods, and so also do the Indians, seeking fuel and thickwood animals, in case of the buffalo failing them during the winter" (Spry 1968:266)

Henry Youle Hind (1971:339) stated: "Ponds and lakes are numerous on the Grand Coteau side, and it is probably on this account that the buffalo cross the Qu'appelle valley near the Moose Jaws Fork and west of Buffalo Pound Hill Lake; in winter they keep towards the Touchwood Hills for the sake of shelter, and the excellent herbage which grows in the beautiful meadows between the aspen clumps".

Lastly, in 1911, Káinaikoan, a Blood Indian informant of Uhlenbeck (1912:1-8), relayed an account of the seasonal round (see Chapter Two). He noted that the Peigan would remain in their wintering camps along the Marias River until spring. Then as the bison moved on to their summer range he stated: "When the buffaloes are far, we overtook them in the Cypress Hills; when they were not far, we overtook them in the Sweet Grass Hills" (Uhlenbeck 1912:1).

PERIOD I (MID-APRIL TO END OF JUNE)

Based on observations of modern animals, calving was expected to occur between mid-April and the end of June. Following Peck (2000), the timing of the spring migration was expected at about this same time. Hence, calving started on the wintering grounds but calves could also be born en route to the summering grounds. That is, calves were expected to be born near the plains-parkland interface as animals moved between their wintering grounds (parkland and plains-parkland interface) and summering grounds (plains).

By late May or June, few bison would be expected in the parkland. The herds would be well out on their summering grounds on the plains. This transition from wintering grounds to summering grounds is expected to have occurred relatively quickly.

EASTERN PARKLAND

Among the earliest references to a calf being born and surviving, in terms of the 'buffalo year', is one that came from Henry the Younger who observed calves on April 11, 1801, at Park Post. (Coues 1965 Vol. I:175). Henry the Younger stated: "Fine warm weather. Buffalo are now mostly with calves of this spring" (Coues 1965 Vol. I:175). Similarly, Henry the Younger observed a calf in the Hair Hills (Pembina Mountains) on

April 13, 1805: "I came off alone; chased several herds of buffalo, and killed three cows and several calves..." (Coues 1965 Vol. 1:241).

Calves were born earlier in the 'buffalo year' but often did not survive. For example, on February 28th, 1801, Henry reported 'a calf of this year' found dead (Coues 1965 Vol. I:171). Still, on March 23rd, 1801, Henry recorded that his men had returned from Reed River where they had seen two calves of this year (Coues 1965 Vol. I:173).

On April 19, 1802, Henry the Younger at the Pembina River Post noted: "Red River began to give away, and the ice moved; snow all melted on the plains, I went hunting; calves are very numerous, and I brought one home with me alive." (Coues 1965 Vol. 1:195). Importantly, between April 20 and 23, Henry noted, respectively: "Buffalo in abundance on the E. side of Red River and crossing opposite the fort [to the West side of Red River, across the Pembina River from the fort]", followed by: "River clear of ice" (Coues 1965 Vol. I:195). On May 10, 1804, near Pembina Post he noted: "I returned home; chased buffalo, and killed three cows and several calves..." (Coues 1965 Vol. I:244). By May 15th of 1802, Henry the Younger was inclined to note: "Men bring home calves daily" (Coues 1965 Vol. I:197).

Another observation Henry the Younger made regarded the large number of bison drifting down the river as the rivers broke up. He noted on April 1, 1801 that: "The river clear of ice, but drowned buffalo continue to drift by [in] entire herds" (Coues 1965 Vol. I:174). Bison continued drifting down the river on April 18th: "Rain, drowned buffalo still drifting down the river, but not in such vast numbers as before, many having lodged on the banks and along the beach" (Coues 1965 Vol. I:175). On April 25th, bison were still drifting down the river: "Drowned buffalo drift down the river day and night" (Coues 1897 [1965] Vol. I:176). On April 30th, "Drowned buffalo drift as usual" (Coues 1965 Vol. I:177). There is some evidence that the drowned bison were largely spring casualties rather than animals trapped in the ice from fall crossings (see Period V, Eastern Parkland).

Given that the animals likely congregated for the calving season and for their movement to the plains, it is reasonable to expect historic accounts of bison abundance during April and May with steadily increasing numbers of accounts of bison scarcity as the animals left over those months. As well, the movement of bison to the plains is expected to have been a quick transition relative to their movement from the plains to the parkland in the fall.

Bison were abundant enough around Park Post for Henry the Younger to chase them on horse back on the 29th and 30th of April, and on the 4th of May, 1801 (Coues 1965 Vol. I:177-178). As noted above, he recorded a similar horseback hunt near the Pembina River Post on May 10, 1804: "I returned home; chased buffalo, and killed three cows and several calves..." (Coues 1965 Vol. I:244). On May 9, 1806, at the Pembina River Post, Henry the Younger observed large herds of bison: "Buffalo grazing in abundance westward" (Coues 1965 Vol. I:275).

In contrast, Henry the Younger, while stationed at Pembina River Post in 1803, noted taking sturgeon, catfish, and a moose during the month of May. It was not until the 31st of May that bison appeared in his records; he stated simply 'Buffalo in abundance'. Interestingly, according to the model, bison were expected to be well on the move to the plains by June. Yet, on June 10, 1803 at Pembina River Post, Henry the Younger stated: "The summer men came in with 10 buffalo, which are numerous, near at hand, and very fat." (Coues 1965 Vol. I:214). The emphasis on their location as 'near at hand' suggests that this may not be the norm. In support of this scenario, on July 7, 1806, north of the Pembina River, Henry the Younger was reunited with a party of Saulteaur who had been camped in the area since June 11th 'living on buffalo'. However, at the time of Henry the Younger's arrival [July 7th] he stated: "Cows there are none, and even bulls are scarce" (Coues 1965 Vol. I:286).

At this time of year, similar things are being said in other parts of the Eastern Parkland. On June 1, 1801, Daniel William Harmon noted: "In short there are nearly one hundred mouths to be filled out of our Store for the greater part of the Summer -- but we have two good Hunters and Moose and Deer are not scarce, but the Buffaloe are gone to the large Plains again." (Lamb 1957:48). As before, 'large plains' is interpreted as the modern plains.

Lastly, the summer hunts of the Red River and White Horse Plains Métis provide a striking example of the nature of bison movements. These hunts were conducted with the purpose of putting up winter stores and for trade. It is reasonable to infer the Métis wanted to have successful hunts and, thus, would hunt in localities containing the most bison. Hind (1971:179) stated:

> About the 15th of June they start for their summer hunt of the buffalo. There are two distinct bands of buffalo hunters, one being those of Red River, the other of the White Horse Plain, on the Assiniboine. Formerly these bands were united, but, owing to a difference which sprung up between them, they now maintain a separate organisation, and proceed to different hunting grounds. The Red River hunters go to the Coteau de Missouri, and even as far as the Yellowstone River; the White Horse Plain settlers generally hunt west of the Souris River, and between the branches of the Saskatchewan, but also over the same grounds as their Red River brethren.
>
> (Hind 1971:179)

NORTHERN PARKLAND

Near Fort Vermilion, on April 15, 1810, Henry the Younger's hunters did not see any calves although, based on the following quote it is clear they expected to see young bison. Henry the Younger wrote: "Mr. Rocque and others went hunting, for diversion, and killed two cows, but not a calf was to be seen." (Coues 1965 Vol.II:597). More affirmatively, James Bird noted taking calves during a trip down the North Saskatchewan River. On May 23, 1800, down stream from the confluence of the North Saskatchewan and Turtlelake River, he stated in his journal: "Killed one cow buffalo and several calves" (Johnson 1967:245). Similarly, Matthew Cocking (Burpee 1908:117), while travelling just west of the Forks of the Saskatchewan on April 20, 1773, observed a bison calf. He stated: "River broke up and much ice came down. A young buffalo seen but too swift to be overtaken on foot" (Burpee 1908:117).

As hypothesised above, at this time of year bison were expected to congregate to calve and move to the plains making them abundant in the parkland periphery in April and May, diminishing in abundance in the parkland periphery into June.

An observation of large numbers of bison occurred, on April 18, 1810, at Fort Vermilion. as Henry the Younger noted: "Mr. Rocque out hunting on the S. side, where he saw numerous buffalo..." (Coues 1965 Vol. II:594). Similarly, as James Bird travelled down the North Saskatchewan on May 22, 1800, he noted numerous bison just down stream from the Turtlelake River; he recorded: "Great numbers of buffalo on the banks of the river" (Johnson 1967:245).

At Edmonton House, in a letter dated April 25, 1798, William Tomison noted the local Cree had recently abandoned nearby bison pounding operations. He stated: "...and so it appears for all the Southerd Indians on the south side the river was at two buffalo pounds until lately, thirty two tents in number..." (Johnson 1967:133). Given that the pounds were used all winter, it is tempting to argue they fell into disuse owing to the departure of the bison to the plains.

William Tomison, while travelling down the North Saskatchewan in the middle of May, failed to record any occurrence of large bison herds and noted on May 27, 1798: "Stopped several times to-day in search of buffalo but had little success. The following day he recorded: "Killed two red deer and two buffalo bulls, all very poor" (Johnson 1967:121).

Perhaps the best description of bison abundance in the Northern Parkland in late May and June was written by Henry the Younger when he arrived at the new Fort White Earth, at the confluence of the North Saskatchewan and the Vermilion River. On June 3rd he noted: "At noon we reached new Terre Blanche [Fort White Earth] and found the place destitute of fresh meat. Pemmican is the only thing we have, and of that but 38 bags, for the following families..." (Coues 1965 Vol. II:602). Henry not only noted the paucity of fresh meat but the likelihood the situation might not change anytime soon as indicated by his evaluation of their provisions [i.e., pemmican].

WESTERN MONTANE

Alexander Ross provided a generalized impression of calving for the western foothills and parkland. Some time between 1810 and 1825 along the western foothills of the Rocky Mountains he made the following observation (reiterated here for consistency):

> The cow calves generally at one period and that period later by a month than our tame cattle, when they all as if with one accord withdraw themselves from the mountains and rocks into large families and resort to the valleys, where there is open ground with small clumps of wood affording shelter and preservation, as there they can from afar see the approach of an enemy. The cows in the centre. The bulls graze in the distance, all in sight of each other.
>
> (Ross 1956:284)

ALBERTA-SASKATCHEWAN PLAINS

On June 5, 1858, the second exploring season of the Palliser Expedition began (Spry 1968:230). The purpose of this part of the expedition was to explore the area between the Saskatchewan Rivers. By June 21 the party was south of the Eagle Hills where they had 'fallen in with a band of five buffalo bulls' of which they killed two (Spry 1968:235). Still in the same area near Landis Lake, they stated: "Buffalos have been seen in large numbers about 15 miles from our stopping place" (Spry 1968:235). On the 23rd, near Ear Hill, the party ran buffalo. Similarly, on the 25th at Wiguahinou valley they ran bison again (Spry 1968:236-238).

The third season of exploration for the Palliser Expedition began on May 24, 1859 (Spry 1968:394). Immediately the party had to leave Fort Edmonton as: "The scarcity of provisions at Edmonton now became very serious: it was evident that we must all go out to the plains and look for meat" (Spry 1968:394). The situation was made even more clear in a statement recorded the following day: "Started for Bull Lake [Buffalo Lake]...Our stores consisted of ammunition, tobacco, blankets, calico, knives, cloth, &c., for Indian presents, or for the barter of horses for the whole season: our supply of provisions was very small, but we hoped with care and the assistance of some chance ducks, that we might shoot on the way, to be enabled to reach the Buffalo" (Spry 1968:395). On June 5th, south of Buffalo Lake, the party continued to subsist on rations of flour until one of the hunters returned with a very lean cow (Spry 1968:399). Then, on June 6th the party arrived at 'the edge of the woods' (northeast of Stettler) and cut poplars to take with them across the plains; this same day they: "Came in sight of buffalo...killed four buffalo; not one of them was good..." (Spry 1968:399). Bison were also encountered on June 9 (Spry 1968:399).

On June 11, the party reached the Hand Hills where a 'permanent camp' was established. Here Palliser noted: "We also killed a good many buffalo, and lived on fresh meat every day, slicing and drying provisions with the overplus, to take along with us through the country, where we had not so good a chance of finding game" (Spry 1968:400). On June 16, James Hector, following after Palliser, came across a band of bulls while others in his party encountered a band of cows near Stettler -- 'the edge of the woods' (Spry

1968:405). Again, on June 17, Hector's party encounter large herds of bison this time between Gough Lake and Sullivan Lake. Meanwhile, as Hector and is party were catching up, Palliser again recorded running bison on June 17 but noted they were still 'very lean and poor eating' (Spry 1968:402). Hector and his party reached the Hand Hills encampment on June 19 and the party spent the 22nd, 23rd, and 24th running buffalo (Spry 1968:407-408).

PERIOD II (END OF JUNE TO MID-JULY)

By the end of June the animals should have arrived at their summering grounds. Few animals would have been expected to remain in the parkland around the forts; the exception being the odd bull which could be found in most areas throughout the year. However, these animals would be easy to confuse with bulls that simply left the wintering grounds at a later time than the cow-calf herds.

EASTERN PARKLAND

Henry the Younger, near the Pembina River Post on July 7, 1808, stated: "Saw only a few bulls" (Coues 1965 Vol. I:431). The next day, July 8, 1808, he stated: "Chased bulls; killed a very fat one and started homeward" (Coues 1965 Vol. I:431).

Similarly, Henry Hind (1971 Vol.1:309) illustrated the scarcity of bison in the parkland on July 8, 1858. In an area of rolling prairie with hummocks of aspen and willow, near the confluence of the Assiniboine River with Two Creeks, he stated: "Here, however, we saw the first buffalo bull, and after a chase of half an hour's duration, succeeded in killing him" (Hind 1971 Vol. I:309). At this time the party is well south of Fort Ellice. Between the party's location and the Fort bison were considered 'numerous' (Hind 1971:311). Importantly, this area was at the most western edge of the parkland. Hind's guide noted: "He had not visited it [this area] for twenty years, and during that interval the timber, which formerly consisted of aspens and willows, had nearly all disappeared. The old man was correct, the country had changed, the aspen forest had been burnt, and no vestige, beyond the scattered hummocks and burnt willow clumps remained..." (Hind 1971:308).

In this same vein, on July 12, 1806, after arriving at his establishment at the confluence of the Assiniboine and Souris River, Henry the Younger realised: "There are here three labouring men, an Assiniboine interpreter, and 40 women and children, almost starving. There are no buffalo in these parts at present, and they have finished what pemmican was left here last spring" (Coues 1965 Vol. I:302).

NORTHERN PARKLAND

No data were encountered for the northern parkland during the period for the end of June to mid July.

WESTERN MONTANE

No data were encountered for the western foothills and parkland during this period.

ALBERTA-SASKATCHEWAN PLAINS

In early July, 1858, some distance southwest of the Eagle Hills, the Palliser Expedition was conducting its second year of exploration. On July 1 and 2, bison appeared to be numerous in the area: "...buffalo all appeared in motion as if they had been hunted" and "...some 2,000 buffalo were lying and grazing..." (Spry 1968:240). Then, on July 6, along upper Ribstone Creek, buffalo were again recorded to be 'very numerous' (Spry 1968:242). On July 13, near Redwillow Creek, the parties provisions were running low so Palliser went out in search of bison and sent back 'the meat of six cows' (Spry 1968:248). On July 15, east of Buffalo Lake, the party killed and dried eleven buffalo (Spry 1968:248). Similarly, on July 16 southwest of Buffalo Lake, the party secured seven more bison (Spry 1968:249). Bison were in abundance on the Alberta-Saskatchewan Plains from the end of June to mid July.

PERIOD III (MID-JULY TO SEPTEMBER)

According to the model, movement of the bison from the summer range on the plains was initiated by the beginning of the rut. The rut was expected to have taken place towards the edge of the summer range between mid-July and September as herds reversed their movements and returned to their wintering grounds (Hence, calving locations could coincide with rutting locations in space but not in time). Associated with the rut were physical markers such as torn ground, wallows, and rubbed trees. As well, separate herds of male and female bison were less likely to occur during the rut.

EASTERN PARKLAND

The rut was an event that was commonly recognized by fur traders. In July and August of 1806, Henry the Younger travelled from Pembina River Post to the Mandan Villages. On July 15, 1806, near the confluence of the Souris River and Antler Creek east of Moose Mountain, Henry observed: "We had seen buffalo in great numbers westward of us, and as they were just entering the rutting season, they made a terrible bellowing during the night" (Coues 1965 Vol. I:308). He continued his observations of bison that evening: "Some herds of buffalo passed near us; the noise they made startled our horses and made them uneasy for the night; they appeared in one body from E. to W., on a quick pace, as if lately chased by horsemen" (Coues 1965 Vol. I:309). The next day, July 16, 1806, Henry the Younger recorded more events of the rut just as he left the Souris River and entered the United States: "We soon fell in with buffalo, all in motion, from E. to W., bellowing and tearing up the ground as they went on. We killed a bull, the flesh of which is more palatable at this season than the cow." (Coues 1965 Vol. I:310). Similarly, the next day, July 17, 1806, somewhere just on the south bank of Souris River near Minot, North Dakota, Henry the Younger stated: "From the summits of those barren hills we could discern others as far as the eye could reach, on which the bulls grazing appeared like so many black spots" (Coues 1965 Vol. I:314). Although it is not stated explicitly, it can be inferred that Henry was looking southwest towards his destination at the Mandan Villages when he recorded the above passage.

On his return trip from the Mandan villages, Henry provided evidence that the rut continued into the next month. On August 1, 1805, as the party approached the Souris River from the south Henry noted hillocks covered with buffalo (Coues 1965 Vol. I:407). Then, later that day just south of the 'loop' of the Souris River he stated: "The buffalo, now at the height of the rutting season, kept bellowing all night. During this season they are in continual motion night and day, scarcely allowing themselves time to feed; several herds passed near our camp, bellowing and tearing up the ground. The bulls at this time are very fierce; they often turn upon a man and pursue him for some distance." (Coues 1965 Vol. I:407). A few days later, August 3, 1805, Henry the Younger noted: "About midnight a large herd of buffalo passed so near some of our horses as to make them break their cords, and away they went; but fortunately their legs were tied." (Coues 1965 Vol: I:409).

The next day, August 4, 1805, was similar: "Buffalo continued to appear in every direction around us." (Coues 1965 Vol. I:409). The same day, Henry the Younger was in the eastern most part of the 'loop' of the Souris River. While facing north on a local high point he provided some evidence of the nature of the environment in which the rut occurred. He described open plains to the west and increasing shrub and tree cover to the east -- the plains-parkland interface. He noted:

> ...to the north lies an extensive plain, bounded by a ridge that runs E. and W., over which Turtle Mountain appears. On the left [west] the country is one level plain, with many small lakes about which numerous herds of buffalo feed. On the right [east], the plain is also level for about three leagues, where it rises into many high, sandy hills, stunted willows and poplar grow in the valleys, but the barren summits display only white sand. In this direction [i.e., east] saw no buffalo, but numerous cabbrie supplied that deficiency. Southward stretched an extensive plain, with many small lakes, and buffalo moving in every direction; the view was only bounded by the small rising grounds we started from this morning.
>
> (Coues 1965 Vol. I:410)

Having noted numerous bison rutting at the edge of the parkland, Henry arrived back at Pembina Post on August 10, 1806, and noted: "The Indians are all starving all over the country, no buffalo being found within their limits" (Coues 1965 Vol. I:416).

Similarly, Daniel Harmon, on July 30, 1803, after a sojourn from Fort Alexandria noted: "I am just returned from an excursion out into the large Plains, and I was accompanied by two of my Men, however in all our ramble we did not see an Indian, the most of whom (as they wont to do every Spring) are gone to War again. But we Saw, run down and killed buffaloe..." (Lamb 1957:68). Here, again, the 'large plains' referring to the 'true' plains. Then, a few days later on August 8, 1803, after returning to Fort Alexandria he alluded to a scarcity of bison in the area: "We are thirty People in the Fort, and not provisions for two Days, our Hunters again not being able to kill, although there are no want of Moose and Deer." (Lamb 1957:69). These quotes do not speak directly to the bison rut, however, they do indicate numbers of bison on the 'large Plains' while they appear to be scarce around Fort Alexandria at the edge of the parkland.

A few miles up Park River from Park Post, on September 18, 1800, Henry the Younger noted an interesting phenomenon: "The few spots of wood along it [Park River] have been ravaged by buffaloes; but none but the large trees are standing, the bark of which is rubbed perfectly smooth, and heaps of wool and hair lie at the foot of the trees. The small wood and brush are entirely destroyed, and even the grass is not permitted to grow in the points of wood" (Coues 1965 Vol. I:99). Henry the Younger observed this same phenomenon, on August 4, 1805, just west of the southeast part of the 'loop' of the Souris River. He noted: "This is a great resort of buffalo and other animals, to shade themselves from the heat of the sun, and may serve as a shelter from storms of winter. The state of the ground in this little wood shows there are always animals in it; for the grass does not grow, and the bark of the trees, to the height of an animal, is worn perfectly smooth by their continual rubbing." (Coues 1965 Vol. I:410). Henry the Younger made another similar observation at Passage Island, near the mouth of the Pembina River. He stated: "The buffalo have ravaged this small island; nothing remains but the large elms and oaks, whose bark has been polished to the height of the buffalo by their perpetual rubbing" (Coues 1965 Vol. I:119). This observation was made on October 14, 1800, but can be inferred to reflect the actions of rutting bison.

Daniel Harmon provided some interesting information about the location of bison around the parkland surrounding Fort Alexandria. On July 17, 1804, after attempting to apprehend some horse thieves within two days ride of the Fort Alexandria area, he acknowledged: "...we therefore left following them, and directed our course another way, in hopes of seeing Buffaloe, but found none." (Lamb 1957:83). The significance of failing to see bison at the edge of the parkland at this time of year is difficult to interpret. It is possible that the bison are still out on the plains and the rut had not commenced. Alternatively, bison are expected to be more spatially clumped in the rut and easier to miss in the open plains [For example, Catlin (1995:280) noted the clumped distribution of bison during the rut, and stated: "During the season whilst they are congregated together in these dense and confused masses, the remainder of the country around for many miles, becomes entirely vacated; and the traveller may spend many a toilsome day, and many a hungry night, without being cheered by the sight of one; where if he retraces his steps a few weeks after, he will find them dispersed, and grazing quietly in little families and flocks, and equally stocking the whole country."]

By late August, bison begin to become more numerous farther east. On August 23, 1801, near the confluence of the Assiniboine and the Red River, Henry the Younger observed: "...numerous herds of buffalo in the grande traverse..." (Coues 1965 Vol. I:185). Thus, large herds of bison are in the area of the Red River by late August. From the above quote it is even tempting to suggest they are crossing the Red River, presumably from their summering grounds further west to their wintering grounds. The previous year, on September 6, 1800, Henry the Younger provided more direct evidence that the animals cross the river from west to east at this time of year. At a location on the Red River just north of its confluence with the Park River he stated: "On approaching the Bois Perce we found immense herds of buffalo, which appeared to touch the river and extend westward on the plains as far as the eye could reach. The meadows were alive with them. On the E. side of the river we now for the first time saw buffaloes; they appeared to be fully as many as there were on the W. side. This is the first place we have found in coming up the river where the plain on that side comes down to the water and forms an open communication with the W. side" (Coues 1965 Vol. I:86-87). Again, the next day, September 7, 1800, he continued to see: "...buffalo in abundance..." (Coues 1965 Vol. I:88).

Apparently in contradiction to the previous statements, the next day, September 8, 1800, Henry the Younger observed bison crossing from the east side of the Red River to the west just north of its confluence with the Park River. He stated: "The buffaloes were all in motion, crossing from E. to W. side of the river, and directing their course toward the Hair hills [Pembina Mountains] as fast as they could walk" (Coues 1965 Vol. I:89). Two explanations come to mind for the crossing of bison from E. to W. First, the rut may not have been completed and the animals may have not yet settled down. Or, second, for whatever reason some of the bison may have 'decided' to winter in the Pembina Mountains.

Evidence for the latter is evident in later moves to the Hair Hills (Pembina Mountains) suggesting it is a common destination at this time. For example, on September

25, 1800, Henry the Younger again observed: "I took a ride northward, but saw only two bulls and three bears, on the E. side of Red River. No buffalo to be seen on the W. side; they appear to have gone to the Hair Hills" (Coues 1965 Vol. I:103).

Evidence that the rut continued to early September comes from observations Henry the Younger made on September 5, 1800, on the Red River just south of its confluence with the Pembina River: "We three went on together, and soon overtook the Indians, who were approaching a herd of cows. Bulls were so numerous that, though we pass them at 100 paces, they did not run, but only turned to stare at us" (Coues 1965 Vol. I:83). The occurrence of cows and bulls together mainly occurred during the rut, however, Henry's records were not clear that the animals were actually herding together. A second line of evidence for the continuation of the rut comes from a journal entry by Henry the Younger on September 9, 1800. This observation, was recorded the day after Henry witnessed the herds going to the Pembina Mountains; he stated: "Everything was quiet during the rest of the night, except the bellowing of buffaloes in every direction and the whistling of red deer" (Coues 1965 Vol. I:93). As noted earlier, bellowing by bison is a fairly unmistakable sign of the rut.

Yet, the co-occurence of bulls and cows appears to be over by mid-September. On September 15, 1800, while camped to build Park Post, Henry the Younger noted a spatial division between the sexes: "Bulls continued near camp, but the cows kept at a distance" (Coues 1965 Vol. I:98). Similarly, on September 23, 1800, at a salt lake near Park River, Henry the Younger recorded another spatial separation of the sexes: "We then directed our course to the salt lake near Park River, where we found bulls in abundance licking up the salt on the beach and drinking water" (Coues 1965 Vol. I:102).

Daniel Harmon also recorded evidence that the bison were moving toward the parkland in the fall. On August 28, 1802, at Fort Alexandria, he stated: "Two of our People who a few Days since I sent into the Plains are just returned, and inform me that Buffaloe are plentiful within two days march of this, and the Natives during the two Days they remained with them killed eighty Buffaloe by driving them into a Park which they had made for that purpose" (Lamb 1957:63).

Regardless of whether the rut continued to the end of September, large herds were common at the edge of the parkland during this time of the year. For example, on August 28, 1800, Henry the Younger was between the Pembina Hills and the Red River and remarked: "Finding myself now some distance ahead of my canoes, and perceiving numerous herds of buffaloes along the Plumb River, which makes a bend almost opposite us, I took a ride on the plain to chase them" (Coues 1965 Vol. I:68). Likewise, on September 17, 1800, from Park Post, Henry observed that: "...buffalo continue very numerous; from the top of my oak, or ladder, I count 15 herds" (Coues 1965 Vol. I:99). Again, observing from Park Post three days later Henry remarked: "I took my usual morning view from the top of my oak and saw more buffaloes than ever. They formed one body, commencing about half a mile from camp, whence the plain was covered on the W. side of the river as far as the eye could reach. They were moving southward slowly, and the meadow seemed as if in motion" (Coues 1965 Vol. I:99). On September 25, 1801, near the Pembina River Post, Henry stated: "...buffalo very numerous at Grand Marais; I killed three cows, one extraordinarily fat, with nearly three inches of depouilles" (Coues 1965 Vol. I:189). Still at the Pembina River Post, exactly one year later, Henry noted: "My man out hunting; buffalo in abundance" (Coues 1965 Vol. I:205). Again, roughly one year later, on September 27, 1803, at the Pembina River Post Henry noted: "Buffalo in abundance" (Coues 1965 Vol. I:225).

NORTHERN PARKLAND

In terms of calendrical months, an early observation of the rut in the northern parkland occurred on July 15, 1810, near the Beaver Hills south of Fort White Earth. Henry the Younger reported: "La Boucane arrived with an Indian, his hunter, from the Beaver Hills where he and Marion [?] are working the beaver. He saw plenty of buffalo on his way, now rutting and perpetually in motion" (Coues 1965 Vol. II:613-614).

Henry reported an occurrence of bison in large numbers, but not necessarily in the rut, on July 22, 1810. On this date he recorded: "At sunset two mounted Sarcees reach the S. side: they came from opposite the Island House below, where all the Sarcees are tented, as is also old Star, with ten tents of Strong Wood Assiniboine; all making provisions, buffalo being plenty" (Coues 1965 Vol. II:615). The 'Island House below' referred to old Fort de l'Isle in the immediate vicinity of Manchester House (Coues 1965 Vol. II:503). Again, this reference does not explicitly illustrate that the animals were in the rut, just that they were common at the edge of the parkland.

Matthew Cocking, while southwest of the Eagle Hills, made some interesting observations that relate to the rut. First, on August 28, 1772, Cocking made the following remark about the spatial separation of the sexes among bison while just west of the elbow of the North Saskatchewan River: "...plenty of Buffalo in sight on all sides, Males and Females in separate herds; which the Natives inform me they always are, except in the covering season. No wood until we pitch in a long narrow ledge of small poplar" (Burpee 1908:104). The model suggests the bison should have been in the rut since mid July; it is possible that it has not begun or has finished by the end of August. The animals were apparently near the parkland but males and females apparently were in separate herds.

Cocking also stated: "All over the Country where the buffalo resort are many hollow places in the ground made by the Bulls in the covering season" (Burpee 1908:108). Cocking only traversed a small area of the plains-parkland interface near the elbow of the North Saskatchewan and the Eagle Hills area. His statement must relate to observations in these areas which geographically resemble the locations of the rut in the Eastern Parkland; that is, the rut occurred at the edge of the plains-parkland interface. Important, as well, this statement links wallowing with the rut (see Chapter Two).

While there appears to have been an occurrence of large numbers of bison at the edge of the eastern parkland for the rut in July, the data are not as clear for the northern parkland. For example, a statement by Henry the Younger illustrated this view. Upon arriving at the 'crossing place' on the North Saskatchewan (modern Carlton, Saskatchewan), on September 5, 1808, Henry the Younger noted: "We also found some of the families belonging to our South Branch house who had passed the summer in the plains, living on buffalo, as we keep up no summer establishment at that lower post" (Coues 1965 Vol. II:491). The implication was that they can now subsist on bison around Fort Carlton, which was at the edge of the parkland, but earlier had to remain on the plains as the bison were there.

By early August it is apparent that some bison were within the northern parkland, but their occurrence there was relatively rare. For example, at Fort White Earth on August 10, 1810, Henry the Younger stated that: "Men came in with nine cows, one red and one jumping deer; the fattest cow had two inches of depouilles" (Coues 1965 Vol. II:618). The fact that other animals beside bison were being taken speaks volumes. Still, two days later, on August 12, 1810, Henry noted: "A herd of 12 cows appeared on the S. side and were going to cross, but the noise of the dogs and children turned them" (Coues 1965 Vol. II:618). It is not unreasonable to suggest the small herd size was indicative of the quantity of bison in the area. This was illustrated by Henry's the Younger's statements four days later on August 16, 1810: "We have no fresh meat and therefore give out dried provisions" (Coues 1965 Vol. II:619). A few days later, on August 18, 1810, Henry the Younger further illustrated the situation: "We learn that all our horses below have been stolen by the Assiniboines, and that no buffalo are to be seen on this side [north side] of the Battle River. The Indians are starving" (Coues 1965 Vol. II:620).

Things did not appear to be much different in other parts of the northern parkland. For example, in 1799, James Bird returned up the North Saskatchewan River to Edmonton House. During his return trip he traded for dried meat on August 7 and 8, near Cumberland House, and only mentioned fresh provisions in the form of 'several buffalo' on August 17, 1810, somewhere above Hudson House (Johnson 1967:203), and 'one cow buffalo' on August 25 and again on August 27, 1799, near Manchester House (Johnson 1967:205).

William Tomison, while returning up the North Saskatchewan River to Edmonton House in the summer of 1798, experienced similar shortages. After leaving Carlton House on August 17, 1798, William Tomison proceeded up the North Saskatchewan River. It was not until he reached the "crossing place" (modern Carlton, Saskatchewan), upstream of Sturgeon River, on August 22, 1798, that he "Killed one buffalo bull" (Johnson 1967:141). On August 22, 24, 25, and 29, Tomison killed one bull, one cow, four cows, and one cow, respectively (Johnson 1967:142). Importantly, on August 30 he received word that Buckingham House and Edmonton House did not have good provisions. On September 2, while near the Red Deer Hills he stated: "At 5 a.m. we proceeded and tracked till 7 then saw some buffalo. The want of provisions induced me to send William Flett and Magnus Spence a hunting which killed two and at noon we put off again" (Johnson 1967:142). As he was informed, upon arriving at Buckingham House on September 4, Tomison noted: "...all well but no provisions, neither at this house or the house above" (Johnson 1967:143). Thus, upon arriving at Edmonton House on September 11 he found no provisions. For the rest of the month he received two deer from hunters on September 14, dried provisions on September 15, two moose deer and a bull on September 18, a red deer on September 21, and three hundred pounds of provisions from Buckingham House on September 23. Apparently, bison were not common in the area at this time of year.

Henry the Younger, found he had somewhat better resources at Fort Vermilion a little later in the month of September. On September 19, 1809, Henry the Younger stated: "Finding our stock of fresh meat short and no appearance of a supply from the Indians, I sent four men to the strong wood for moose and red deer. There were buffalo on the S., but it would be imprudent to send there, surrounded as we are with Indians who are insolent even in the fort" (Coues 1965 Vol. II:545).

Still later in September, Duncan M'Gillivray, on September 26, 1794, at Pine Island Fort (in the vicinity of Manchester House), made the following observation: "Buffalo are exceeding numerous -- from the summit of a hill which afforded an extensive prospect, we observed the face of the Country entirely covered by them, in short they are as numerous as the locusts of Egypt, and give us passage they were forced to range themselves on both sides and we were no sooner Past than they closed their ranks as before" (Morton 1929:28). Still, within a days ride of Fort George, M'Gillivray observed: "As we approached near the Fort animals became less numerous, a circumstance we greatly regretted being so well mounted and equipt for the chace [sic]..." (Morton 1929:28).

The situation in the Forks of the Saskatchewan provided a similar account of bison occurrences, yet, bison appeared to be more plentiful in this area. For example, Peter Fidler left Carlton House and travelled up the South Saskatchewan River in order to reach Chesterfield House. On August 17, 1800, just west of the Forks of the Saskatchewan he: "Saw a bull buffalo the first we have seen as yet" (Johnson 1967:254). The next day he reported: "Killed several buffalo [bulls] but only found cows late in the evening" (Johnson 1967:255). However, on August 20, 1800, now some distance up the South Saskatchewan

River but north of the Moose Woods, Fidler saw plenty of bison: "Saw many buffalo but killed none" (Johnson 1967:256). On August 22, 1800, he continued to see large number of bison: "Went up the river to where the buffalo are plentiful...Killed three cows (Johnson 1967:256).

Then, in late August, while still some distance north of the Moose Woods, Fidler found fewer bison. His records were as follows: August 25, 1800: "Split and dried meat of two buffalo, no buffalo near us" (Johnson 1967:257); August 26, 1800: "Killed one buffalo" (Johnson 1967:257); August 27, 1800: "Killed seven buffalo...began to split and dry it" (Johnson 1967:257). With bison becoming more scarce, Fidler expressed concern for his situation: "This dry meat will be very serviceable when we arrive at the place we intend to build at, particularly, should no Indians visit us soon after and the buffalo perhaps may be few there too" (Johnson 1967:258). Yet, as Fidler entered Moose Woods, in early September, he found more buffalo: "Killed three buffalo, they are very plentiful here" (Johnson 1967:259). As well, at the upper end of Moose Woods he noted: "...a fine low plain S. side full of buffalo..." (Johnson 1967:260).

Similarly, Matthew Cocking, just west of the elbow of the North Saskatchewan on August 28, 1772, observed many bison. He stated: "...plenty of buffalo in sight on all sides; Males and Females in separate herds..." (Burpee 1908:104).

Alexander Henry the Younger travelled up the North Saskatchewan at roughly the same time of year Cocking crossed the North Saskatchewan River and roughly the same time of year Fidler headed up the South Saskatchewan River. On September 2, 1808, near the Forks of the Saskatchewan, Henry traded for some moose buck meat (Coues 1965 Vol. II:485-486). On September 5, 1808, after trading for some provisions, Henry encountered six bull bison swimming across the river near the "crossing place" (modern Carlton, Saskatchewan). The next day, on September 6, 1808, he observed: "We had not gone far before we saw a few bulls, and soon after the plains were covered with numerous bison, as far as the eye could reach, on both sides of the river' (Coues 1965 Vol. II:491). The same day he also stated: "The Red Berry Hills appeared covered with buffalo" (Coues 1965 Vol II:492). The Red Berry Hills lie southwest of modern Carlton, Saskatchewan.

Near the elbow of the North Saskatchewan, on September 7, 1808, Henry the Younger importantly noted: "We found buffalo in abundance crossing from S. to N." (Coues 1965 Vol.:494). He elaborated this scene:

> ...the whole body of buffalo on the S. suddenly moved and went at full speed, directing their course obliquely for the river about a mile above us, as if determined to force their way across. We rode along the lower bottom until we came abreast of them, when we concealed ourselves in a hummock near the spot where we supposed they would land. By this time the river was crowded with them, swimming across, bellowing and grunting terribly. The bulls looked really fierce; all had their tails up, and each appeared eager to land first. The scene would have struck terror to one unaccustomed to such innumerable herds. From out on the plains, as far as the eye could reach, to the middle of the river, they were rushing toward us..."
>
> (Coues 1965 Vol. II:495)

The bellowing and grunting, accompanied by the raised tails strongly suggests the aggressive posture taken by males during the rut. As well, Henry's word usage suggested both sexes were crossing together, that is, Henry indicated 'the bulls looked terribly fierce' which suggests there were animals other than bulls present. This, taken with the date of the quote, September 7, strongly suggests the rut was still in progress.

Just west of the elbow of the North Saskatchewan near the Sandy Hills, Henry the Younger observed more large herds of bison: "Having passed those sands; we came to a beautiful level country, covered with buffalo" (Coues 1965 Vol.:496-497). The next day, September 9, 1808, Henry again observed large numbers of bison near Eagle Hill River (Coues 1965 Vol. II:497). Similarly, near Turtle Creek, on September 11 and 12 buffalo continued to be numerous (Coues 1965 Vol. II:502-503). After arriving at Fort Vermilion on September 13, 1808, buffalo were abundant as Henry the Younger asked a Blackfoot Chief to hunt for provisions for his party. He stated: "We desired to him [the Chief] to send his young men out to hunt buffalo for our people, which he readily consented to do, giving orders to the camp for a party to set off instantly, as the buffalo were at hand" (Coues 1965 Vol. II:507).

About this same time of year, Duncan M'Gillivray was going up the North Saskatchewan River to Fort George. On September 9, 1794, he passed the Forks and on September 11, 1794, he saw buffalo near the Sturgeon River (Morton 1929:21). The next day near dawn: "...a party crossed the River to hunt for Buffaloes. They returned about noon having killed a dozen..." (Morton 1929:22). Similarly, on September 12, 1846, Paul Kane documented a Cree pounding operation near Fort Carlton. While inspecting the pound he stated: "This had been the third herd that had been driven into this pound within the last ten or twelve days..." (Kane 1925:80-82 in Verbicky-Todd 1984:88). Upstream from Fort Carlton along the North Saskatchewan River at Eagle River, on September 20th, 1794, M'Gillivray did not observe the number of bison he expected and noted: "Buffaloes are not so numerous as usual in these parts, we are therefore of the opinion that some Tribe of Indians hover about us and frighten away the animals to some other place less frequented by man" (Morton 1929:24).

Again, late in September, in 1805, Daniel Harmon arrived at South Branch House, which is roughly east of Carlton on the South Saskatchewan River, where he was informed that buffalo: "...are plentiful within half a Days march of this" (Lamb 1957:97). Similarly, on September 27, 1772, south of the Eagle Hills, Matthew Cocking observed: "Buffalo feeding on all sides. Barren unlevel country" (Burpee 1908:107). Thus, in mid to late September there appeared to have been substantial numbers of bison in open country west of the Forks on both the North and South Saskatchewan rivers.

WESTERN MONTANE

Slightly to the south of the study area, in modern west-central Montana, there were a number of examples of bison rutting behaviour as already presented in Chapter Two. Lewis and Clark observed bison in the rut on a number of occasions. Recall, on July 10, 1805, near the confluence of the Shishequaq and the Medicine rivers, Captain Lewis noted: "We saw vast numbers of buffalo below us, which kept a dreadful bellowing during the night." (McMaster 1904 Vol. III:172-3). The next day, July 11, 1805, he noted the size of the herds involved: "...but in this neighbourhood the buffalo are in such numbers, that on a moderate computation, there could not have been fewer than ten thousand within a circuit of two miles. At this season, they are bellowing in every direction, so as to form an almost continued roar, ..." (McMaster 1904 Vol. III:172-3). Captain Clark made a similar observation on July 27, 1806, near the mouth of the Bighorn River. He noted the occurrence of the rut, immense number of bison, and continuous bellowing (McMaster 1904 Vol. III:232). In this same area, again already noted in Chapter Two, George Catlin observed the rut in the vicinity of the mouth of the Teton River in the Missouri River valley.

ALBERTA-SASKATCHEWAN PLAINS

In July of 1869, Isaac Cowie was travelling around the north end of Last Mountain lake in east-central Saskatchewan and noted the formation of wallows by innumerable bison during the rut (see Chapter Two). Cowie was so observant that he noted both wallows and the often associated 'excretions' produced during confrontations in the rut (Cowie 1913:374).

Between 1857-1859, John Palliser conducted his famous expeditions to explore the northern Plains. On July 14, 1857, the first season of exploration began from Upper Fort Garry located at the confluence of the Red River and the Assiniboine. As the party departed the fort, Palliser recorded: "We did not expect to fall in with the buffalo for a considerable time, and therefore, in addition to the luxuries of tea and sugar, were provided with pemmican and flour" (Spry 1968:92). It should be noted that the scarcity of bison near Upper Fort Garry was likely due, in part, to over-hunting by Europeans, Métis, and eastern Tribes of Indians, and not just an indicator of seasonal movements of the animals (Hornaday 1887:489).

Near the east end of Turtle Mountain, Palliser noted: "This hill, however, had once a great name as a hunting ground, and abound with moose, wapite, and bears, but as the buffalo resort here every winter, and bring in their trail numerous camps of Indians and companies of half-breed hunters, the game has been either exterminated or driven away" (Spry 1968:115). The party first encountered bison near Moose Mountain Creek south of Moose Mountain, on August 21, at which time Palliser stated: "...we came in sight of two buffalo bulls, which I killed" (Spry 1968:128). At the tail of Moose Mountain they had a second buffalo chase during which they only killed bulls (Spry 1968:130). More bison were run on September 20 and 21 northwest of present day Mortlach near Eyebrow Hills (Spry 1968:143-145). At this time Palliser noted:

> We are now in the heart of the buffalo country. This region may be called a buffalo preserve, being the battle-ground between the Crees

> and the Blackfeet, where none go to hunt for fear of meeting enemies and where those who go to war abstain from hunting. The whole region as far as the eye could reach was covered with buffalo, in bands varying from hundreds to thousands.
>
> (Spry 1968:146)

Palliser and his party continued travelling through astounding numbers of bison. For example, on September 25, just upstream from the modern Riverhurst Ferry crossing on the South Saskatchewan River, he stated: "We now every day see great herds of buffalo..." (Spry 1968:149) and on September 28 he noted: "Found buffalo plentiful on this side of the river..." (Spry 1968:152).

Interestingly, a few days later, on September 30, Palliser noted: "With the exception of two or three bulls, we found no buffalo until we came to within 20 miles of the elbow of the Saskatchewan" (Spry 1968:153). For the South Saskatchewan, Palliser generalized: "...we saw the largest quantity of game in the region of the elbow of the south branch, and also the greatest variety I have ever seen north of the Missouri" (Spry 1968:153-154).

On June 15, 1858, the second exploring season of the Palliser Expedition began. In July the party was located southwest of Buffalo Lake (Spry 1968:249). On July 28th, just south of the modern town of Innisfail at the "edge of the woods", the party noted that: "No animals were to be got in the neighborhood..." (Spry 1968:255-256). On July 29, the party needed provisions so they moved south but still the hunters returned without having seen bison (Spry 1968:256). Then, on July 30, near Beiseker the 'scouts' reported: "...buffalo in great quantities about 10 miles to the eastward" (Spry 1968:257). The next day Palliser noted: "We were now more than two miles' distance from the buffalo, who were not in sight, as we had taken care to take up such a position as that they could neither see us or get our wind; they were in such numbers that their peculiar grunt sounded like the roar of distant rapids in a large river and causing something like a trembling in the ground" (Spry 1968:258). Importantly, Palliser estimated that four or five thousand animals were gathered together, consisting of both males and females (Spry 1968:258).

Given the spatial distribution of the bison (very clumped), the size and composition of the herds, the 'roar' they produced, and the time of year, it is reasonable to infer the bison were in the rut. On August 3, Hector noted one last onslaught on the herds as: "...they were still passing, but not in such numbers as previously" (Spry 1968:286). Then, on August 14, 1858, at the Hudson Bay Company's Old Bow Fort just down stream from Seebee, Palliser noted: "...the hunters had not been very successful; they had not fallen in with buffalo in that neighborhood..." (Spry 1968:266).

Almost a month later, on September 14, Palliser crossed the Bow River apparently above its confluence with Fish Creek at which time he noted bison further east. The following day Palliser and a companion ran bison and he remarked: "Our run after bison had taken us so far to the east, that we were beyond the line of fertile country which skirts the mountains" (Spry 1968:284).

The next year, on July 16, 1859, the Palliser Expedition had reached Lonesome Coulee, through which modern Alkali creek flows: "This valley, which was five or six miles wide, was full of buffalo" (Spry 1968:411). Not surprisingly, the following day the party encountered numerous bison. Such large number of bison together may have been an indication of the beginning of the rut as the animals aggregate and move to the edge of the parkland.

In late July the party made it to the Cypress Hills where they hunted elk and deer on July 30, but the next day they: "Descried buffalo; started off to run them; we killed a considerable number, and among them were several in very fair condition. Commenced making pemmican in the evening" (Spry 1968:422). The hunt was successful enough that, on August 2, Palliser stated: "We had now a fine supply of very fine meat, so threw away our tough elk meat..." (Spry 1968:422).

On August 11, 1859, Hector was encamped with some Stoney Indians at the mouth of the Highwood. At which time he noted: "The 'Stoneys' were very much disappointed when they heard from us that there are no buffalo for many days to the eastwards, and were, therefore, off every day hunting along the river valleys for deer and bears" (Spry 1968:432).

Importantly, on July 30, 1857, Hind (1971:364) left a Cree camp and pound just east of the elbow of the South Saskatchewan River. As he departed the camp he noted the tenor of the bison in the surrounding area. He stated: "The buffalo were crossing the South Branch a few miles below us in great numbers, and at night, by putting the ear to the ground, we could hear them bellowing" (Hind 1971:365). The occurrence of great numbers of bison and bellowing in the night strongly suggests the rut had commenced.

PERIOD IV (OCTOBER TO MID-NOVEMBER)

In mid-July to September, the bison moved to the periphery of the plains for the rut. Following the rut, the animals continued their movements further into the parkland; however, this movement was somewhat weather-dependent and may have varied from year to year. The bulls often arrived in the wintering grounds ahead of the mixed herds.

EASTERN PARKLAND

For the most part, any mention of bison from October to mid November in the eastern parkland emphasises the vast numbers that were present. On October 2, 1800, Henry the Younger had been riding north from Park Post for a number of kilometers along the Red River when he observed: "I went almost to the Bois Perce before I saw anything but bulls. Here I fell in with a herd of red deer feeding on the edge of the woods" (Coues 1965 Vol: I:108). From this quote it appears the sexes have separated and the rut was over It also illustrates that bison bulls (anyway) were fairly common and that they are at the 'edge of the woods'. A few days later, on October 5, 1800, Henry noted: "The buffaloes are moving southward in one body" (Coues 1965 Vol. I:112). Then, on the 8 October, 1800, near Park Post he observed "...several small herds of buffalo and red deer..." (Coues 1965 Vol. I:113). The next day, some distance down the Red River from Park Post he noted: "I saw plenty of buffalo on the plains..." (Coues 1965 Vol. I:114). On October 13, 1800, near the Red river's confluence with the Roseau river, he fell in with: "...one continuous herd of bison..." (Coues 1965 Vol. I:117). Then, a short time later at the Pembina River traverse, Henry: "...climbed a high tree, and, as far as the eye could reach, the plains were covered with buffalo in every direction" (Coues 1965 Vol. I:117-118).

In 1803, Henry the Younger was established at Pembina River Post and was still able to kill five bulls on October 24, even though the plains are burned almost everywhere (Coues 1965 Vol. I:229). On October 31, 1800, Henry 'saw plenty of bulls and red deer' near Park Post (Coues 1965 Vol. I:131). Similarly, at the Pembina River Post on October 31, 1805, Henry saw 'buffalo in abundance' (Coues 1965 Vol. I:133).

The abundance of bison at the edge of the eastern parkland continued into early November. On November 2, 1802, at Pembina River Post, Henry observed: "Buffalo in abundance" (Coues 1965 Vol. I:205). About this same time at Park Post in 1800, Henry the Younger observed both a cow and a bull herd (Coues 1965 Vol. I:134).

At Fort Alexandria things were slightly different. On October 28, 1803, Daniel Harmon sent hunters for bison meat. Upon their return to the fort Harmon was informed on November 6th: "...that they [bison] are plentiful within a three Days march of this" (Lamb 1957:71). On the same day in 1805 at the Pembina River Post, Henry the Younger: "Chased buffalo on horseback with William Henry; killed two cows" (Coues 1965 Vol. I:273).

In 1800 at the Park River Post, on November 7, Henry the Younger: "...saw a great herd of cows going at full speed southward..." (Coues 1965 Vol. I:136). The next day Henry: "...saw buffalo and red deer in great abundance..." near a marsh on the edge of the plains west of the confluence of Turtle River and the Red River (Coues 1965 Vol. I:138-139). In 1800, by the middle on the month of November, Henry could afford to be choosy of the game he hunted. He stated: "I desired him [Henry's hunter] to camp near Salt river and hunt red deer, there being no animals near the fort excepting bulls, which are lean and indifferent at this season" (Coues 1965 Vol. I:153).

NORTHERN PARKLAND

In contrast to the forts in the eastern parkland, which were located relatively close to the plains-parkland interface, the forts along in the northern parkland were located well within the parkland, often a substantial distance from the plains-parkland interface. In the eastern parkland, the preceding discussion illustrated that the bison, especially the bulls, at this time of year were common at the plains-parkland interface. Since information in the northern parkland comes from forts situated along the North Saskatchewan River, it is expected that the arrival of the animals in large numbers at the forts would have been 'delayed' relative to their arrival at the eastern forts.

Duncan M'Gillivray summarized this situation on October 17, 1794. He laid out his expectations of bison movements, with regard to his position at Fort George, when he stated: "We have now 6 Hunters employed in maintaining us in Provisions, it may therefore reasonably be expected that when the Buffalo approach a sufficient quantity of meat will soon be provided for the winter" (Morton 1929:35-36).

As alluded to in the above passage, bison were relatively scarce at the forts along the North Saskatchewan River in early October. For example, William Tomison, travelling between Buckingham House and Edmonton House, noted that on October 2, 1795: "The Indian I engaged to conduct us up killed one bull buffalo of which we had a meal" (Johnson 1967:12). The next day: "The Indian killed a cow of which we had enough for two meals". On October 6, 100 lbs of provisions were accepted from an Indian woman in trade (Johnson 1967:13). Similarly, on October 8, the hunter returned with part of two buffalo while some Indians arrived with some provisions to trade (Johnson 1967:12). Over the next few weeks he received: 120 lbs of meat on October 18, one horse-load of meat on October 22, two horse-loads of meat on October 23, a few provisions on October 24, a little fresh meat from the Indians on November 1, and the flesh of two buffalo from the hunter on November 3. Importantly, on November 9, Tomison stated: "At noon our hunters arrived for men to fetch meat, which we are much in need of at present, not having a morsel in the house..." (Johnson 1967:18). Tomison's men returned with the better part of four buffalo on November 9 and three more on November 14 (Johnson 1967:18)

Tomison had a similar experience on the North Saskatchewan River three years later. In 1798, Tomison arrived at Edmonton House on September 11. Provision requirements were just being met by the hunter and Indian trade at the end of September (see above). This trend continued in early October. On October 2, Tomison: "Received the flesh of one buffalo from the Indians (Johnson 1967:145). Over the next few weeks he received 500 lbs of provisions on October 4; one red deer on October 5; one moose deer on October 6; a small amount of provisions on October 14, 18, and 19; two deer from the hunting tent on October 24; a few provisions and one moose and two red deer from the hunter on October 28; two red deer from the hunting tent on November 7; and two moose deer from the hunter on November 17.

Bison appeared to be scarce at this time of year and, those that were to be had were quite often bison bulls. Duncan M'Gillivray summarised the situation succinctly when, on October 10, 1794, at Fort George, he stated: "The hunters have killed 2 Bulls. They report that animals are very scarce" (Morton 1929:32). At the same time of year, but in 1772, Matthew Cocking made a similar comment while southwest of the Eagle Hills: "Bison at present very scarce" and then, two days later he stated: "Male Buffalo our food at present, very poor excepting in the spring" (Burpee 1908:108).

Similarly, at Edmonton House on October 13, 1796, George Sutherland noted the shortage of provisions which his men rectify the next day by killing two bulls (Johnson 1967:66). Similarly, on November 10 of the same year, Sutherland received seven bulls (Johnson 1967:72). In between these dates, the blame for the lack of provisions was laid on the drunken state of the local Indians (Johnson 1967:68). A hunter was hired on October 24 and the first mention of provisions occurred on October 31: "Three men went to fetch meat from the hunter and arrived in the evening with the flesh of two moose and two bulls" (Johnson 1967:72). Things appeared to have changed by November 10, when: "The men that went for meat yesterday return with the flesh of seven buffalo" (Johnson 1967:72).

Likewise, on October 5, 1809, writing at Fort Vermilion, Henry the Younger recorded: "One of the hunting party returned with two bulls; they had seen no cows between this and Montage du Milieu" (Coues 1965 Vol. II:549). Four days later Henry the Younger acknowledged the receipt of nine bulls from his men (Coues 1965 Vol. II:551). Importantly, a few days later on October 11, 1809, Henry the Younger stated: "Durand arrived with a cow from Deschamps' tent. Buffalo are now coming up" (Coues 1965 Vol. II:552). By October 14, Henry: "Sent Parenteau and a party with horses to hunt buffalo" (Coues 1965 Vol. II:552).

This scenario was repeated at Fort Vermilion. On October 23, 1809, Henry the Younger: "Sent eight men with 30 horses to hunt buffalo on the S. side..." (Coues 1965 Vol. II:558). His investment of men, horses, and time, suggests he expected a good payoff. He was disappointed on October 25, when: "Three men returned with bull meat; no cows to be seen" (Coues 1965 Vol. II:559).

Henry the Younger's comment that 'the bison are now coming up' is significant. As will be illustrated, bison continued to appear in greater numbers in the northern parkland through mid to late October. For example, Duncan M'Gillivray was expecting bison to approach Fort George during the winter of 1794-1795. On October 12, he was informed of the reason why bison were scarce:

> Hunters killed a stag: they report that a few of the men who have received permission to Winter in the meadows, frighten away the animals from the quarter where they are stationed. Mr. S. therefore ordered me and 2 men to go in pursuit of them and command them to return to the Fort, a thing they declined to do at the instance of the Hunters tho' they used Mr. Shaws authority for that purpose.
>
> (Morton 1929:35)

Then, on October 17 (as already cited), he noted:

> We now have 6 Hunters employed in maintaining us in Provisions, it may therefore reasonably be expected that when the Buffalo approach a sufficient quantity of meat will soon be provisioned for Winter.
>
> (Morton 1929:35)

By October 20 , M'Gillivray stated: "Men generally employed carrying home meat from the Hunters tents and we are happy to learn that the Buffaloes are very numerous at a small distance" (Morton 1929:36).

Similarly, on October 30, M'Gillivray heard from an Assiniboine Chief that: "...vast herds of Buffaloes are at the Paint River [Vermilion River] where he intends to make a Pound in the course of the winter" (Morton 1929:38).

Peter Fidler experienced the same trends in the bison populations as he travelled from Buckingham House to the Rocky Mountains. Fidler left Buckingham House on November 8, 1792. His travelling companions killed their first bison bull on November 9 (Haig 1990:11). On November 11, near Torlea Flats, he noted: "A good number of Bulls in the plain that we crossed..." (Haig 1990:12). November 13 he saw more bulls (Haig 1990:14). On November 14, at the Battle River, he: "Saw a good number of Bull Buffalo this Day upon small places that has not been burnt, killed 3 of them. No cows we have yet seen since we left the house which is principally owing to the grass having been lately burnt..." (Haig 1990:15). Then, on Nov. 20, north of the Red Deer River, he finally encountered bison cows: "Some Men on hunting and killed a few Cows the first we have yet killed this Journey" (Haig 1990:18).

WESTERN MONTANE

On October 2, 1810, while en route to Rocky Mountain House near the Blindman River, Henry the Younger observed: "Buffalo are numerous here lately, but the Indians have driven them off" (Coues 1965 Vol. II:637).

ALBERTA-SASKATCHEWAN PLAINS

On October 1, 1857, the Palliser Expedition had reached the elbow of the South Saskatchewan River where they were able to run bison (Spry 1968:155). That same day the party observed a band of cows watering at the river (Spry 1968:155). The next day, in a valley near Stockwell Lake (one of the Red Deer Lakes) Palliser noted: "...a large band of buffalo ran right across, ahead of our line of carts, and without any exertion we killed three fat cows" and that "...buffalo are very numerous, and have eaten the grass down considerably, and have not left much for the horses" (Spry 1968:156). On October 3 to 6, the party travelled north through: "...sandy ground covered with low coppice, and here and there rising into hills clad with poplar trees" (Spry 1968:157). The next day, as the party entered the Moose Woods, Palliser noted: "Reach the Woods. Old Buffalo Pound" (Spry 1968:158). He further stated: "...passed on to the north of a clump we named Three Tree Point, and camped in the evening, where we found plenty of good water; passed an ancient buffalo pound, where the Indians in winter decoy and drive buffalo to slaughter in great quantities" (Spry 1968:158).

PERIOD V (MID-NOVEMBER TO MID-APRIL)

A) Settling in on the wintering grounds (mid-November to December)

During later November and December, bison were expected to occur fairly consistently in large numbers in the parkland. As long as the weather was reasonably cold the animals remained in the parkland. If the weather warmed, the animals ventured out some distance on to the plains but still within close proximity to the plains-parkland transition zone.

EASTERN PARKLAND

By mid November the bison reached their wintering grounds. Through mid-November and December the animals settled into their wintering grounds and could be regularly harvested by fur-trade hunters and Native people. For example, in 1801, at Pembina River Post, bison were apparently abundant. On November 15, Henry stated: "Men now go again for meat..." (Coues 1965 Vol. I.:191). Bison were reported near the fort on December 14, and five days later: "...buffalo are abundant near the fort" (Coues 1965 Vol. I.:191).

In 1802, bison had been abundant around the Pembina Post since late September (Coues 1965 Vol.:204-205). This continued into November and the reason for their abundance was clear. Henry the Younger stated: "We cannot stir out doors without snowshoes. Buffalo are very numerous; I shot three cows. The cold was so severe that I froze all one side of my face, which was soon an entire scab and very painful" (Coues 1965 Vol. I.:206). Given the abundance of bison, by December 25, Henry stated: "Buffalo passing in droves within 100 yards of the fort. My winter stock complete" (Coues 1965 Vol. I:206).

Late November and December are much the same at the Pembina Post in 1804. On November 22, Henry stated: "Went to Hair Hills; chased a drove of bulls..." (Coues 1965 Vol. I:253). On the 27th, Henry recorded: "Plains burned in every direction and blind buffalo seen every moment wandering about...In one spot we found a whole herd lying dead...At sunset we arrived at the Indian camp, having made an extraordinary day's ride, and seen an incredible number of dead and dying, blind, lame, singed and roasted buffalo" (Coues 1965 Vol. I:253-254).

Similarly, on November 6, 1805, still at the Pembina River Post, Henry the Younger chased bison on horseback (Coues 1965 Vol. I:273). On November 15 he stated: "A terrible snowstorm; buffalo passing northward in as great numbers as ever I saw them, and within 100 yards of the fort" (Coues 1965 Vol.I:273). By December 1, bison were so common Henry the Younger had almost completed his winter stock; he stated: "My men go daily for buffalo to the hunter's tent, three miles distance, with 15 to 20 horse travailles, and return with 30 cows; in this manner our winter stock is rapidly completed" (Coues 1965 Vol. I:273).

Again, in late November and December at the Pembina River Post, but in 1807, Henry noted: "We have experienced a run of terribly cold, stormy weather, that drove the poor old bulls every night to take shelter along our stockades" (Coues 1965 Vol. I:426). He does not note any provision problems or otherwise (Coues 1965 Vol. I:425-428).

However, the Pembina Post is not always surrounded by 'bison in abundance'. For example, throughout October of 1803, Henry had observed fires. On October 24, 1803, after killing five bulls Henry stated: "The Plains are burned almost everywhere; only a few small spots have escaped the fury of the flames" (Coues 1965 Vol. I:229). Henry had previously remarked on the significance of such events in 1800 when he stated: "If this fire spreads all over the country, we shall be hard up for provisions, as there will be no buffalo..." (Coues 1965 Vol. I:158). On November 6, Henry observed some herds of buffalo in a snow storm (Coues 1965 Vol. I:230). On the 15th he noted: "A great fire to the S.W., although the ground is covered in snow..." and, that same day, stated: "We have few buffalo toward Plumb River. X.Y. starving" (Coues 1965 Vol. I:231). And by December 4, he noted: "We are now obliged to eat pemmican" owing to the fact that there were: "...a few bags remaining from last spring, which had been lying all summer in a heap covered with a leathern tent, and never had been stirred or turned, in a damp storehouse" (Coues 1965 Vol. I:232). And on December 10: "We have nothing but tough and lean bulls to eat, and the X.Y. not even that..." (Coues 1965 Vol. I:232). Fortunately, on December 23, Henry noted: "Cows begin to appear, but the great scarcity of grass keeps them always on the walk in search for food" (Coues 1965 Vol. I:232).

Alexander Henry the Younger had a similar experience at Park Post in 1800. On November 11, Henry observed bison feeding beyond the edge of the woods on a plain (Coues 1965 Vol. I:150-151). On November 20th, in severe cold, Henry killed two bulls. The next day he noted a cow herd was at hand, and the day following that bulls were numerous (Coues 1965 Vol. I:155). On December 10th, Henry claimed the recent fires in the area scared off the bison bulls, but cold weather on the 11th brought the bulls back by the 15th (Coues 1965 Vol. I:159-160). Importantly, a few days later Henry observed bison in an amazing abundance around Park Post: "On the 22nd the plains were covered with buffalo in every direction. I went hunting on foot with one of my men; we killed three cows. My people killed three bulls within 100 yards of the stockades, which served for our dogs. Next day all hands went for meat with sleighs" (Coues 1965 Vol. I:161).

Daniel Harmon recorded a similar situation for those stationed at Fort Alexandria in 1800. On December 2, he accompanied some men to his hunter's tent. The tent was located a full day's round trip from the fort. "The Country we past through in going there is a large Plain with here and there a Grove to be seen" (Lamb 1957:39). From the hunters' tent: "The Buffaloe are still a considerable distance farther out into the spacious Plains and nothing but severe cold weather, will drive them into the more woody part of the Country" (Lamb 1957:39-40). As described above, Harmon's the use of the term 'plain' refers to open places with grooves of trees scattered across it while the term 'large [or] spacious plains' refers to the plains proper. Of course, cold would drive the bison 'into the *more woody* part of the Country' (Lamb 1957:39-40, italics mine).

NORTHERN PARKLAND

In the Northern Parkland, during later November to the end of December, bison were expected to occur fairly regularly and in large numbers. As above, if the weather was cold the bison remained in the parkland. But, if the weather was warm the animals may have ventured out into the plains but within reach of the plains-parkland transition zone.

In 1772, travelling southwest of the Eagle Hills on the edge of the plains-parkland transition zone, Matthew Cocking lived without bison meat or on poor bull meat in early October. However, by October 21, he observed buffalo in droves. By October 22, he arrived at a buffalo pound. The area had groves of poplar nearby of which there was enough wood to make a pound (Burpee 1908:109). The repeated failure of the pound between October 22 and November 30 lead the Indians to kill bison with bows and arrows and guns (Burpee 1908:109-110). On December 1, the 'Archithinue' arrived and further prepared the pound (Burpee 1908:110). Over the next few days the Archithinue only managed to pound three male and one female bison (Burpee 1908:111). At this time Cocking was informed by the 'Archithinue' that 'the season is past' for pounding (Burpee 1908:111).

Between the 7th and 12th of December the Archithinue managed to pound a few more bison. Importantly, by December 14 to 15: "Three Archithinue Natives of the same tribe, came to us from the Westward; who say the Buffalo are scarce..." (Burpee 1908:112). This provided the impetus for Cocking and his company to leave the area for the Eagle Hills. Importantly, Cocking noted the environment while heading east to the Eagle Hills: "...now in the barren ground obliged to use Buffalo dung for firing" (Burpee 1908:112). At the Eagle Hills, Cocking: "Saw several buffalo feeding, a joyful sight to hungry mortals; Food being the principle concern of my companions" (Burpee 1908:112). On December 22, Cocking crossed the North Saskatchewan River and entered a place considered to mark the 'termination of the barren land'. Having entered the parkland, Cocking received the following information: "A young man joined us from the Beast pound to the Eastward of us where we intended to go. He says the Buffalo are so scarce that the Indians are distressed for want of food and therefore unpitched intending to build a pound further on to the Eastward, where Buffalo are said to be numerous". He proceeded east ending his December comments with: "Hungry times" (Burpee 1908:113).

In late November to the end of December, 1794, Duncan M'Gillivray commented on his comfortable position at Fort George. He stated: "...the night generally produces a few inches of snow, which is dissolved by the heat of the sun next day -- upon the whole it is an exceeding fine fall" (Morton 1929:41). His provisions were also in fine form as, on November 16, he stated: "Mr. Hughes and myself are just arrived from the hunters tent but with 20 Buffalos. The Hunters have been very successful for some time past and there is a fine quantity of fresh meat in the Hangard..." (Morton 1929:41).

On November 22, a local chief invited M'Gillivray to his pound near the Vermilion River. The next day, his visit was rewarded by seeing buffalo enter the pound (Morton 1929:43). Similarly, on December 11, M'Gillivray was informed that another chief had established a successful pound in the Beaver Hills (Morton 1929:49). Yet another pound was identified on December 17 when the Grand River Assiniboine arrived with 1500 lbs of pounded meat (Morton 1929:50). At this time M'Gillivray stated: "The Men are continually employed in carrying meat, there is now a large quantity of provisions in the Hangard" (Morton 1929:52).

Things were not always this good in every part of the northern parkland. In 1795, at Edmonton House, William Tomison experienced a fairly tough fall. On November 21, his men returned with four red deer and one poor buffalo (Johnson 1967:18). Similarly, on November 27, Tomison sent: "...four men to fetch red deers flesh from the hunting tent" (Johnson 1967:20). Similarly, men were sent to fetch a unknown amount of flesh on December 1, three red deer on December 3, and one red deer on December 6 (Johnson 1967:20-21). Starting, on December 23, the hunter's tent started to produce more buffalo: one poor buffalo on the 23rd, one poor cow on the 25th, and five poor buffalo on the 31st (Johnson 1967:23).

Similarly, in 1796, at Edmonton House, George Sutherland realized that the bison had not 'come up' to the fort as expected. On November 28, he received the meat of two red deer from an Indian hunter (Johnson 1967:73). On November 29, he received two more red deer from his hunter's tent (Johnson 1967:74). Seven bull bison were collected from the hunter's tent on November 30. By December 4, Sutherland had the meat of four more buffalo. December 9, he received the flesh of two bull bison.

In a letter dated December 12, Sutherland admitted: "The Buffalo are still very scarce, the few the hunter kills are very poor, being chiefly bulls" (Johnson 1967:74). Similarly, Sutherland received a letter dated December 20th, 1796, in which Peter Fidler at Buckingham House stated: "We are but middling off for provisions, having only three weeks stock before hand, but hope the buffalo will be nearer to us than before by reason of the severe weather that has of late prevailed" (Johnson 1967:79). Apparently by late December the bison have come up; on December 22, 24, 28, 29, and 30, the hunter's tent produced eight cows, six cows, six cows, three cows, and six cows, respectively (Johnson 1967:77-80).

The next year, 1797, William Tomison had the following experience: in late November he received four 'animals' on the 13th, three red deer on the 18th, seven 'animals' on the 25th, six 'animals' on the 28th, and four 'animals' on the 30th (Johnson 1967:102-103). It is unclear if these 'animals' were bison but, in a letter dated November

26, 1797, from relatively nearby Buckingham House, George Sutherland wrote: "The Buffalo begin to be pretty plentiful about the Big Hill and there is some meat in the house..." (Johnson 1967:128). In December, he received three 'animals' on the 5th, three 'animals' on the 7th, five red deer on the 21st, one red deer on the 22nd, and fifteen cows on the 28th (Johnson 1967:104-105).

William Tomison experienced a more difficult fall in 1798. On November 17 he received two moose from his hunter. Then, on November 22, he received three red deer from Native people and on November 26 he traded for sixty tongues from the Blackfoot (Johnson 1967:149-150). On the 27th, he received some trade provisions and two red deer from the hunting tent (Johnson 1967:150). November 30 brought the meat of three red deer from the hunter's tent (Johnson 1967:150). On November 25, Tomison summarized the situation at Edmonton House in the fall of 1798 in a number of letters to Henry Hallet, James Bird, Peter Fidler; all of these letters state roughly the same thing: "...we arrived the 11th, found all well but like the other house not any provisions of any kind and most of the men was out of provisions last night, and since that I have never experienced so miserable a time since I have known inland and no prospects of its mending. While the Indians was coming and going in the fall we made a kind of living, but since they drew off to their wintering ground we have been very ill-of[f], and had it not been for the garden stuff it would have been much worse" (Johnson 1967:184).

The situation did not improve in December. On December 6, Tomison specifically sent four men to look for bison (Johnson 1967:151). On December 10, the bison search party returned and: "...brought the flesh of two buffalo; no buffalo to be seen within seventy miles of this place" (Johnson 1967:151). The next day, two red deer were brought from the hunter's tent (Johnson 1967:151). On December 20, Tomison received six bison bulls from the hunter's tent (Johnson 1967:152). This is the last meat they would get until January 2 (Johnson 1967:152-153).

James Bird witnessed a similar fall at Edmonton House in 1799. Little meat was stockpiled in late November: two bulls and one doe moose on November 12th, a little dried provisions on the 16th, meat on November 19th, meat on November 26th, and a moose deer on November 30th. Things changed little in December: two red deer and a bull on

December 3rd, and a moose and a red deer on December 11th. On December 14, Bird illustrated that the Indians were hurting as well: "A few Fall Indians arrived with a few furs, they tell us that it is with the utmost difficulty they can live, no buffalo being to be had in their country etc." (Johnson 1967:226). On December 28, Bird received the meat of two bulls (Johnson 1967:227). In a letter of this date he acknowledged: "We have very poor appearances in this quarter both as to trade and provisions. From want of buffalo in their country the Slave Indians [Blackfoot] have confined their exertions to the [sic] procuring provisions for their own families, consequently very few of them have hitherto visited the houses, and even those have brought very little with them" (Johnson 1967:228).

In 1810, Henry the Younger travelled to Fort Augustus (modern Edmonton) near which he killed four cows and four bulls on November 18th (Coues 1965 Vol. II:571). On November 26th, while still in the Fort Augustus area, a band of Blackfeet arrived, loaded with fresh buffalo meat" (Coues 1965 Vol. II:572). On the 20th of December, near the elbow of the Vermilion River, Henry arrived at a Blackfoot bison pound. However, poor weather conditions prevented pounding; still: "A principle chief of a neighbouring pound came to invite us to his camp, where he said the buffalo were numerous..." (Coues 1965 Vol. II:577). While at the pound he never saw it in operation, still one got the impression of the number of bison in the area: "...we had only the satisfaction of viewing the mangled carcasses strewn about in the pound. The bulls were mostly entire, none but good cows having been cut up" (Coues 1965 Vol. II:577). The next day, December 22, he saw plenty of bison near the pound but none entered (Coues 1965 Vol. II:577); that day he left. Then, on December 23: "Some Blackfeet arrived from the camp where I had been, bringing a quantity of fat meat. They informed me we had scarcely left when large herd was brought in..." (Coues 1965 Vol. II:577). Henry the Younger's comments back at Fort Vermilion summarized the situation well: "This afternoon my men returned with meat, and the hunters also accompanied them. They brought in the remainder of 300 buffalo which I have received since the arrival of the canoes, Sept. 13th. To-day they brought in 36 cows, besides their own offals" (Coues 1965 Vol. II:578).

Information from the Palliser Expedition included Hector's impressions of a Cree pound that contained more than 100 buffalo located near modern Vermilion on December

26, 1857 (Spry 1968:197). He stated: "The pound is a circular strong fencing, about 50 yards in diameter, made of stakes with boughs interlaced, and into this place were crammed more than 100 buffalos, bulls, cows, and calves. A great number were already killed, and the live ones were tumbling about furiously over the dead bodies of their companions..." (Spry 1968:197).

WESTERN MONTANE

On November 23, 1810, Henry the Elder was informed of bison in the Red Deer area: "Two Sarcees arrived from near Wolf [Blindman] River, where buffalo are numerous..." (Coues 1965 Vol. II:665)].

More instructive, on November 8, 1792, Peter Fidler left Buckingham House on the North Saskatchewan River to spend the winter with the Peigan Indians in southern Alberta. As noted above (i.e., Period IV), he only saw bison bulls until he reached the Red Deer River, just east of modern Red Deer, on November 19. Here he described the landscape as 'pretty open' with: "...fine grass land interspersed with hummocks of small Poplar or asp" (Haig 1990:19). It was in this vicinity he stated: "Some men went hunting and killed a few Cows, the first we have yet killed this Journey" (Haig 1990:18). Later, on November 25 and 27, in a land of very little wood, Fidler's party was running bison on horse back at which time they killed a number of bulls but saw no cows (Haig 1990:21-22). By December 1, Fidler's party was still killing bulls and were no longer near wood (Fidler 1990:22-23).

Fidler observed a former pound at *Nee tuck kis*, a single very large pine at a point of woods, on November 30, and a former buffalo jump near Carstairs, on December 5. Fidler's party continued to kill bison bulls the next few days even though there are: "Great quantities of Buffalo far out in the plain, SE from us" (Haig 1990:26).

On December 7, Fidler's party managed to run and kill 20 bison cows (Haig 1990:27). Importantly, on this day : "At 2 ½ PM thermometer +58°, which at this season of the year is remarkably warm" (Haig 1990:27). Like the day before, Fidler's party managed to run 20 bison on December 8. On December 9, Fidler reached the Bow River, just east of Calgary, on the south side of which he observed an old pound (Haig 1990:30).

On December 13, Fidler's party stopped at the Sheep River where: "No woods to be seen to the east, and only small hammocks towards the Mountain" (Haig 1990:33). On December 14, Fidler arrived at a Peigan camp of 150 tents on the Highwood River: "No woods to the Eastwards and very little to the Westwards, only, here 2 good Hammocks of pretty large poplars, one here and the other about 3 miles to the N. Eastward down the river" (Haig 1990:33). At this camp he: "Saw a few Buffalo far out in the Plain to the Eastward" (Haig 1990:33).

On December 16, the majority of the 150 tents in the camp moved to one of two jumps located to the south. The jumps that the groups moved to were undoubtedly at the front range of the foothills that are located just south of the Highwood camp (e.g., Old Women's Buffalo Jump). By the next day, December 27, one of the parties had: "...already got 2 large heards [sic] of Buffalo drove before the steep rocks" (Haig 1990:34-35). The next day he observed the results of a buffalo jump northwest of the location of the large camp (Haig 1990:35). Fidler's party attempted driving bison between December 19 and 25 (Haig 1990:38).

On December 25, Fidler arrived at Pekisko Creek about 10 miles above its confluence with the Highwood in an area of pretty good poplar growth; the Indians continued to run bison (Haig 1990:38). On the 27 to 29th, near Sheppard Creek he observed both a great number of bison and a very successful pound (Haig 1990:39). On December 31, Fidler arrived at the Oldman River near the base of the Rocky Mountains (Haig 1990:44).

From Fidler's observations, in late November and early in December, the bull bison are just entering the edge of the parkland/foothills. The females appear to be a substantial distance out on the plains, but still within sight of the parkland and/or foothills. But later in the month he witnessed a series of successful kills and pounds near the base of the Rocky Mountains. Large numbers of animals apparently moved into the western foothills and parkland during December. This is late movement into the foothills/parkland for the model but, given the small geographic area of the western parkland and foothills compared to the northern parkland, perhaps the influx is 'delayed' relative to the northern and eastern movement. Another possibility is that the warm weather influenced bison movements.

Importantly, Fidler (Haig 1990:23) described a chinook on December 1. Then, on December 7, he took a thermometer reading of +58° F (14.4 °C): "...which at this season is remarkably warm" (Haig 1990:27). While the basic pattern of bison movement to the western parkland and foothills remained intact in Fidler's descriptions, frequent chinooks brought warm weather and open grasslands that convoluted this picture.

ALBERTA-SASKATCHEWAN PLAINS

In the winter of 1857/58, James Hector took notes for the Palliser Expedition in the absence of its leader. While at Fort Carlton, Hector noted on November 15: "A man brought in from the buffalo hunt dangerously hurt having been thrown from his horse, when an old bull charged him..." (Spry 1968:184). Given the severity of his injuries observed at the fort it can be inferred that bison were in the immediate area. On December 15, Hector departed from Fort Carlton for Fort Edmonton. Near Red Berry Lake, Hector again recorded bull bison: "As we travelled along we saw a band of buffalo bulls..." (Spry 1968:188). Then, on December 16, the party crossed an open plain 'which takes nearly a whole day to do'. Importantly, he then stated: "Soon after starting [across the plain] we came on a herd of buffalo, but did not follow them, trusting to meet with others towards afternoon" (Spry 1968:188).

On December 17, while journeying near Whitewood Lakes, Hector noted: "Soon after starting we passed a 'pound', into which the Indians drive buffalo to slaughter them; however, they are very hard up this winter, as the mildness of the season has allowed the buffalo to stay much longer than usual out in the plains this year, severe weather always compelling them to seek shelter in the woods" (Spry 1968:189). On this same day, as the party crossed Jack Fish Lake, they noted: "The slipperiness of the ice, which gave us so much trouble in crossing the lake, was turned to good account the other day by the Indians, as they drove a band of buffalo cows so that they had to go out on the ice of the lake, when of course they fell and stumbled, and could make no progress, while their pursuers, approached them on foot, with ease killed the whole, to the number of 14" (Spry 1968:191).

On the 19th of December, near the confluence of the English River and the North Saskatchewan, Hector remarked: "We are now travelling amongst immense herds of buffalo..." (Spry 1968:193) and a while later he 'observed a band of bulls feeding' (Spry 1968:193). The party reached Fort Pitt, on December 20, at which time Hector noted: "...the buffalo never being far distant ever in summer, as the real bare prairies extend far north in this longitude, almost reaching this place" (Spry 1968:195).

As Hector's party continued west along the south bank of the Vermilion River they noted: "...passing many herds of buffalo..." (Spry 1968:196) and they: "...camped early to-day so as to kill a bull for our dogs" (Spry 1968:196). Then, while travelling south of modern Derwent the party came across a bison pound:

> ...we saw the fresh tracks of Indians, and soon heard the bawling and screaming of an immense camp, all in a high state of excitement. Diverging from our path to pay them a visit, we found that they had succeeded in driving a large band of buffalo into their 'pound' during the night, and were now engaged in slaughtering them.
>
> (Spry 1968:197)

During December 26 through 28 the party travelled through the Vermillion Lakes area where they saw 'immense herds of buffalo' and 'a good number of buffalo", respectively (Spry 1968:198-199). Hector reached Fort Edmonton, on December 30, and while there wrote: "This year these animals [bison] are within a few days of the fort [Fort Edmonton], and it is accordingly well off; but many years there is great scarcity, and even starvation here" (Spry 1968:201).

PERIOD V (MID-NOVEMBER TO MID APRIL)

B) Severe cold on the wintering grounds (January to February)

Ewers (1955:124) considered the end of December to be when the intense cold and heavy snow arrived on the Northern Plains. This is the time of year the bison would be expected to be the most concentrated in the parkland. Longley (1972:44) indicates that, for the Canadian plains, the period of snowcover is four or five months between November to April.

EASTERN PARKLAND

On January 1, 1801, at the Park Post, Henry the Younger noted a large number of bison in the area. He stated: "Buffalo in abundance; some within gunshot of the fort. The plains were entirely covered; all were moving in a body from N. to S." (Coues 1965 Vol. I:162). The next day, January 2, he remarked on this phenomenon again: "The cold was severe; weather cloudy and calm. The oaks made a continual cracking noise as they split with the frost, sometimes like the report of a gun. Buffaloes came within gun shot of the stockades..." (Coues 1965 Vol. I:163). Similarly, "On the 9th we had a terrible snowstorm. The buffalo now keep at a distance" (Coues 1965 Vol. I:166). Many bison were seen again on the 14th and 15th of January: "At daybreak I was awakened by the bellowing of buffalo. I got up and was astonished when I climbed into the SW bastion. On my right the plains were black, and appeared as if in motion, S. to N. Opposite the fort the ice was covered, and on my left, the utmost extent of the reach below us, the river was covered with buffalo moving northward...I had seen incredible numbers of buffalo in the fall, but nothing in comparison to what I now beheld. The ground was covered at every point of the compass, as far as the eye could reach, with every animal in motion" (Coues 1965 Vol. I:167). And on the 15th: "The plains were still covered with buffalo moving slowly northward" (Coues 1965 Vol. I:167). By January 19th, Henry the Younger recorded: "My winter stock of provisions is now complete" (Coues 1965 Vol. I:168)

Even with his stock complete he noted: "Indians go hunting on the E. side of the river, where the buffalo are numerous as on the W. side, and much easier to approach in the willows and long grass (Coues 1965 Vol. I:168-169). On January 30th, Henry the Younger made mention of: "...the old scabby bulls that take shelter in the woods..." (Coues 1965 Vol. I:169).

On February 1st, Henry the Younger, still writing from Park Post stated: "A terrible snowstorm. Stormy weather causes the buffalo to approach the woods for shelter, and it no sooner abates than they return to the plain" (Coues 1965 Vol. I:169). Of course, the 'plain' meaning the open areas between the wooded stream courses and not the plains much farther to the west. Thus, on February 3rd, Henry the Younger: "...went hunting on the E. side. Saw plenty of buffalo; killed one cow and one calf. One of them, a large fat cow, I shot at

125 paces, directly through the head, with my double-barrelled gun. I took only the tongues and depouilles..." (Coues 1965 Vol. I:169). Similarly: "On the 17th we had a terrible snowstorm. I can count daily, from the top of my oak, from 20 to 30 herds of buffalo feeding on the plains. It is surprising how the cows resist the piercing N. wind, which at times blows with such violence over the bleak plains, and raises such drifts, that it cannot be faced; still, those animals graze in the open field" (Coues 1965 Vol. I:169-170). As above, the 'plains' are the open fields between the well wooded stream courses.

On February 25th, Henry the Younger noted a herd of cows crossing the river ice near the fort (Coues 1965 Vol. I:170). Further towards the end of February, Henry commented: "Wolves and crows are very numerous, feeding on the buffalo carcasses that lie in every direction" (Coues 1965 Vol. I:171). And on February 28th, Henry observed: "An Indian brought in a calf of this year, which he found dead. It was well grown, and must have perished last night in the cold. This was thought extraordinary; they say it denoted an early spring" (Coues 1965 Vol. I:171).

The same scenario occurred for Henry the Younger at Pembina Post in 1802. On January 3rd, Henry the Younger noted: "Buffalo near the fort..." (Coues 1965 Vol. I:193). Similarly, on the 10th: "Hunters running buffalo with which the plains are covered; at the fort heard them fire, and saw the cows fall; they killed 23" (Coues 1965 Vol. I:193). Hunts such as this were so successful that by February 13th Henry stated: "My winter stock of fresh meat is complete" (Coues 1965 Vol. I:193). Interestingly, on February 23rd, Henry added: "X.Y. are starving, though buffalo surround them. They eat the old scabby bulls we kill for our diversion" (Coues 1965 Vol. I: 193-194).

Henry's situation was even better at Pembina Post in January and February of 1803. Henry had his winter stock completed by December 25, 1802 (Coues 1965 Vol. I:206). Henry then went on a journey from Pembina River Post to McDonnell's House near the south end of Lake Manitoba, north of Portage la Prairie. During this trip he stated: "Through all this country we never marched a day without passing herds of buffalo; even along the shore of lake they were very numerous" (Coues 1965 Vol. I:207-208). Similarly, upon his return to the Pembina River Post on February 3rd, Henry learned of the local bison population situation: "On arrival I found some of Mr. Cameron's men from above; they have lately been up as far as Goose Lake, and tell me the buffalo continue in abundance from this place to that river, and as far as the eye could reach southward, what vast numbers there must be!" (Coues 1965 Vol. I:209).

In 1808, at Pembina River Post, Henry the Younger once again experienced a January and February with substantial provisions. On January 1, he noted: "Buffalo in great abundance" (Coues 1965 Vol. I:428). By the 28th Henry noted: "Finished our winter stock of fresh meat, having sufficient to last until July" (Coues 1965 Vol. I:428). Similarly, on February 13th, Henry reiterated: "Filled our house with ice and fresh meat" (Coues 1965 Vol. I:428).

Provisions at Fort Alexandria were not in such good order as to those of Henry along the Red River. On January 2, 1801, Daniel Harmon noted: "In the morning the greater part of our People (Men, Women, and Children) were sent to go and pass the remainder of the Winter in the plains about two Days March from this, and where they will live upon the flesh of the Buffaloe which they will kill themselves..." (Lamb 1957:41). Similarly, on January 11, Harmon himself went out into the "plains" to hunt: "Beautiful weather. On the eleventh I accompanied Six of our people to our Hunters Lodge and the day following they return to the Fort with their Sledges loaded with meat, while I remained there to go farther into the Plains along with the Hunter, and where I am sure I saw in different herds at least a thousand buffaloe grazing" (Lamb 1801:42).

On February 11, Harmon travelled three days to a camp of fifty Assiniboine and Cree. The first night they encounter a terrible snow storm while "...encamped in the open plains, with nothing to shelter them..." (Lamb 1957:43). Still, the next day they were able to eat around a rousing fire (Lamb 1957:43). Similarly, at the Assiniboine and Cree camp Harmon observed a ceremonial dance around a fire (Lamb 1957:44). During his excursion, Harmon: "...saw Buffaloe in abundance, and when on a small rise of ground I may with truth say that we could see grazing in the Plains below at least five thousand of which Animals we killed what we wanted for ourselves and Dogs and this evening [16th?] returned to the Fort loaded with Furs and Provisions..." (Lamb 1957:44). Even with a foot and a half of Snow, the inhabitants of Fort Alexandria "...killed a Buffalo in the Plain opposite the Fort and another came within ten rods of the Fort Gate but the Dogs pursued him and he ran off" (Lamb 1957:44).

In the winter of 1801-1802, Harmon was located at Bird Mountain Post which was a one day trip northeast from Fort Alexandria on the Swan River (Lamb 1957:51). On January 9th, Harmon noted: "Several days ago I sent a number of men to Alexandria for Meat (as our Hunters do not kill anything yet there are no want of Moose and Deer hereabout) but they have just returned with nothing and say that the Buffaloe owing to the late mild weather have returned a considerable distance out into the large Plains -- therefore we are obliged to live upon pounded meat or dried choak [sic] cherries which are little better than nothing at all..." (Lamb 1957:53). On the 17th, Harmon noted: "Last evening our people brought home from our Hunters Lodge the Meat of a Moose, the sight of which caused every one to put on a joyful countenance and rejoice...Although we are twelve persons in all, yet for the last fifteen Days we have subsisted on what would scarcely have been sufficient for two people! In short they were the darkest Days I ever experienced in this or any other Country" (Lamb 1957:53).

February 1 was exceedingly cold and, then, on February 7: "During the last three Days we subsisted on tallow and dried cherries, but this evening two of my Men returned from Alexandria with their sledges loaded with Buffaloe Meat..." (Lamb 1957:54). On February 8, "All the Indians of this place except my Hunters are gone to pass a couple of Months (as they are wont yearly to do) on their beloved food -- Buffaloe Meat" (Lamb 1957:54). By February 19, Harmon wrote: "At present thanks to God we have a pretty good stock of Provisions in the Store and therefore may expect not to want again this season" (Lamb 1957:54). In short, Harmon indicated that warm weather had kept the bison on the 'large plains' causing his provision problems. After a cold spell there was enough bison to put up a good stock in the store.

In 1804, Harmon wintered at Fishing Lake, approximately a two day trip from Fort Alexandria. On Harmon's arrival at the fort, sometime after January 15th, he noted: "For sometime after our arrival we subsisted on Rose-buds!...for the Buffaloe at that time were a great distance out into the Plains and my Hunter could not kill, either Moose or Deer" (Lamb 1957:72). He then mentioned: "However, now thanks to our merciful God we have

Provisions in abundance..." (Lamb 1957:72). On February 11, Harmon travelled: "...several days march farther into the Plains, where we fell upon a Camp of thirty Lodges of Crees and Assiniboines, and with them made a good trade of Furs and Provisions. They were encamped on the summit of a hill, from whence we had an extensive view of the surrounding Country, which lay low and level and not a tree to be seen, but thousands of Buffaloe were grazing in different parts of the Plains--and to kill them the Natives in large Bands mount their Horses run them down and kill what number they choose, or drive them into Parks, and kill them at their leisure" (Lamb 1957:72).

This is one of the few examples of Native people well out on the plains where there was '...not a Tree to be seen...' . Still, the mention of the park or pound is a good indicator of substantial amounts of wood in the vicinity. As noted earlier, later in the text, Harmon informed his readers how a pound was built: "The Natives look out for a small grove of trees, surrounded by a plain. In this grove of trees they make a yard, by falling small trees, and interweaving them with brush..." (Lamb 1957:285-287). The fact that there was "...not a Tree to be seen..." likely indicated Harmon's general impression of the area. To speculate, this camp that was located 'several days march farther into the plains' but, more than likely, lay along the well treed Qu'Appelle River Valley, the same river valley from which he started his journey from at the Fort at Lac la Peche (Lamb 1957:72). The treeless vista Harmon described was likely from the river valleys edge out towards the plains.

Harmon's winter at Fort Alexandria, in 1804/1805, was very similar to his previous winter at Bird Mountain. On January 22, he noted: "For nearly a Month we have subsisted on little els [sic] than Potatoes! but thanks be to kind Providence, last night two of my Men returned from the Plains with their Sledges loaded with the flesh of Buffaloe, and bring us pleasant news that those animals are now plentiful within a Days march of this and they could not come at a time when they would be more wanted, for our potatoes also are getting low" (Lamb 1957:85-86).

On February 7, Harmon elaborated on the situation: "As at the [sic] most of the Posts in Swan River Department they are short of Provisions they therefore have sent the most of their people to pass the remainder of Winter with me, where we now have buffaloe in abundance" (Lamb 1957:86). This statement was reinforced on February 16th: "I left this in a Cariol [carriole] (drawn by a Horse) and went about two Days march into the Plain to where a number of our people have past the greater part of the Winter -- and in my pleasant ride I saw thousands of Buffaloe" (Lamb 1957:86). Once again, Harmon's 'plain' exhibited groves of trees here and there, likely corresponding to the edge of the parkland.

NORTHERN PARKLAND

In January and February of 1773, Matthew Cocking and his party travelled east through the parkland as there were no bison in their vicinity and they had been informed of bison in the parkland further east (Burpee 1908:112-113). Cocking noted: "The Natives suffer hunger, &c. with surprising patience. Several stragglers from the Asinepoet Natives joins us, who all complain of want of food" (Burpee 1908:113). Even though he experienced 'sharp weather', on February 3, Cocking was again informed by Natives that: "...Buffalo are very scarce" (Burpee 1908:114). On February 18 to 19, he recorded: "All the Young men looking out for Buffalo but not yet come in" (Burpee 1908:114). On February 22 and 23, a few bison were killed near the North Saskatchewan River (Burpee 1908:114). On February 23, Cocking was informed of a pound in the Birch Hills. He decided: "The Neheathaway Natives intend to go to the pound but slowly: endeavouring to preserve provisions by pitching after the buffalo; fearing a scarcity at the Beast pound; with these I intend to go" (Burpee 1908:115). By the end of February, Cocking's party was informed by men from the west of plenty of bison there and that the Birch Hills pound had had middling success. Similarly, Cocking's party itself had middling success hunting (Burpee 1908:115).

Alexander Henry the Elder left his fort on Beaver Lake (north of Cumberland Fort) on January 1, 1776. By January 15, Henry had reached the plains; he noted: "...we were scarcely able to collect enough wood for making a fire to melt the snow" and "We are now on the borders of the plains" (Bain 1969:271). By the 27th, Henry the Elder reached "Fort des Prairies", known later as the Upper Nippeween located immediately below the confluence of the North and South Saskatchewan (Bain 1969:275).

As Henry travelled across the plains he noted: "At noon, we discovered, and presently passed by a diminutive wood, or island. When I could see none, I was alive to the danger to be feared from a storm of wind, which would have driven the snow upon us. The

Indians related, that whole families often perish in this manner" (Bain 1969:283). Still, that night the party reached a wood where: "...the largest tree yielded easily to the hand" (Bain 1969:283). The next day, on February 7, near modern Humboldt, Saskatchewan, Henry the Elder observed: "Soon after sunrise, we decried a herd of oxen, extending a mile and a half in length, and too numerous to be counted" (Bain 1969:283). That night they again camped in a wood, and: "In the morning, we were alarmed by the approach of a herd of oxen, who came from the open ground to shelter themselves in the wood. Their numbers were so great, that we dreaded lest they should fairly trample down the camp..." (Bain 1969:286). The next night, on the February 11, they again camp in 'a little shrub' (Bain 1969:287). Henry the Elder described arriving at the Assiniboine camp: "On the twelfth, at ten o'clock in the forenoon we were in sight of a wood, or island, as the term not unnaturally is, as well with the Indians as other: it appeared to be about a mile and a half long" (Bain 1969:287). After partaking in festivities in the Assinboine camp, Henry the Elder was taken to a second 'small island' in the plains about five miles from the camp (Bain 1969:299). Here a pound had been constructed which, later that day, took at least seventy-two bison (Bain 1969:301). Shortly after pounding, the chief of the Assiniboine decided to trade at Fort des Prairies. The return trip was very similar to the trip west. The party hopped from 'wooded island' to 'wooded island' for the purpose of shelter and firewood. As Henry the Elder approached the Fort des Prairies he described the surrounding parkland: "...the twenty-third of the month [February], we passed several coppices, and saw that the face of the country was changing, and that we had arrived on the margins of the Plains. On the twenty-seventh, we encamped on a large wood..." (Bain 1969:317).

At Fort George in 1795, Duncan M'Gillivray began the year with a 'large quantity of provisions' and a 'violent fit of rheumatism' (Morton 1929:50-51). Still, on February 27, the Strong Wood Assiniboine arrived from their pounds with furs and provisions (Just as they and the Grand River Assiniboine had done earlier in the winter in mid December). At this time M'Gillivray also noted: "The men still employed carrying home meat from the Hunters Tent...we have therefore only the Gun Case and Marching Wolf employed in hunting and a sufficient number of animals will I hope soon be killed for the Spring". M'Gillivray also noted that this winter had been unusually severe (Morton 1929:52). On February 9th, more

Grande River Assiniboine arrived with a substantial amount of provisions (i.e., 500 lbs.). February 19th, M'Gillivray recorded: "...by examining the meat account it appears 413 animals have been carried this Winter to the Fort, but a sufficient quantity of Meat, Still remains to maintain us 'till the Middle of May' (Morton 1929:54).

At Edmonton House during the winter of 1775/1776, William Tomison was well supplied with bison. In January, Tomison received from the hunter's tent: six and one half bison on January 21st, five cows on the 23rd, five bison on the 26th, and one moose and six bison on the 29th; in terms of trade he received small quantities of provisions on the 4th, 17th, and the 30th; he specified that 100 lbs of provisions were traded for on January 31st (Johnson 1967:23-27). The constant supply of bison continued in February: three bison on the 1st, five bison on the 3rd, five bison on the 17th, and eight bison on the 19th. Importantly, on February 17th, Tomison noted: "The hunter also came home having killed as much as is required" (Johnson 1967:29). Still, Tomison's men brought in four bison on the 23rd and six bison on the 27th.

In the winter of 1796/1797, George Sutherland was at Edmonton House. A telling remark about bison can be found in a letter he wrote to James Bird (at Carlton House) on January 3, 1797: "Am sorry your fall trade is so little but hope you will make it up in the course of the winter. Yet this is what can hardly be expected as many of your Indians are in this quarter and doing nothing but pounding buffalo" (Johnson 1967:80). Still, at this time he also noted: "I am very glad you are likely to make twenty bags of pemmican as there are very little beat meat or fat brought in here as yet and still less at Buckingham House" (Johnson 1967:81).

The pounding activity of the Natives was reflected in the meat obtained by the House during the rest of January: six cows on the 7th, some dry provisions on the 8th, seven cows on the 10th, seven cows on the 12th, six cows and some dry provisions on the 14th, six cows on the 17th, six cows on the 19th, four cows on the 26th, six cows on the 27th, four cows on the 29th, and seven cows on the 31st. Importantly, on January 16, Sutherland recorded: "The rest employed cutting up fat meat to be melted down from making pemmican for use of the men in the summer" (Johnson 1967:82). This trend continued into February: six cows on the 1st, five cows on the 2nd, six cows on the 3rd, four cows on the

4th, and eight cows on the 7th. On the 9th: "The men that went for meat yesterday returned with twelve cows as did the hunter and men who went with him, he having kill'd a sufficient quantity of provisions to last the winter" (Johnson 1967:84).

In January and February of 1798 at Edmonton House, William Tomison again experienced little trouble getting bison. From his hunter he received: four bison on January 4th, two bison on January 6th, seven bison on January 9th, seven bison on January 16, three bison on January 18, two bison on the 21st, seven buffalo on the January 24th, five buffalo on the January 27, and six poor bison on January 30th, eleven bison on February 1st, four bison on February 6th (also received 1000 lbs. of provisions), nine bison on February 14, seven bison on February 16th, eight bison on February 17th, eight poor bison on February 21st, and seven very poor bison on February 23rd.

A different picture of the availability of bison emerged from Tomison's records of Edmonton House in January and February 1799. On January 2, Tomison wrote: "In the evening one man came home from the hunting tent for men to fetch two buffalo which is all that has been killed for the last fifteen days" (Johnson 1967:153). Thus, on January 4th, Tomison: "Sent five men in search of buffalo..." (Johnson 1967:153). The same day he received some bison flesh from a Fall Indian (Johnson 1967:153). From the hunter's tent he received: three poor bison on January 8th, six bulls on January 11th, six bison on January 15th, five poor buffalo on January 18th, and two poor bison on January 24. Near the end of January or early February, Tomison received a letter from James Bird from the Sturgeon River that stated: "...save the Bungee, all without exception are tenting in the plains, killing buffalo for themselves to eat..." (Johnson 1967:183). Tomison's response to this letter included a statement concerning their provisions: "...which article has been very scarce ever since our arrival at this place and no likelihood of amendment we have just been able to keep from starving and at present not more than eight Animals in Stock; pounded meat about 1400 lbs. but little or no Fat as yet..." (Johnson 1967:187). On February 6, Tomison received 300 lbs. of provisions and 1000 lbs more on the 27th (Johnson 1967:157-158). The hunter produced seven poor bison on February 14; five poor bison on the 19th, two bison on the 23rd, two bison on February 25, and two bison on the 28th.

The year 1800 provided an example of a winter when bison did not appear in the north. James Bird was at Edmonton House during January and February of 1800. He noted, on January 7th, that the Hunter's tent produced three bulls. Bird noted the frustration of the Indians to procure furs and provisions: "A few Blood Indians arrived with a few wolves, foxes etc., they say they are unable to kill wolves for want of both snow and buffalo, and that they have slept twenty-two nights in their way to the house" (Johnson 1967:229). On both January 15th and 17th, men arrived back after being sent for meat but Bird's journal did not record what they brought with them. This also occurred on February 5th and 8th. On February 21: "The men who went for meat yesterday arrived to tell us that twenty tents of Blackfeet have made a pound quite near the hunting tent and drove off every buffalo that our hunters are now quite at a loss where to go" (Johnson 1967:235). Further information from the Indians helped clarify the situation: "The two parties [of Blackfoot] brought us 494 made beaver in wolves and small foxes but no provisions of any kind: indeed they complain of not being able to procure sufficient provision [sic] for their own families, there being a scarcity of buffalo everywhere owing principally to the amazing warmness of the winter" (Johnson 1967:235). The next day Bird instructed his hunter: "...to remove to the river and endeavour to kill red deer etc..." (Johnson 1967:235)

In 1810, Henry the Elder was at Fort Vermilion. He had just visited a successful Blackfoot pound at the elbow of the Vermilion River although he did not see any animals get brought into the pound (Johnson 1967:576-578). As well, on December 31st, he noted that his stores were about 300 bison. On January 20th he noted: "Missisticoine, a Cree, arrived with his family from the strong wood on his way to Cree camps below. This is the first of my Cree who has come out of the woods this season; we expect no more fur from them during the season, as they idle, playing and eating buffalo" (Coues 1965 Vol. II:580). Similarly, on February 2: "A tent of Crees arrived from the woods, on their way to the pounds below (Coues 1965 Vol. II:582).

On January 24th, "A band of Crees from their pound on the Horse Hills came to trade provisions..." (Coues 1965 Vol. II:581). On February 17, while looking for a new location to build a fort at the mouth of the White Earth River, Henry the Younger observed: "We saw many buffalo at Basfond du Lac des Oeufs [Egg Lake] on the N. side" (Coues

1965 Vol. II:586). Henry recorded no provisioning concerns during January or February, 1810 (Coues 1965 Vol. II:581-590).

The next year, 1811, Henry the Younger was at Rocky Mountain House in January. On January 9th, Henry noted that they only had one day's rations (Coues 1965 Vol. II:670). On the 14th, Henry sent men off to the Peigans for meat (Coues 1965 Vol. II:670). Then, on January 16th: "Two young Peigans, who came for tobacco for their countrymen who are coming in to-morrow, had been told by Black Bear to inform us that he had made a pound near Red Deer River [at Bow Hills] for the purpose of supplying us with buffalo" (Coues 1965 Vol. II:670). Henry's men returned with meat from the pound on January 20th and February 1st.

WESTERN MONTANE

In early January of 1793, Fidler had just returned from a trading mission to the Oldman River near the base of the Rockies to a camp near Sheppard Creek.. On January 6, 1793, Fidler noted they were pounding bison at Sheppard Creek (Haig 1990:52). Later that day, January 6, he returned to Pekisko Creek where there were good large poplars and about 220 tents (Haig 1990:55-67). On January 16, he noted: "Men on hunting at the foot of the Mountain & killed several Buffalo. They say that they are plentiful there". Interestingly, the following day on January 17, Fidler noted: "The Thermometer has been always between +40° and +55° [F] ever since we have been here" (Haig 1990:59). This is between +4.4°C and +12.8°C. Importantly, on January 23rd Fidler recognized: "Men on hunting and brought home Bulls meat, no cows to be seen, being all drove away by the great number of Indians hunting here these many days" (Haig 1990:62). On January 30, Fidler left Pekisko Creek for Buckingham House (Haig 1990:67).

Fidler's return trip to Buckingham House provided one of the few documented traverses of the plains in winter. Importantly, he did encounter bison on the plains but under unusual circumstances. During his trip back, as he crossed the Highwood River on February 1, Fidler experienced the coldest day of his trip (i.e., -3° F or -20°C). During this time the Native people continued to kill bulls on horseback (Haig 1990:69-71). In sharp contrast, by February 4th, near the Bow River, the thermometer was at 40° F or 4.4°C and the party was still killing bulls; north of the Bow River towards the present day town of Carbon; bison were plentiful (Haig 1990:71).

On February 10, Fidler noted: "The calves in the womb are now all well covered with hair. These all Indians are remarkably fond of even when not more than the size of a quart pot they eat them. The greater part of the Cows the Indians now kill is merely for nothing else but for the calf' (Haig 1990:73). And every day, the men were running buffalo and killing a few each outing (Haig 1990:74-75).

On February 13 along the Red Deer River near Kneehills Creek, Fidler observed: "The buffalo are very numerous on the NE side of the Red Deers river and near it they are also very near it, from N. to S. the ground is entirely covered by them and appears quite black. I never saw such amazing numbers together before" (Haig 1990:76). Not surprisingly, on that day, as well as for the last few days, he had recorded a thermometer reading of +30° F or -1° C (Haig 1990:74). As Fidler's party moved up the Red Deer River he noted that buffalo were exceedingly numerous on the 15th, 16th, and 18th (Haig 1990:78). On February 19, when the thermometer read +42° F or +5.6°C, he noted: "Great numbers of Buffalo come down the bank on this side to cross over, about 2 miles below, when the Indians killed many of them. All the north side of this river has been for these many days entirely covered with buffalo but not a single one to be seen on the other side, until numbers crossed over this Day. They have eaten all the grass up as the cause of their crossing" (Haig 1990:79). February 21, Fidler observed: "Buffalo still as numerous as ever on this side, what cross over the river, others appears in their place from the Eastwards, and appears as if all the Buffalo in the Country was collected in this place as a focus" (Haig 1990:80).

Through early February Fidler travelled, for the most part, through grasslands which had experienced warm chinook conditions. The bison encountered along the Red Deer River enjoyed temperatures well above zero Celsius and were not very far from the parkland to the north and west. In fact, Fidler encountered the edge of the parkland two days later on February 23. As well, the river valley, of course, could have provided shelter for the animals in the instance of a sudden storm. Hence, Fidler's encounter of bison along the Red Deer River does not provide evidence of bison on the plains in winter but rather illustrates an exception to the rule. Very warm temperatures and the proximity to both parkland and the river valley permitted this scenario.

Two days later, on February 23, Fidler crossed the Red Deer River (east of modern Trochu) and observed: "The woods edge appears from NWbN to N1/2E, called the edge of the upper Beaver Hills" (Haig 1990:81). To reiterate an important point, the large numbers of bison Fidler saw a few days earlier were, at most, a few days out into the plains. Interestingly, on February 26, Fidler heard word from a scout: "...that the Buffalo is plentiful there [to the northwest] and that these Indians, have lately heard from a Band of Stone Indians (Assiniboine), to the Eastwards and say that no buffalo is near and that they have been under necessity to eat several of their horses to keep themselves from dying of hunger" (Haig 1990:82). Again, this suggests the herd movements were exceptional at this time. By February 28th, near Stettler, Fidler observed 'a good deal of woods to the west' but where he camped there were none (Haig 1990:83).

In January of 1858, Hector had travelled from Fort Carlton to Fort Edmonton. While at Fort Edmonton he decided to venture farther west to Rocky Mountain House. Hector arrived at Rocky Mountain House on January 14, 1858. While there he recorded that: "As the buffalo were far out in the plains, owing to the open winter, the Indians were themselves badly off for provisions, as in coming to the fort they had nearly consumed their store, owing to the length of the journey" (Spry 1968:210). Hector then returned to Edmonton by January 29 only to depart again for a mission on Lake St. Anns west of Edmonton. At Lake St. Anns, Hector: "... found the priests, M. Le Combe and his coadjutor nearly alone, the population of the settlement being absent in the plains hunting buffalo" (Spry 1968:219).

In 1859, Palliser travelled from Fort Edmonton to Rocky Mountain House in early February about which he stated: "Ours was a pleasant trip; we fell in with plenty of buffalo; travelled very slowly on account of the horses, who had often very deep snow to struggle through, and reached Rocky Mountain House early in the month of February" (Spry 1968:342-343).

During the winter of 1858, Hector set out from Fort Edmonton to 'visit' the mountains around the Devil's Head (Spry 1968:346). South of Sundre, Hector's party met an old acquaintance about which Hector stated: "He had been pitching slowly along the base of the mountains since then [end of September], and was now bound for the "Edge of the Woods", as he heard the buffalo were close and the Blackfeet far" (Spry 1968:352). December 14, the party was on the upper Dogpound Creek where they encountered 'a small herd of bison' (Spry 1968:357). As the party returned to Edmonton, on December 18, near the confluence of the Little Red Deer and the Red Deer River, Hector noted: "On getting up to the plain we saw a large band of buffalo..." and later remarked: "Away out towards the 'Cache Camp' [east of Bowden near Nisbet] we saw the plains quite covered with them..." (Spry 1968:359). The hunters of the party managed to kill six bison the next day (Spry 1968:359).

ALBERTA-SASKATCHEWAN PLAINS

No data were collected for Period IV (October to mid-November) for the Alberta-Saskatchewan Plains.

PERIOD V (MID-NOVEMBER TO MID-APRIL)

C) Preparing to leave the wintering grounds (March to mid April)

At this time, the coldest months of the year were over. The bison were becoming restless as they prepare to move back to the plains. Some calves would have been born in this period, although the peak of calving was in the first two weeks of May. Animals could have begun migrating by this time; if this was the case, the males would likely have been left behind.

EASTERN PARKLAND

In 1801, at Park Post, Henry the Younger made a series of observations concerning bison during March. On the 5th he noted that the Red River ice was breaking up and that: "The buffalo have for some time been wandering in every direction" (Coues 1965 Vol. I:171). Then, on March 17th, Henry the Younger experienced a terrible storm at which time the bison approach the fort (Coues 1965 Vol. I:173). On the 21st he noted that bison 'abound' (Coues 1965 Vol. I:173). On the 23rd, Henry recorded that his men had returned from Reed River where they had seen two calves of this year (Coues 1965 Vol. I:173). On the 27th Henry killed two cows; he noted: "...they have an ugly appearance, as their long winter hair is falling in large patches" (Coues 1965 Vol. I:174). The Red River ice broke on the 31st, "...bearing great numbers of dead buffalo from above, which must have drown in attempting to cross while the ice was weak" (Coues 1965 Vol. I:174). And again he noted on April 1st: "It is really astonishing what vast numbers have perished; they formed one continuous line in the current for two days and nights" (Coues 1965 Vol. I:174). By April 11, the bison were well into the calving season as he stated: "Buffalo are now mostly with calves of this spring" (Coues 1965 Vol. I:175).

In 1803, when at Pembina River Post, Henry made an interesting observation. On March 19th the Red River was clear of ice but, relatively speaking, very few bison came down (Coues 1965 Vol. I:210). The river cleared a few days (i.e., ten) earlier than in 1801. The lack of bison in the river during spring break-up may be due to the fact that the slightly earlier break-up date occurred before the animals began to cross in any numbers on their return migration to the plains.

On March 5, 1804, Daniel Harmon was at the north side of Good Spirit Lake in very open plains at night when he noted: "Neither would it have been safe to have encamped without fire, for in so doing we should run much risque [sic] of being trampled upon by large herds of Buffaloe that are roving about in the Plains..." (Lamb 1957:75). During much of March, Harmon appeared to have travelled over parts of the Touchwood and Beaver Hills as he moved from Fishing Lake, to Last Mountain, to Good Spirit Lake, and back to the Qu'appelle Valley about which he stated: "The Country I travelled over is beautifully situated, and covered as it were with Buffaloe and various other kinds of animals..." (Lamb 1957:72-79).

NORTHERN PARKLAND

In March of 1773, Matthew Cocking reached a bison pound in the Birch Hills. He observed droves of bison being brought to the pound but only a few actually entered it (Burpee 1908:116).

In 1796 at Edmonton House, William Tomison finished his meat stock on March 2: "In the evening those came home that went for meat, brought three buffalo which is the last" (Johnson 1967:30). Similarly, in 1798 at Edmonton House, William Tomison was still gathering provisions in early March. On March 1, he received six bison from the hunter's tent; on the 3rd, he received six poor bison (Johnson 1967:111). Also on the 3rd, two Indians arrived from an unspecified pound (Johnson 1967:111). On the 7th, he received six poor bison from the hunter's tent; sixteen bison on the 12th, and on the 20th he paid off the hunters (Johnson 1967:112-113).

In 1799 at Edmonton House, William Tomison received three very poor bison on March 14, and three bison the 19th (Johnson 1967:159-160). On April 8, : "...fifteen tents of Indians arrived on the other side from a buffalo pound where they have been most part of winter..." (Johnson 1967:162). Unfortunately neither the tribal affiliation nor the location of the pound was mentioned.

In 1800 at Edmonton, James Bird received ten bull bison on March 6th. On March 12, Bird noted: "We find it impossible to prevail on our hunter to continue any longer hunting, he says that there are no longer any animals, and that he wishes to join a war party" (Johnson 1967:238). Still, on March 13, the hunter and his family arrived with nine bull bison (Johnson 1967:238).

Similarly, on March 15, 1806, at South Branch House, Daniel Harmon noted: "Buffaloes have been found in plenty within a few miles of the fort, during the whole winter" (Lamb 1957:99).

WESTERN MONTANE

In March of 1793, Fidler had just begun to enter the Parkland northeast of Rumsey on his return trip of wintering with the Peigan (Haig 1990:84). On March 6, just southeast of Buffalo Lake Fidler observed: "There is plenty of Buffalo here and good grass for the Horses" (Haig 1990:86). That same day he: "...came to 12 Tents of Blood Indians who has been here at a Pound all winter and is now nearly full of putrefied carcasses. Nearby is a former pound for which this place got its name --'Willow Pound' (Haig 1990:86-87). Similarly, just east of Buffalo Lake, on March 8, Fidler passed another pound: "...but they only got one single Bull into it (Haig 1990;88). Just south of Battle River, on March 9th, Fidler: "...found here 25 Tents of Blood Indians who have been here a long while at a Pound" (Haig 1990:88). Across the Battle River on March 11, he noted: "Men ran and killed a few bulls, no cows to be seen, the Blood Indians having been remaining near here the greater part of the winter and has drove them away" (Haig 1990:89). Importantly, fire had burned everywhere in this area making information about bison herd positions difficult to interpret (Haig 1990:88-89). March 14, in the modern Minburn area, Fidler observed a pound full of dead bison left lately by the Sessew [Sarcee] Indians (Haig 1990:90-91). His party also killed some bulls in this area (Haig 1990:90-91).

On March 18, just south of the Vermilion River, Fidler's party: "...passed a Tent where Canadian Free men have been remaining at all Winter, hunting for themselves, but now lately removed a little distance Westerly as no Buffalo is near here" (Haig 1990:92). The area of the camp was described as: "...pretty thicketty of small asp and willows with several small open plains" He arrived back at his starting point, Buckingham House, two days later (Haig 1990:93).

ALBERTA-SASKATCHEWAN PLAINS

In the spring of 1858, Palliser had sent a number of men from Red River to Fort Carlton in preparation for the 1858 expedition. He stated:

> ...on my arrival to this place [5th of June at Fort Carlton] I learned that the men had arrived on the 7th of April, and were afterwards obliged to go out to the south of the Eagle Hills, where they supported themselves by hunting the buffalo, there being no provisions to spare at Carlton. These men, twelve in number, had been allowed the use of our horses; and hunted with the hunters of the fort. The men and horses which Doctor Hector had procured during the winter, and who we called the St. Ann's Brigade, were likewise unable to be supported at Fort Carlton. They were camped in the Eagle Hills, and the horses purchased in the winter, and likewise supporting themselves by hunting buffalo. The brigade consisted of twelve men and our half-breed Blackfoot guide Paul.
>
> Buffalo had moved off so far from Fort Carlton, and the hunters of the fort were obliged to go such long distances in search of meat, that the supplies did not even suffice for the inhabitants of the post, who were sent off with their wives and families to winter out. Mr Hardisty, the gentleman in the Hudson Bay Company's service in

> charge of the fort, could not be certain of a sufficient amount of food for the gentlemen of the expedition, and was even obliged to request my secretary, Mr. Sullivan, and our servant James Beads, to leave the fort and join the hunters on one occasion, and on another they joined a party at Jack Fish Lake, where they supported themselves by fishing. Afterwards, on Mr. Sullivan's return, Lieut. Blakiston and Monsieur Bourgeau likewise left for the plains, on the return of Doctor Hector and Mr. Sullivan.
>
> Immediately before our arrival [5th of June, 1958] the supply of meat greatly increased, owing to the greater facility of bringing the meat in the carts...
>
> (Spry 1968:174-175)

During March of 1859, Hector travelled from Fort Edmonton to Fort Pitt. On March 23, he was near the Vermilion Lakes when he noted an abandoned pound that had supplied Fort Pitt with meat during the winter (Spry 1968:387).

CHESTERFIELD HOUSE: AN ANOMALY IN THE MIDDLE OF THE PLAINS?

A substantial challenge to a migratory model of bison behaviour has recently been presented by Mary Malainey and Barbara Sherriff (1996). They argued that bison remained on the open plains year-round and did not move to the parkland in the winter. In partial support of their position, Malainey and Sherriff (1996) presented excerpts from Peter Fidler's journals from Chesterfield House as evidence that bison remained on the open plains all year long. They state: "At the turn of the nineteenth century, bison were abundant and available throughout the fall and winter in the vicinity of Chesterfield House, located far out on the plains" (Malainey and Sherriff 1996:345)".

Importantly, Chesterfield House was located at the confluence of the Red Deer River and the South Saskatchewan River. Fidler recorded his impression of the area in some detail in his journal (Johnson 1967:253-293). In 1800, Fidler's party canoed up the South Saskatchewan River towards its confluence with the Red Deer River. As they neared their destination on September 8th they started to see: "A good deal of pretty good poplars on both sides of the river in places" (Johnson 1967:265). They continued to see poplars along the river banks as they paddled farther west. On the 21st, Fidler noted: "...NWbW2 all full of willow and poplar islands on both sides, mostly all rowing. W1/2, S8, put up at the head of a large poplar island on the south side" (Johnson 1967:266). On the 23rd he stated: "...a good point of poplars on north side, the best we have seen yet...”; at this time he also indicated its similarity to Moose Woods (Johnson 1967:267). Then, on the 25th, Fidler reached the confluence of the two rivers and stated: “The woods here are few and bad for building” (Johnson 1967:268).

However, over the next few weeks, Fidler's party and another trading company built their winter trading rooms, sheds, and cellars out of the wood from the ‘few and bad’ woods locally available (Johnson 1967:268). The woods also got cut down for firewood, etc. For example, in the winter of 1801/1802 firewood was cut on October 11, 1801; November 9, 1801; November 30, 1801; December 5, 1801; December 18, 1801; January 2, 1802; January 9, 1802; and January 23, 1802 (Johnson 1967:293-324). Other instances which assist in determining the extent of the woods can be found in the following passages:

> September 28, 1800: “Three or four of us going through the woods, I happened to be before, when a sprig caught the trigger of the next person's gun behind me and it went off...” (Johnson 1967:269).
>
> January 14, 1801: “...much rime [crust on snow] in the woods”.
>
> February 7, 1801: “All hands carrying in poplar logs to saw for stuff to make bateau...” (Johnson 1967:285).
>
> December 21, 1801: “Tradesmen at their duties and the rest falling logs to saw for a bateau” (Johnson 1967:304).
>
> February 15, 1801: “In the afternoon the Canadians and our four men returned that went for pitch, having not seen a single pine tree, they returned short although they say they went five successive days journey, but I imagine they were very short ones” (Johnson 1967:285).
>
> February 12, 1802: “...falling trees near the house.” as they were blocking the view across the river (Johnson 1967:310).

This is ample evidence to support the notion that there was a lot more “woods” around Chesterfield House than one would expect for the ‘open’ plains. Thus, Chesterfield House was located in a large wooded oasis at the confluence of the Red Deer and South Saskatchewan Rivers. The following reviews bison data recorded by Fidler in terms of the ‘buffalo year’ in order to discern their movements relative to the wooded valley.

Peter Fidler left Fort Carlton on August 15, 1800. He arrived at the confluence of the Red Deer and South Saskatchewan River on September 15, 1800. After overwintering he departed for Cumberland House on April 22, 1801. He returned to Chesterfield House on September 27, 1801, only to overwinter and depart for the last time on April 20, 1802.

PERIOD I (MID-APRIL TO END OF JUNE)

Given the schedule above, it is clear that Fidler departed Chesterfield House about mid-April and returned well after the end of June. In 1801, Fidler remained at Chesterfield House until April 22 at which time he departed for Cumberland House without further mention of bison (Johnson 1967:289-290). In 1802, however, on April 16 he mentioned that: "The Indian man here goes on hunting daily but cannot find buffalo, and our meat here is beginning to turn a little..." (Johnson 1967:321).

PERIOD II (END OF JUNE TO MID JULY)

During the period between the end of June and mid-July Fidler was not at Chesterfield House; he had returned to the lower forts by this time.

PERIOD III (MID-JULY TO SEPTEMBER)

In 1800, Fidler arrived at Chesterfield House on September 15. By September 26, 1800, a hunter killed one cow and one calf (Johnson 1967:268). On September 27, 1800, Fidler went hunting and killed 7 cows, 1 calf, and 1 bull (Johnson 1967:268), and on September 30, 1800, a hunter killed three cows (Johnson 1967:269).

Similarly, after he returned to Chesterfield House on September 27, 1801, Fidler noted: "Buffalo very plentiful all along on both sides of the river" (Johnson 1967:293). On the 28th, seven men went hunting and returned with three bulls but no cows were seen" (Johnson 1967;293). On September 30, Fidler traded for deer meat as the party was in need of fresh meat (Johnson 1967:294).

PERIOD IV (OCTOBER TO MID-NOVEMBER)

On October 3, 1800, a hunter killed two cows. Fidler also stated: "Buffalo very numerous just at the house" [A footnote added: "...that the buffalo had 'come out of the Barren ground for cold'"] (Johnson 1967:270). Hunters killed two cows on October 8, 1800. (Johnson 1967:270). On October 10, 1800, the footnote indicated that 'no luck and no bison near' (Johnson 1967:271). On October 31, 1800: "Buffalo numerous close to the water's edge on the south side the river" (Johnson 1967:274). On November 12, 1800, Fidler stated: "Our fresh meat finished, the buffalo is now a good distance away" (Johnson 1967:275). November 15, 1800, three hunters kill one cow (Johnson 1967:276).

Similarly, on October 12 of the following year, 1801, the hunters brought in one bull with no cows to be seen (Johnson 1967:12). The Blackfoot brought in six cows for Fidler on October 14. On October 18th Fidler noted: "Great numbers of cows came to the river to drink which is a pleasant sight, as our provisions of late has not been very good" (Johnson 1967:297). Fidler's hunters returned with two cows on October 24. On October 29, Fidler recorded: "Great numbers of buffalo about the house. On November 4, Fidler's hunters brought in three bulls but the Indians had driven off all the cows (Johnson 1967:299). Fidler received two buffalo from an Indian he had sent hunting on November 7; similarly, the Blackfoot brought in three cows on November 10 (Johnson 1967:299). On November 15, Fidler recorded: "They [the hunters at the hunting tent] say that the buffalo are numerous around them, they are tenting twelve miles from the house" (Johnson 1967:301).

PERIOD V (MID-NOVEMBER TO MID-APRIL)

A) Settling in to the wintering grounds (mid November to December)

November 26, 1800, a hunter brought in one bull, no cows were near (Johnson 1967:277). Importantly, November 22 to 29, 1800, were all warm days (Johnson 1967:277). In a letter dated December 1, 1800, Fidler stated: "...buffalo at present scarce about us, but expect when the winter sets in that we shall have them more plentiful and nearer hand" (Johnson 1967:278). On December 4, 1800, Fidler noted: "...several places in the Bad River clear by the late warm weather" (Johnson 1967:279). On December 6, 1800, the men went hunting but failed to see bison (Johnson 1967:279). On December 10, 1800, the Blackfoot were sent hunting and returned with 2 ½ bison (Johnson 1967:279); similarly, on December 12, 1800, the Blackfoot returned with 1 ½ bison (Johnson 1967:280). Importantly, on December 13, 1800, Fidler noted: "...nearly all the snow melted although full two inches on the ground before..." (Johnson 1967:280). On December 27, 1800, the Blackfoot brought Fidler one cow (Johnson 1967:281). The hunter's tent sent four horse-loads of meat (Johnson 1967:281).

In 1801, on November 20, Fidler sent men to kill bulls for their hides to make line and they returned with two skins (Johnson 1967:301). On November 21, the hunter's tent produced one cow (Johnson 1967:301). On November 30, Fidler's men killed two bulls for line; the hunters brought in four cows; the Indians brought in six cows (Johnson 1967:303). On December 2, Fidler's hunters brought in four cows (Johnson 1967:302). Fidler traded for five cows on December 3. On December 16, the hunters brought in four cows; the Indians traded five cows (Johnson 1967:303). The next day, December 17, the hunters brought in three cows (Johnson 1967:304). The Blackfoot traded three cows on December 19 (Johnson 1967:304). On December 23, the hunters brought in one cow (Johnson 1967:304). On December 25, 1801, the Blackfoot brought in four cows to trade (Johnson 1967:304). On December 26, Fidler recorded: "The two men at the hunting tent [four miles from the house] made two trips to the house, they brought home ten cows, buffalo very plentiful in sight of the house (Johnson 1967:305). One hunter killed seven cows near the house and the Indians traded five cows on December 27 (Johnson 1967:305). December 28th, Fidler's men came home with five cows (Johnson 1967:305). Then, on December 29, he recorded: "Our men came home from the hunting tent with five cows and everything with them. I imagine that we shall have nearly enough meat to last us till embarkation. The hunter also pitched his tent to the house. Thousands on thousands of buffalo in sight from the house" (Johnson 1967:305). On December 30, an Indian brought in three cows. Lastly, December 31st: "A Blackfoot brought in five cows to us which we refused to take as we shall have enough without it..." (Johnson 1967:305).

PERIOD V (MID-NOVEMBER TO MID APRIL)

B) Severe Weather in the wintering grounds (January and February)

January 2, 1801, Fidler wrote: "The hunter pitched to the house, very few buffalo near here; he brought meat of near one buffalo" (Johnson 1967:281). January 4, 1801, Fidler noted: "Two Fall Indians came in with furs from a pound about twenty miles off. Buffalo very plentiful close at the river on the south side opposite the house, but the Fall Indians run them on horseback so that we have a poor chance of killing any" (Johnson 1967:281). On January 5, 1801: "Two men brought home the meat of two cows killed near the house" (Johnson 1967:282). On January 12, 1801, some Fall Indians come from the pound with a number of bison tongues (Johnson 1967:283). The Indians brought two cows on January 16th, one cow on the 20th, and three cows on the 23rd (Johnson 1967:283-284). Fidler's hunters killed two cows on January 31, 1801 (Johnson 1967:284). On February 1, 1801, Fidler noted: "The Blackfeet brought us four cows, which will be enough with what we have till the embarkation in the spring" (Johnson 1967:284). February 24, 1801, Fidler noted: "Indians busy trading and most part of them pitched away, as there is no grass or buffalo near this place" (Johnson 1967:286).

In 1802, on January 11, Fidler noted: "Millions of buffalo all round the house not ¼ mile off, and from a high eminence the ground is black quite round to a great distance" (Johnson 1967:306). On January 15, Fidler was informed: "...the whole [Fall Indian] Nation is at three pounds and that they are not hunting furs scarcely at all" (Johnson 1967:307). On February 5, after a period of severe weather, Fidler recorded: "Thousands of buffalo on the face of the bank on SS....Snow most part of the day", as indicated by a footnote (Johnson 1967:309).

PERIOD V (MID-NOVEMBER TO MID APRIL)

C) Preparing to leave the wintering grounds (March to mid April)

On April 3, 1801, Fidler sent hunters to get bison hides for tying, etc.; they returned that night with three hides (Johnson 1967:289). On April 9, 1801, five hunters returned after a three day hunt for fresh meat with five cows (Johnson 1967;289). He left the post on April 22, 1801.

In 1802, Fidler did not leave the post until April 20 and did not mention any occurrences of bison between the beginning of March and his departure date (Johnson 1967:313-321). Similarly, on April 16, 1802, Fidler's party scrambled to get fresh meat before leaving. As stated for Period I, above, Fidler mentioned that: "The Indian man here goes on hunting daily but cannot find buffalo, and our meat here is beginning to turn a little..." (Johnson 1967:321).

DISCUSSION

The occurrence of bison around Chesterfield House appears to have been fairly consistent. To summarize, in Period I (mid April to the end of June), Fidler and his party scramble for fresh meat to take on their trip to the lower forts in late April of 1801 and 1802. Otherwise there is no data for this period. Similarly, there is no data for Period II (end of June to mid-July) as Fidler and his party are en route to the lower fort. The predictive model would expect few bison to be in the wooded river valley during most of the summer, with the exception of watering.

For Period III (mid-July to September), bison were clearly in the area but there was no indication they were in extremely large numbers. For the most part, the animals were away from the river valley and the fort. Unfortunately, the lack of bison in the area also means the behaviour of the bison could not be observed for rutting activity. Again, the predictive model would expect the animals to be around the periphery of the treed river valley engaging in the rut activities.

In Period IV (October to mid-November), in both 1800 and 1801, there were more bison there than the previous period as terms such as 'great numbers' are used to describe the quantity of animals. As well, based on the quantity of meat being brought to the house the bison were consistently in the area.

In Period Va (mid-November to December) of 1800, early December was fairly warm and the quantity of bison meat being traded was low. In 1801, however, large quantities of bison meat were consistently being traded.

In Period Vb (January to February) of 1801, bison were brought in fairly regularly and the meat requirements for the winter were met by February 1. In 1802, the terms 'millions' and 'thousands' were used to describe the bison at this time. The Native people were pounding at three separate pounds in the area. There was plenty of bison in the area in this period of severe cold.

In Period Vc (March to mid-April) there were few references to bison in either 1801 or 1802 suggesting bison were not in the area in any numbers.

Although one cannot be sure of the situation in the wooded valley around Chesterfield House compared to that of the adjacent wooded valley or plains uplands, the general trend of bison movements into the river valley [i.e., = parkland] in the fall and a departure in the spring was indicated. Of course, in periods of relative warmth during winter it was likely that bison occupied the uplands surrounding the valley and were not restricted to the flood plain. Importantly, inference allows one to suggest that other wooded valleys of substantial size might have also been used by bison in this fashion. In fact, for the Missouri River valley, Clow (1995) used historical documents to illustrate that bison summered on the plains adjacent to the river valley but largely wintered within the valley itself (see Chapter Two).

SUMMARY

Based on observations of modern bison a predictive model of bison behaviour through an annual cycle was developed. Five periods were distinguished in which Period I (mid-April to the end of June) includes the movement of bison from their wintering grounds to their summering grounds. Also, at this time, the bison cows began to calve while on the wintering grounds, but this continued during the migration to the summering grounds. In Period II (end of June to mid-July), the bison reached their summering grounds and did little else other than eat. Period III (mid-July to the end of September), includes the rut or the bison's mating season. The rut occurred at the edge of the summering grounds as the event was embedded in the return migration to the wintering grounds. Period IV (October to mid-November), consists of that part of the migration to the wintering grounds that occurred after the rut. Lastly, during Period V (mid-November to mid-April), the bison were on their wintering grounds and became quite sedentary relative to their lifestyle in previous periods.

The interpretation of historic references to bison using the aforementioned model provided a synthesis for numerous independent sets of historical references. In Period I, most of the geographic areas considered wintering grounds and areas around the periphery of the parkland observed bison cows calving. During April and May the animals moved out of the parkland towards the plains in their spring migration. For the most part, this movement out of the parkland was accomplished by June leaving only a few bulls behind.

In Period II, the historic documents illustrated the scarcity of bison in the parkland periphery of the plains while abundance occurred on the plains proper in July.

In Period III, numerous observations of the rut and related behaviours were recorded. Historic observations placed the rut largely on the plains near the plains-parkland periphery. The geographic position of the rut was interpreted as the initial stages of the return migration to the wintering grounds. By the end of September, historic references that could be interpreted as rutting behaviour became absent from the records.

In Period IV (October to mid-November), historic documents illustrated that bison continued to move into the parkland in greater numbers. The most northern forts indicated the bison 'came up' largely between mid-November to early December. Similarly, observations in the western montane also noted bison at the plains-parkland interface until mid-December with a subsequent movement into the foothill and parkland after this date. Chesterfield House, and presumably other large river systems, also had substantial numbers of bison approach them during this time of year.

In Period Va (mid-November to December), bison were largely observed near their wintering grounds. As noted above, in some cases the animals had yet to arrive at their wintering grounds. For Period Vb (January to February), the historic documents contained repeated observations of large numbers of bison in the parkland and river valleys. By Period Vc (March to mid-April), historic documents continued to record large numbers of bison in the parkland. The animals were described as restless, shedding, and may have been beginning to move back to the plains.

The correspondence between the predictive model, based on modern animals, and the historic observations of bison is substantial. Historic documents provide numerous instances of the expected seasonally significant bison behaviours. In light of this correspondence, it is difficult to ignore the notion that bison migrated in relatively predictable annual cycles, at the regional level, in the past.

CHAPTER FIVE: APPLICATION OF DENTAL CEMENTUM INCREMENT ANALYSIS TO BISON: THE MODERN COMPARATIVE SAMPLE

INTRODUCTION

This chapter serves as an introduction to dental cementum increment analysis of bison dentition with the purpose of estimating season of death. Of course, assessing the dentition of bison from known archaeological contexts allows one to estimate the season of site use. This chapter provides a discussion concerning the nature of cementum, a review of some terminology particular to dental cementum increment analyses, an outline of the methodology used in thin sectioning teeth, and a description of the methodology for reading thin sections. The modern comparative sample is also presented in this chapter, including a review of some of the relevant literature concerning previous efforts to apply dental cementum increment analysis to bison and a presentation of the comparative sample, itself. Lastly, this chapter considers other seasonal assessment techniques (i.e., tooth eruption and wear and foetal development analyses).

DENTAL CEMENTUM INCREMENT ANALYSIS

Layering in teeth has been recognized for at least 140 years, as Gordon (1991:1) noted: "Melville described conspicuous dental increments in his 1851 novel, Moby Dick, but scientific studies were sparse until 1950s when biologists escalated increment use in determining the age of wildlife". Since the 1950s, the technique of dental cementum increment analysis has been widely used with much of its development owed to biologists concerned with monitoring animal population structures for wildlife management (e.g., Lieberman 1993:1162; Gordon 1991:1). By the late 1970s, Grue and Jensen (1979:3) considered the analysis of dental cementum increments as a 'routine tool in population studies'. In fact, dental cementum increment analysis has been used reasonably successfully in determining the age at death of numerous mammals including: moose (Sergeant and Pimlott 1959), caribou (McEwan 1963), mules (Low and Cowan 1963), black-tail deer (Low and Cowan 1963), red deer (Mitchell 1963), white-tailed deer (Ransom 1966), pronghorn antelope (McCutchen 1969), cattle (Coy et al. 1982; Beasley et al 1992), musk oxen (Savelle and Beattie 1983), black bears (Harshyne et al. 1998), wolves (Landon et al. 1998), bison (Moffit 1998; Novakowski 1965:176), and the list could continue.

THE NATURE OF CEMENTUM

Cementum is an incremental structure that covers the outside of tooth roots below the gum. As Lieberman (1993:1162) indicates: "Cementum is an avascular bone-like tissue, that anchors tooth roots by mineralizing extrinsic collagen fiber bundles (Sharpey's Fibers) produced in the periodontal ligament". In short, cementum functions to maintain teeth in position for effective occlusion in spite of the high strains caused by chewing (Lieberman 1993:1162). This process occurs over an annual cycle that correlates with the annual cycle of physiological growth (Klevezal' and Kleinenberg 1967; Burke and Castanet 1995:480).

Grue and Jensen (1979:3) acknowledged that, when deposition is retarded, incremental structures in cementum may reflect a general slowdown in an organism's growth in response to a regular seasonal reduction in growth rate. Coy et al. (1982) concur with this scenario. Still, the actual physiological process that leads to the growth of incremental structures in cementum and the regulation of those processes is relatively unknown (Grue and Jensen 1979:3).

Stallibrass (1982) suggests that variation within cementum microstructure produces the optical effects that visually appear as banding. He also suggests that this variation is produced by variation in relative mineralization and variation in collagen orientation; secondary causes of the variation include stress and strain associated with nutritional biomechanical variation and hormonal cycles (Stallibrass 1982)

More recently, Burke and Castanet (1995:479) have suggested that: "...cementum is conditioned by both genetic factors and environmental factors such as degree of seasonal climatic change and biotic variability". This statement is supported by observations that the relative distinctiveness of cementum increments decreases when specimens from areas of large seasonal variation are compared to those from areas of little seasonal variation (Grue and Jensen 1979:32, 33). This suggests a genetic component to cementum formation. Similarly, Grue and Jensen (1979:27-29) could find little difference in the formation of cementum increments between the sexes regardless of physiological condition (e.g., gestation or rut). This, also suggests a degree of genetic control.

A number of researchers have suggested that cementum deposition is strongly related to environmental factors (e.g., Turner 1977; Lieberman 1993, 1994). Most recently, Lieberman (1993:1162) has argued that cementum increments occur due to two processes associated with diet: "...1) changes in the frequency and magnitude of strain from chewing different diets alter the orientation of collagen fibres in cementum; 2) changes in the nutritional status of animals cause variations in the relative mineralization of cementum bands that are deposited at different rates." He concludes that incremental growth in acellular cementum (cementum towards the tooth crown) results from changes in the orientation of collagen fibres produced by seasonal variations in the frequency and magnitude of force required to chew diets of varying quality and hardness (Lieberman 1994:536). As well, the deposition of acellular and cellular cementum results from differences in mineralization produced by the relative speed of collagen deposition along a single depositional front (Lieberman 1994:537).

Interestingly, McCullough (1996) recently observed that deer populations that had undergone very severe population reductions, with the survivors enjoying high-quality forage, produced 'obscured' cementum increments. The fact that the increments were present, but obscured, suggests there is an underlying genetic component to cementum deposition. This observation also appears to support Lieberman's (1994) explanation of cementum growth in that the lower mastication stress reduced the visibility of the increments. Importantly, McCullough (1996:723) noted that usual natural fluctuations in populations were unlikely to produce problems with age determinations.

It is important to note that the annual apposition of material that makes cementum appropriate for determining age at death is also found in dentine and the periosteal zone of bone (Klevezal' and Kleinenberg 1967). In fact, increments in tooth and bone are known to occur, with few exceptions, in all mammals whether they live in tropical or polar climates, terrestrial or aquatic areas; whether they hibernate annually or remain active, and whether they are carnivorous, omnivorous, or herbivorous (Gordon 1991:10; see also Klevezal' and Kleinenberg 1967).

Cementum has a number of advantages over dentine and bone for the analyses of age at death. Researchers have observed that, in terrestrial mammals, dentine may not be a particularly good indicator of age once the specimen has passed its first few years of life. After the first few years of life the pulp cavity becomes full; thus, the space within the pulp cavity becomes a limiting factor in recording age (Grue and Jensen 1979:3; Gordon 1991:13). Similarly, a number of researchers have noted that apposition in bone can be used for determining age in some species but loss of bone tissue by resorption can obscure age estimates (Klevezal' and Kleinenberg 1967; Grue and Jensen 1979:3; Gordon 1991:10, 13).

Cementum, in contrast with dentine, is deposited throughout the life of the tooth (Klevezal' 1970:268; Gordon 1991:10). Monk (1981:194) observed that both Sergeant and Pimlott (1959:316) and Low and Cowan (1963:468) considered cementum apposition more easily viewed than dentine apposition. Similarly, cementum in contrast with bone is not subject to resorption (Klevezal' 1970:268). However, more recent research suggests cementum: "...rarely remodels or resorbs because it is avascular and grows from a single mineralization front...". (Lieberman 1993:1162, 1994:527).

TERMINOLOGY

There is a defined terminology employed in dental cementum increment analysis. For the purpose of this study, following Burke and Castanet (1995:480), a growth layer refers to any layering in dental cementum as a result of incremental or appositional growth. Growth layers are divided into four types of growth zones: 1) rapid-growth zones, 2) incipient rapid-growth zones, 3) slow-growth zones, and 4) incipient slow-growth zones. (The following discussion is based on viewing specimens via transmitted light).

Rapid-growth zones are translucent and reflect active cementum growth over the summer. This is the growth zone of Burke and Castanet (1995:480); the light or transparent bands of Klevezal' and Kleinenberg (1967:15); the zones of Pike-Tay (1995), and the translucent zone of Kimura (1980:161) and Gordon (1991:9). Similarly, incipient rapid growth appears as a translucent, bright, gelatinous band located along much of the outermost edge of the tooth.

Slow-growth zones are opaque and reflect slow growth during the winter. This term equates with the annuli of Burke and Castanet (1995:480), the dark or opaque bands of Klevezal' and Kleinenberg (1967:15); the incremental line of Klevezal' 1970:261); the incremental lines of Grue and Jensen (1979:6); the annuli of Pike-Tay (1995), and the opaque zone of Kimura (1980:161) and Gordon (1991:9). Incipient slow-growth zones appear as a grayish, semi-opaque, gelatinous featureless band located along much of the outermost edge of the tooth.

METHODOLOGY

The basic methodology of dental cementum increment analysis involves: 1) increment exposure, 2) grinding and polishing of the specimen's surface, and 3) viewing under magnification. Before thin sectioning of any teeth, however, the appropriate specimens must be selected.

Grue and Jensen (1979:8) suggested little concern was needed over the choice of which tooth to use for dental cementum increment analysis owing to that fact that, as long as the teeth were undamaged, the teeth should all have the same number of growth layers (once the time of formation of the initial growth layer is taken into account for each tooth). Saxon and Higman (1969) observed consistency across all the teeth within a single mandible, but focused on the first molar because it is the first permanent tooth to erupt and it exhibited the least variation in the timing of its eruption.

In examining deer, McCullough (1996:722) suggested petrographic thin sectioning was appropriate for examining the dentition of large herbivores as they have long cheek-teeth rows which form thick cementum layers in response to their role in chewing. As well, he specifically suggested that the first molar be used as it has the longest exposure to wear, and inferentially, the thickest cementum (McCullough 1996:722). Wolfe (1969:428) came to similar conclusions concerning the deposition of moose cementum.

Similarly, Gordon (1991:3) explained that molars and premolars are the preferred teeth for dental cementum increment analyses owing to their 'normally parallel albeit close together' increments. Further, he indicated mandibular teeth are easier to embed for thin sectioning than maxillary teeth as they lie flat due to their root structure (Gordon 1991:6).

From an archaeological perspective, Gordon (1982:2, 1991:6) observed that incisors, having only a single root to anchor them in bone, are rarely found in excavations. More to the point, Beasley et al. (1992:38) noted that it is important to base the development of comparative material on molars as cheek teeth rows are commonly recovered intact but without incisors. In this same vein, Lieberman and Meadow (1992:68) further warn that, because cementum is not especially hard and can be stripped from the dentine, only molars found intact in bone should be used. Still, stripping of the cementum can be detected as the exterior of the tooth lacks any evidence of periodontal ligaments. Thus, the evaluation of loose teeth could lead to incorrect seasonal or age assessments but, at the same time, with careful examination damaged teeth can be detected (Lieberman and Meadow 1992:68).

In terms of the nature of the thin section to be cut from the tooth, many researchers use longitudinal thin sections (e.g., Sergeant and Pimlott 1959:316; Low and Cowan 1963:468; Saxon and Higman 1969:304; Burke and Castanet 1995:482–484; Lieberman 1994). Some researchers found longitudinal sections less readable than transverse cross sections (Gasaway et al. 1978:561). Still, the reason behind reading longitudinal sections is that they expose the most cementum for reading (Stallibrass 1982; Lieberman 1994:535).

The petrographic method is currently considered most appropriate for dental thin sectioning as it uses changes in the defraction of polarized light which appear to result from biological variation in the structure of dental cementum increments (Lieberman 1994:535; Lieberman and Meadow 1992:66-68). An alternative thin sectioning technique, called decalcified thin sectioning, can provide better contrast between cementum increments but can remove some histological differences that distinguish cementum bands and, in some cases, can also destroy archaeological samples that lack collagen (Lieberman 1994:535; Lieberman and Meadow 1992:68; Bourque et al. 1978:531).

The preparation of specimens for thin sectioning in this study, and the procedure itself, were conducted based on protocols developed in the University if Manitoba thin sectioning lab (under the direction of Ariane Burke) (e.g., Burke 1995:16-17). The modern control sample was prepared by degreasing and dehydrating each specimen. This was accomplished by maceration followed by a series of chemical baths involving increasingly stronger ethanol concentrations. Following degreasing and dehydration the specimens were air-dried for a number of days. The archaeological specimens were simply cleaned of loose dirt by brushing.

Silicon molds were manufactured to hold the specimens while they were imbedded in epoxy resin. A vacuum chamber was used to impregnate and encase all teeth within the epoxy resin (i.e., Buehler Epo-thin low viscosity epoxy resin™ and Buehler Epo-thin low viscosity epoxy resin™). After 24 hours, the silicon moulds were removed to reveal the specimens embedded in the resin.

The resin blocks were then set in a low speed saw so that the specimen was aligned to be cut longitudinally along a single root occlusal-apical, perpendicular to the cementum surface. The exposed longitudinal plane of the tooth was then polished using increasingly finer grits of abrasive papers on a grinding wheel. The polished surfaces of the specimens were glued to microscope slides using the aforementioned resin and cut to a thickness of about 100μ on a Buehler Petro-thin™ thin sectioning system. The specimens were then further thinned on a grinding wheel, again using increasingly finer grits of abrasive papers. Thinning proceeded until the specimens were about 50μ thick. Thickness was evaluated by the optical properties (i.e., absence of color, distinctness of 'zones' under polarization) of the specimen under magnification.

Thin sections were microscopically viewed under magnifications of 10x and 25x using polarized transmitted light (e.g., Lieberman and Meadow 1992:69). Generally, the location on the slide that provided the optimal location to 'interpret' the specimen was just apical (towards the root tip) to the cement-enamel junction where the increments were clear, parallel, and continuous.

CEMENTUM READINGS

The term used to label the procedure for assigning age or season of death by means of cementum structures is 'cementum reading' (Grue and Jensen 1979:3). Equipment required in cementum reading includes a polarizing light microscope with a rotatable stage or lens as this setup is essential for distinguishing between acellular cementum increments (Lieberman and Meadow 1992:69).

While some researchers emphasize examining the entire perimeter of the tooth when cementum reading (e.g., Gordon 1988), most commonly, they have noted that the 'best' place to read dental cementum increments is the neck of the tooth at the cementum-enamel junction or dentine-enamel-cementum junction (e.g., Gordon 1991:11; Pike-Tay 1991; Burke and Castanet 1995:485; Lieberman and Meadow 1992:69; Lieberman 1994:535; Grue and Jensen 1979:19). As Gordon (1991:11) noted: "...this junction gives more uniform results in virtually all mammals". Further, Lieberman (1994:535-536) suggested cementum increments are more prominent lingually, while Gordon (1991:11) indicated that they are more prominent labially. The examination of the modern comparative sample (described below) indicates that cementum increments are most reliable lingually in bison.

The reason the junction provides such good readings relates to the difference between cellular and acellular cementum. Lieberman (1994:527) describes the two types of cementum. Cellular cementum contains cementocytes or lacunae that derive from cementoblasts that became trapped in the cementum matrix and die leaving a hole; cellular cementum is distributed towards the apical end of the tooth root (Lieberman 1994:527). Acellular cementum is deposited more rapidly and is less mineralized with a general lack of lacunae; acellular cementum is distributed towards the coronal end or tooth crown (Lieberman 1994:527). Importantly, acellular cementum (cementum towards the crown) is usually deposited parallel and equidistant while further down the tooth cellular cementum (cementum towards the root) is more plentiful but less parallel and clearly defined (Gordon 1991:11; Lieberman and Meadow 1992:64; Lieberman 1994:527, 535-536; Saxon and Higman 1969:306; Coy et al. 1982:131). It is the equidistant spacing and parallel nature of acellular cementum depositional layers that makes them easier to interpret.

While analyses of error in reading dental cementum increments are rare, some common problems can be stated. Sex variation has been suggested as a possible source of error (e.g., Harshyne et al. 1998). However, as stated above, Grue and Jensen (1979:27-29) found no major differences in the formation of cementum increments. Similarly, Klevezal' and Mina (1973, in Grue and Jensen 1979:28-29) found that neither the sex of the specimen nor changes in physiological condition (e.g., gestation and rut) produced differences in the formation of cementum increments. Still, Coy and Garshelis (1992) provided evidence that accessory lines indicating reproductive histories of black bears were observable suggesting gestation, at least, can influence the formation of cementum increments in some species.

Gasaway et al. (1978:560) indicate that one possible source of error in cementum reading lies in the "somewhat" subjective nature of the analysis. This observation is justified as a number of 'blind tests' have failed to achieve very comparable results (e.g., Gasaway et al. 1978:561; Kimura 1980; Bodkin et al. 1997). Bodkin et al. (1997:973), based on observer differences in a study of sea otters, suggested reader accuracy may increase with improving protocols, reference catalogues to known age animals, and larger comparative sample sizes.

Lastly, some researchers suggest greater clarity in cementum reading can be attained by viewing thin sections with oblique light and in a dark room (Beasley et al. 1992). The oblique light assists in minimizing reflection from the very fine lines produced during cutting. The dark room presumably cuts down on distracting background light (Beasley et al. 1992:47). This was not attempted in the current research due to success in viewing specimens in illuminated rooms.

MODERN CONTROL SAMPLE

The following section introduces and defines the modern control sample of *Bison bison* developed for interpreting archaeological specimens. First, previous research on this topic is reviewed. Then the 'requirements of' and the 'assumptions surrounding' the use of a comparative sample are expounded. Last, the modern sample is interpreted.

PREVIOUS RESEARCH

Currently, the analysis of dental cementum in bison is very limited for both modern specimens (i.e., Mundy 1962; Novakowski 1965; Armstrong 1965; Klevezal' and Pucek 1987; Moffit 1998) and prehistoric specimens (Bourque et al. 1978; Goldberg 1986; O'Brien 1997). Importantly, the analyses that have been conducted did not develop modern control samples with which to evaluate interpretations of archaeological specimens. This situation justifies the development of a modern control sample.

The earliest study of layering in bison teeth is the work of K. D. R. Mundy who, in 1962, produced a report on age determination in bison using dental cementum deposition on incisors (Mundy 1962; Novakowski 1965:174).

Subsequently, Novakowski (1965) examined bison dental cementum and observed layering which he inferred, based on studies in other species, to indicate annual cementum deposition. These observations were expanded by Armstrong (1965) as he established a strong correlation between the age of a specimen and the cementum layering in bison dentition. Similarly, Klevezal and Pucek (1987), in their study of European bison, indicated that a strong correlation exists between primary cementum increments and the age of the bison. Bourque, Morris, and Spiess (1978) conducted the first application of DCI analysis to archaeological bison dentition as a sidebar to developing a new thin sectioning technique. More recently, Goldberg (1986) applied DCI analysis to a collection of archaeological bison teeth from the Ice Glider site in North Dakota and interpreted them based on the nature of cementum deposition recorded for other species. Importantly, Goldberg (1986) recognized the need to establish a modern comparative sample of thin sectioned bison teeth in order to confirm the scheduling of cementum increment deposition in bison relative to other species. In fact, Gordon (1991:15) suggested: "If one game species predominated [subsistence], and hunters and herders were disposed to follow it, a comparison of seasonal increment widths across the landscape will also trace herd followers of bison, ...". Most recently, Moffit (1998) demonstrated that dental cementum increments in bison are deposited with the '...clarity, regularity, and distinctiveness...' necessary to accurately determine specimen age.

THE NATURE OF THE COMPARATIVE SAMPLE

As alluded to above, a modern control sample for the target species should be used to establish the pattern of dental cementum increment formation to provide a way to interpret cementum increments in archaeological specimens (e.g., Gordon 1988:144-146; 1991:12, 15; Burke and Castanet 1995:479; Lieberman and Meadow 1992:58; Beasley et al. 1992). This step is required because a) the formation processes of dental cementum increments are not entirely understood (Lieberman 1992:58), b) dental cementum increments form at different times of the year for different species (Grue and Jensen

1979:11-18), and c) different populations of the same species that inhabit different environments and experience different conditions may exhibit different timing in dental cementum increment formation (Burke and Castanet 1995:479; McKinley and Burke n.d.; Pike-Tay 1995).

Hence, the modern comparative sample should be as similar as possible to the target species (Gordon 1991:12). Similarly, because environment has not been ruled out as an influence on cementum increment deposition, it is important to establish a control sample from an environment similar to that of the target species (Burke and Castanet 1995:479; McKinley and Burke n.d.; Lieberman and Meadow 1992:58). Burke and Castanet (1995:479) summarized the situation:

> The use of a modern species for the study of a [Full Glacial] fossil one, therefore, rests on the assumption of genetic and behavioural uniformity, as well as the existence of a similar degree of seasonal variability in the Recent and Pleniglacial environments studied, at similar latitudes.
>
> (Burke and Castanet 1995:479)

Even then, one must infer that change between the timing and patterning of cementum growth is minimal between the target species and the modern species.

In establishing the modern control sample, the aforementioned conditions were met as best as possible. The control specimens consisted of modern bison (*Bison bison*) obtained from North Country Bison Meats™ and Alsask Beef Co.™, Edmonton, Alberta, Canada. While the herd was restrained and maintained for human consumption, the animals ranged free on grasslands in the Edmonton area (although a month prior to processing, the animals were removed from the range and grain fed). Comparative specimens were collected throughout the year of 1998 at a rate of roughly five specimens every month and a half. Theoretically, this selection of comparative specimens should exhibit the entire annual range of dental cementum increment development in bison. Importantly, the ages of the control sample specimens were restricted to a very narrow range spanning 2.0 years to 3.5 years. Additionally, all of the comparative specimens are male. In summary, the control sample, while not ideal, provides a reasonably strong standard of comparison for archaeological material (For details of the control sample see Table 1).

The processing of the teeth (discussed above) in the control sample was only conducted on the first permanent molar (M_1). As already discussed, a number of authors have indicated that molariform teeth are preferable for thin sectioning owing to their thicker cementum deposition (e.g., Burke and Castanet 1995:16; McKinley and Burke n.d.).

INTERPRETATION OF THE COMPARATIVE SAMPLE

The interpretation of the modern comparative sample is presented in Table 2. The collection of specimens in the control sample began on February 22, 1998. At this time, five mandibles were collected. Of the five specimens (No. 1-5) collected, four of the specimens (No. 1-4) indicated a period of slow-growth, while the fifth specimen (No. 5) was not interpretable.

Three specimens were collected on March 2, 1998. Two of the specimens (No. 6-7) indicated a period of slow-growth, while the third specimen (No. 8) indicated a period of rapid-growth.

On March 26, 1998, five specimens were collected. One of the specimens (No. 35) indicated incipient rapid-growth; the incipient rapid-growth zone appears (in transmitted polarized light) as a translucent, bright, featureless band located along much of the outermost edge of the tooth. Three of the specimens (No. 35, 37 and 38) exhibited periods of slow-growth. The remaining specimen (No. 34) was not interpretable.

Five specimens were collected on March 30, 1998. One of the specimens (No. 9) indicated a period of rapid-growth. A second specimen (No. 12) indicated a period of slow-growth. The remaining specimens (No. 10, 11, and 13) were not interpretable.

Five specimens were collected on June 15, 1998. All the specimens (No. 14-18) exhibited periods of rapid-growth.

On August 31, 1998, five specimens were collected. Two of the specimens (No. 19 and 21) indicated periods of rapid-growth. One of the specimens (No. 20) exhibited a period of slow-growth. The remaining two specimens (No. 22-23) were not interpretable.

Five specimens were collected on October 28, 1998. Three of the specimens (No. 24, 27-28) exhibited incipient slow-growth; the incipient slow-growth zone appears (in transmitted polarized light) as a grayish, semi-opaque, featureless band located along much of the outermost edge of the tooth. The remaining two specimens (No. 25-26) indicated periods of rapid-growth.

Five specimens were collected on December 15, 1998. These were the last specimens to be collected. Three of the specimens (No. 29, 30, and 32) indicated periods of slow-growth. The remaining two specimens (No. 31 and 33) were not interpretable.

Table 3 presents the schedule of dental cementum increment development based on the interpretation of the modern comparative sample. Plates 1 to 4 illustrate the nature of the dental cementum increments at various stages throughout an annual cycle. The interpretation of the control sample produced a schedule in which incipient rapid-growth zones are first recognized in late March. As described above, the incipient rapid-growth zone appears (in transmitted polarized light) as a translucent, bright, featureless band located along much of the outermost edge of the tooth. Importantly, the incipient rapid-growth layer is absent from the specimens from early March. Incipient rapid-growth may only be evident in late March but the nature of the sample only allows one to state that by mid-June there is only evidence of the translucent rapid-growth zones and not the distinctive incipient features. From mid-June to as late as late October, rapid-growth zones are deposited. As early as late October, incipient slow-growth layers begin forming. As described above, the incipient slow-growth zone appears (in transmitted polarized light) as a grayish, semi-opaque, featureless band located along much of the outermost edge of the tooth. The incipient slow-growth layer is no longer evident in specimens from mid-December. By mid December, slow-growth layers are evident. The slow-growth layers continue being deposited until late March at which time the incipient rapid-growth zones begin being deposited.

There are a number of specimens that deviate from the schedule as suggested by Table 2. Specimens collected March 2, 1998, have been interpreted to represent a period of slow-growth even though one specimen (No. 8) indicated a period of rapid-growth. Similarly, Specimen No. 20 indicates slow-growth in a part of the schedule which has been interpreted as a period of rapid-growth. Less problematic are the specimens collected March 30, 1998; they fall at the transition between slow-growth and rapid-growth and, not surprisingly, exhibit both slow-growth and rapid-growth.

These results allow for some generalizations about the accuracy of interpreting specimens based on the comparative sample. As noted above, a total of 38 teeth were analyzed. Of the 38 teeth, 29 (76.3%) were interpretable, and 9 (23.7%) were not interpretable. Of the interpretable specimens (n=29), only 2 (6.9%) did not fit the schedule. At present it is reasonable to infer, then, that for every 10 teeth analysed, approximately 7-8 will provide interpretable results while 2-3 will not provide interpretable results. As well, one specimen will not 'fit' the schedule or will not provide the 'correct' seasonality. Thus, in the subsequent analysis of archaeological specimens, a single aberrant specimen in a sample of ten or so will be interpreted as 'that 6.9% that did not fit the schedule'.

Of the uninterpretable specimens (n=9), seven were not interpretable due to overgrowth of periodental ligaments. Optically this appeared as large rhizomatic-like structures occuring at the location on the thin sectioned tooth where cementum would be expected. The remaining two specimens were not interpretable due to poor cementum deposition in that no increments were visible. Other possible ways that cementum increments might be obscured include hypercementosis, in which there is overproduction of cementum possibly due to excessive tooth wear (Hillson 1996:205-206), and improper extraction of dental specimens, in which cementum is stripped from teeth as they are extracted from the socket.

COMMENTS ON OTHER METHODS FOR DETERMINING SEASONALITY

As alluded to above, dental cementum increment analysis on bison has rarely been used in archaeology. Most often, the seasonal assessment of plains archaeological sites has been inferred from studies of tooth eruption and wear (TEWS) and foetal bone analysis. These two methods are described and critiqued below. It is argued that nondestructive age assessments (i.e., tooth eruption and wear and foetal bone analysis) suffer from assumptions of linear growth and individual and geographical variation that lead to large inaccuracies in adults and aged.

COMMENTS ON TEWS

Tooth eruption and wear (TEWS) studies have been the dominant approach for deriving seasonal information in plains archaeology (Frison 1967, 1968, 1970a, 1970b, 1971, 1973; Frison and Reher 1970; Reher and Frison 1980; Brumley 1973; 1995; Brumley and Peck 2000). This technique was derived from approaches in wildlife management (Brumley 1995:2) with the first systematic application of the technique on archaeological material conducted by George Frison (1970a:30) at the Kobold site, Wyoming. The technique was popularized in plains archaeology by Frison and Reher (see Frison 1970a, 1970b, 1973; Frison and Reher 1970; Reher and Frison 1980). In the study area, TEWS has been developed by Brumley (e.g., 1973, 1995; see also Brumley and Peck 2000)

The TEWS methodology requires the development of an eruption schedule and a wear schedule from teeth of known-age modern animals. Frison and Reher (1970:46-47) indicated that the majority of their modern sample was derived from commercial buffalo herds slaughtered at yearly age increments (i.e., ½, 1½, 2½, etc.). Importantly, most other seasonal assessments of bison on the plains have been based on this schedule including the Casper Site (Reher 1974) and the Vore site (Reher and Frison 1980), as well as Brumley's (1973, 1995) seasonality work. Because sample size is always a problem, researchers often assume a linear wear relationship to interconnect their points of data. This is what appears to be the case for the aforementioned studies. In order to assess the state of erupting teeth in a mandible, the tooth eruption schedule can be compared to archaeological specimens. Similarly, in assessing the state of wear on teeth, the wear schedule from the known age animals can be compared to the wear on the archaeological specimens (e.g., Morris 1978).

There are some methodological problems with the TEWS approach that require discussion. But first, it is acknowledged that tooth eruption is a reasonably well documented process in bison (e.g., Fuller 1959; Armstrong 1965; Frison and Reher 1970, Reher and Frison 1980). Yet, the process of tooth eruption in bison is largely complete between 2 and 3 years of age leaving wear patterns to assess seasonality in older animals. In fact, the reason these two techniques are often combined is owing to their complementary nature (Morris 1978:487).

More problematic for this technique is variation between individuals in the amount of tooth wear that is produced by exposure to different environmental conditions (e.g., Keiss 1969:175). Similarly, other researchers have suggested tooth eruption and wear is highly population specific and inter-populational comparisons would be tenuous (Fandos et al. 1993). A problem that TEWS shares with dental cementum increment analysis is that different levels of experience in the researchers can produce variation in the assessment of specimens (Keiss 1969:175).

A final concern involves the assumption of linear wear rates which are implicit in tooth eruption and wear analyses. For example, both Reher and Frison (1980:69) and Haynes (1984) provide wear rates in mm/year in their seasonal assessments of bison. Solounias, Fortelius and Freeman (1994), in an analysis of ruminant molar wear, demonstrated that teeth wear fastest in young and old animals and slowest in middle aged animals. The increased rate of wear in young animals is attributed to hypsodontic teeth which initially have small wear surfaces owing to their peaked structure. Increased wear rates in old age occurs for similar reasons as in youth; the base of the tooth is narrower with less surface area than the middle of the tooth where wear is slowest (Solounias et al. 1994).

Since the late 1960s, a growing number of wildlife biologists have stated that dental cementum increment analysis provides a more reliable age estimate than the tooth eruption and wear technique (e.g., Keiss 1969:179; Morris 1978; Quéré and Pascal 1983:235; Landon et al. 1998; Wolfe 1969). Besides the methodological concerns of the TEWS approach mentioned above, the examination of cementum increments has the advantage of not being as directly affected by environmental factors as tooth wear (Kay 1974:226; Monk 1981:197). As well, individual teeth are the foci of dental cementum increment analyses while the whole tooth row is desired in tooth eruption and wear studies; this makes sample size potentially larger in the former case, at least for archaeological samples (e.g., Kay 1974:226)

COMMENTS ON FOETAL BONE DEVELOPMENT

Seasonal interpretations of bison foetal bone from archaeological sites on the plains were first conducted by Wilson (1974) at the Casper site (Frison 1974) and the Big Goose

Creek site (Frison et al. 1978). For the study area, Brumley (1995; see also Brumley and Peck 2000) has conducted the majority of the studies.

The technique is based on changes in bone morphology due to inherent processes in the developing foetus. Using modern foetuses at different stages of development a schedule of landmarks in development can be determined. The technique also relies on bison having a relatively defined mating and calving period as it allows one to estimate a birthing period of May 15 for the average bison based on modern observations (Brumley 1995:4). Thus, knowing the average date of birth and working backward by reversing the schedule of foetal development, a seasonal assessment of the specimen is possible.

However, modern foetal bison are relatively rare specimens to acquire. Wilson (1974:148) used two foetal bison (i.e., one seven month foetus and one three day old new born) to model development and estimate seasonality. Brumley (1995:4-8; see also Brumley and Peck (2000:10-16)) based his interpretations of foetal bone development on Wilson's (1974) precedent. However, Brumley (1995:5-6) used a single modern new born calf as a base line reference against specimens of unknown age/seasonality. Still, Brumley (1995:6) expressed a number of concerns regarding the use of the outlined approach including: the lack of known age material used to develop the technique, the limited range of comparative elements, and the problem of out-of-season births.

One clear methodological problem is the assumption of linear growth used by Wilson (1974) and Brumley (1995:6) for creating models of developing bison. They acknowledge this shortcoming. Related to this issue is the assumption that body elements develop at proportional rates. Thus, at mid-term, the foetal animal and its elements would be expected to have reached half the size they will be at full term (Brumley 1995:6). Again, both authors acknowledge this is not the case but are forced to make such assumptions for the purpose of the model (Wilson 1974:146-147; Brumley 1995:6).

Another problem lies in the inference of a short mating/calving period. For example, in 1931, an investigator of slaughtered surplus bison in Yellowstone National Park observed:

> A great variance in the size of the fetuses was noted, which indicated a long breeding season. This is probably due to the fact that this herd has

> been artificially fed during winters for the past 25 years, thus lessening the dependence upon favorable seasonal conditions of birth of young.
> (Rush 1932:372)

In agreement with modern observations, historic observations recorded the rut occurring over a few months -- mid July to the end of September (see Chapter Four). Births were observed to occur over a substantial period of time -- mid-April to June (see Chapter Four). Some aberrant births were even recorded in February and March. Given this variability in terms of conception and parturition dates, it is likely that variation in foetal development will be substantial at any given time in the year. Still, as more modern specimens are collected the accuracy of the technique will improve.

SUMMARY

Dental cementum increment analysis equips archaeologists with a technique that can provide seasonal estimates of death for dental specimens recovered in excavations. The season of site occupation can be inferred from such analyses. There are, of course, numerous hazards associated with using such a technique. Importantly, the development of a comparative sample for the target species is essential. For this reason, the use of multiple means of assessing seasonality need to be compared further in order to ensure precision and accuracy.

Still, the modern bison comparative sample that was developed with this study, while not ideal, provides a meaningful and internally consistent schedule of dental cementum increments (As well, an independent test of the comparative sample is currently being assembled). Other methods of seasonal assessment of archaeological fauna are available (i.e., TEWS and foetal analysis). Decades of research, largely by wildlife biologists, indicates that DCI analysis provides the most accurate assessment of season of death.

CHAPTER SIX: APPLICATION OF DENTAL CEMENTUM INCREMENT ANALYSIS TO ARCHAEOLOGICAL BISON SAMPLES

INTRODUCTION

Understanding how people arranged themselves on the landscape, irrespective of bison movements, can be approached through an analysis of individual sites or a settlement pattern study. As noted previously, the term 'settlement pattern' was defined as: "...a set of culturally significant locations each of which occupies a specified position within an array that makes up a coherent distribution... [and] ...simultaneously mark the intersection of human activities and their cultural environment" (Fish 1999:203). In the case of mobile hunter-gatherers, the 'coherent distribution' or the relationship between the sites can be partially understood by the seasonal assessment of each site in order to examine the study area for annual cycles in land use. This approach is not new to the northwestern Plains as Vickers (1991), Meyer and Epp (1990), and Brumley (1995; see also Brumley and Peck 2000), to name a few, have utilized site seasonality data to infer seasonal round models for the study area.

Roughly following Willey's (1953:1) approach to settlement patterns, the goal of this settlement pattern study is the evaluation of twenty-one Old Women's phase sites from southern Alberta, southern Saskatchewan, and north-central Montana in terms of: 1) their geographical and chronological position, 2) their function, or site type, designation, and 3) their position in sequential order (i.e., seasonality).

SETTLEMENT PATTERN STUDY

This section provides a hypothetical model that indicates where and in what season archaeolgical sites in the past would be expected to be located given the model of bison movements presented above. This section also provides background information concerning the archaeological sites from which the archaeological dental specimens were selected. After describing each archaeological site, an interpretation of the dental cementum increment analysis of the site's bison dentition is presented (Table 4). That is, the geographical and chronological position of the sites, the function of the sites, and the seasonality/sequential order for each site is reviewed.

As expounded above, the model of bison movement predicts that bison rutted at the edge of the parkland, wintered in the parkland, calved back at the edge of the parkland, and summered on the plains proper. Working on the inference that Plains Natives relied on the bison for food, a hypothetical model would predict archaeological sites to occur in the parkland edge in fall, the parkland in winter, the parkland edge in spring, and the plains in summer. This hypothetical model of Native peoples movement can be most clearly falsified by finding considerable numbers of sites in the parkland in summer or the plains in winter.

The sites are located on the northwestern Plains; that is the plains of Alberta, Saskatchewan, and Montana. The archaeological sites described from Alberta include the Crowsnest River kill site (DjPm-80), DjPm-100, DjPm-114, the Blakiston Site (DjPm-115), the Castle Forks Buffalo Jump (DjPm-126), DjOu-62, the Ramillies Bison Kill and Campsite (EcOr-35), the Junction site (DkPi-2), Head-Smashed-In Buffalo Jump (DkPj-1), the Fish Creek Bison Kill site (EfPm-27), EgPn-440, and the Bodo site (FaOm-1). The archaeological sites described from Saskatchewan include the Davies/Garratt site (EcNj-6/7), the Estuary site (EfOk-16) and the Tschetter site (FbNr-1). The archaeological sites described from Montana include the Boarding School Bison Drive (24GL302), the Wahkpa Chu'gn site (24HL101), the Beaver Creek Park site (24HL411), the King site (24PH2886), the Carlisle site (24RL246), and the Bootlegger Trail site (24TL1237).

ALBERTA SITES

CROWSNEST RIVER KILL SITE (DjPm-80)

The Crowsnest River Kill site is located on the north side of the Crowsnest River. Landals (1991:75) excavated the bone bed which lies at the base of a 35+ m high bedrock terrace. She estimated that 80 to 90% of the site was excavated within the 59 sq. meters of excavation (Landals 1991:75).

Three small pieces of lead foil and a possible immature radius of a horse were recovered suggesting a relatively recent date (Landals 1991:75). As well, a date of 290 +/- 160 BP from bone collagen was obtained for the bone bed suggesting a calendrical date between AD 1500 and AD 1820 (Landals 1991:75). Underlying the bone bed were two points attributed to the Old Women's phase associated with a small hearth (Landals 1991:75).

Landals (1991:76) interpreted the faunal remains as indicative of highly selective butchering:

> ...an ultra 'gourmet' pattern (Binford 1978) is apparent -- only tongues, hump meat, some ribs and likely internal organs were taken. Essentially, the nearly complete skeletons of a minimum of 16 animals were left at the base of the jump, indicating a very small, opportunistic kill event.
>
> (Landals 1991:76)

She indicated the seasonal evidence from tooth eruption and wear suggested a winter kill while a minimum of three well-developed foetal remains suggested an early spring kill (Landals 1991:76). Landals (1991:76) indicated the kill represented the result of mounted buffalo jumping as witnessed by Peter Fidler in the late 1700s.

A sample of ten (n=10) molars (M_1) from left mandibles for an MNI of 10 were analysed using dental cementum increment analysis. Of these specimens, one indicated an event between late December and late March, five indicated an event from mid-June to late October, and four were indeterminate (see Table 4). These data are best interpreted as a kill event between mid-June and late October. The interpretation of well-developed foetal material does not correlate especially well with the dental cementum increment analysis and the tooth eruption and wear interpretation is in conflict with the dental cementum increment analysis.

DjPm-100

DjPm-100 is located in the bottom Warriner's Coulee towards the upper (west) end of the Oldman River Dam area (Van Dyke et al. 1991:25). The site is a campsite positioned in the well protected coulee bottom just as it meets the main valley bottom of the Oldman River (Van Dyke et al. 1991:31). The site consists of mixed Avonlea and Old Women's phase occupations.

In terms of the projectile points, there was a mixing of five Avonlea side-notched, three Avonlea triangular, five Plains side-notched, five Prairie side-notched, three unclassified side-notched, two Besant, and six unclassified points in the site (Van Dyke et al. 1991:55). Based on a radiocarbon date Van Dyke et al. (1991:54-55) argued that the site exhibits a thick bone bed attributed to the Old Women's phase (with a radiocarbon date of 630 +/- 80 BP, AECV 736C) overlaying stone features and lithics of an Avonlea Phase occupation (with a radiocarbon date of 1,380 +/- 90 BP, AECV 745C).

A sample of two (n=2) molars (one M_1 and M_1/M_2) from right mandibles were analysed using dental cementum increment analysis. Of these specimens, one indicated an event between late December and late March and the other was indeterminate (see Table 4). Although sample size is a very important consideration at this site, the single thin section is best interpreted indicating a kill event between late December and late March.

BLAKISTON SITE (DjPm-115)

The Blakiston site was excavated in 1990 by Barry Dau of Ethos Consultants Ltd. and is located at the confluence of the Oldman and Crowsnest Rivers in southwestern Alberta (Dau 1990). The site is located on a low terrace above the rivers and consists of twelve tipi rings, three surface hearths, five stone hearths, and two cairns.

Artifacts recovered from the Blakiston site include cores, unifaces, bifaces, hammer stones, Late Side-notched projectile points, and Saskatchewan Basin Complex: Late Variant pottery (Dau 1990:146; Giering and Peck 1998). Also, a fairly large amount of worked bone and shell were recovered and interpreted as ornamental (Dau 1990). In addition, a number of items of Euro-Canadian origin were recovered including seven small rusted metal fragments, one of which may be a projectile point (Dau 1990).

Fractured bison bone dominated the faunal assemblage but deer, antelope, elk and a small amount of canid bone were also recovered. An examination of the bison tooth eruption and wear and foetal bone indicated that the site was occupied primarily during a period from late fall to late spring (Dau 1990:23).

Based on aforementioned assemblage, the Blakiston site was interpreted as a campsite at which extensive food processing occurred. Dau (1990:192) also suggested that the artifacts and radiocarbon dates clearly indicated a fairly continuous occupation by people over about 450 years from 750 BP to at least as late as 300 BP. The artifacts and dates assign the Blakiston site to the Old Women's phase. The excavator observed that cultural activities and artifacts remain relatively unchanged at this site, even after the introduction of Euro-Canadian items, suggesting considerable cultural continuity (Dau 1990:192).

A sample of nineteen (n=19) specimens (ten M_1s, three M_2s, five M_1/M_2s, and one M_3) for an MNI of 12 were analysed using dental cementum increment analysis. Of these specimens, one suggested a late March to mid June occupation, six suggested a late December to late March occupation, and twelve were indeterminate (see Table 4). The best interpretation of these data is that the site represents a late December to late March campsite or series of campsites with habitations possibly lasting into late March and mid June. This interpretation corresponds reasonably well with that arrived at using tooth eruption and wear and foetal analyses (i.e., fall to spring); however, no evidence of a fall event was arrived at using dental cementum.

CASTLE FORKS BUFFALO JUMP (DjPm-126)

The Castle Forks Buffalo Jump is located on the south side of the Oldman River less than one km upstream from its confluence with the Castle River (Landals 1991:73). The site itself is positioned at the base of a steep sandstone escarpment that faces northeast towards the Oldman River. A large amount of bison bone along a river cut exposure of 25-30 m long by 3-4 m wide was present at the base of the escarpment (Landals 1991:73).

Landals (1991:73) indicated the site has elements consistent with traditional buffalo jump practices. She stated: "The size of the jump, its location in relation to prevailing winds, the topography of the gathering basin behind the jump and the reported presence of drive lanes (Reeves 1987; unfortunately destroyed by plowing) all conform to the traditional and expected pattern for a classic plains buffalo jump" (Landals 1991:73).

The interpretation of the site suggested a single communal kill event was present underlain by campsite deposits and other more ambiguous deposits. The dental specimens used in this study come from the communal kill deposits and will be focused on here. Within the bone bed of the communal kill nine lithic and one metal projectile point were recovered (Landals 1991:73). Landals (1991:73) classified the lithic projectile points using Forbis' (1960) classification system; this classification suggests the points are of a relatively recent date. Visual inspection of an illustration of these points by the author indicate they are Cayley Series projectile points (Peck and Ives 2001). The presence of the metal point attests to a recent date for this material. Landals (1991:74) suggested a date of 'the last half of the 18th century or early in the 19th century' for the bone bed.

Based on butchering patterns of the faunal remains the site is interpreted: "...as a 'bulk' butchering pattern or an extremely frugal strategy in which virtually the only elements discarded are those of extremely low utility" (Landals 1991:75). Unfortunately, the seasonality analysis of the mandibles using tooth eruption and wear was hindered by the use of the mandibles as chopping tools which destroyed the tooth cusps (Landals 1991:75). No seasonal assessment was offered.

A total of fourteen (n=14) molars (seven M_1s, six M_2s, and one M_3) with an MNI of 13 were analysed from the Castle Forks site. Of these specimens, three indicated a late December to late March kill event. Eleven of the sample were indeterminate (see Table 4). The data are best interpreted as representing a kill event between late December and late March. There is no other seasonal data with which to compare this evaluation.

DjOu-62

DjOu-62 is located at the bottom of Forty Mile Coulee in southeastern Alberta (Brumley and Peck 2000:82). The site consists of 14 stone circles interpreted to be tipi rings (Brumley and Peck 2000:82). Grasslands persist at and around the site and, not surprisingly, water is seasonally available (Brumley and Peck 2000:82).

Of the fourteen rings, six were tested. In Stone Circle 5 a projectile point fragment assignable to Late side-notched (Cayley Series) types was recovered (Brumley and Dau 1988:243). A metal fragment was also excavated from Stone Circle 5 possibly suggesting a protohistoric age (Brumley and Dau 1988:243). In Stone Circle 9, a ceramic sherd 'likely' assignable to the Saskatchewan Basin Complex was recovered (Brumley and Dau 1988:243). Bison bone was recovered which yielded a date of 250 +/- 80 BP (Beta 6716) (Brumley and Dau 1988:243). Similarly, in Stone Circle 11 bison bone was recovered which yielded an age of 230 +/- 90 BP (Beta 19801). In and around Stone Circle 12 a total of five projectile points assignable to the Plains/Prairie side-notched (Cayley Series) projectile points were recovered. Also within this stone circle was bison bone dated to 470 +/- 70 BP (Beta 19802). The site was interpreted as a series of occupations that date to the Late Prehistoric and Protohistoric Periods (Brumley and Dau 1988:243-244; Brumley and Peck 2000:82). The recovery of Plains/Prairie side-notched projectile points, pottery likely attributable to the Saskatchewan Basin Complex, the dates, and recovery of historic items in association suggest this is an Old Women's phase site.

A sample of three (n=3) molars (one M_1/M_2, two M_3s) for an MNI of 2 were analysed from this site. One specimen suggested a late March to mid June or the early part of mid June to late October for the event (see Table 4). The other two specimens were indeterminate. With the small sample size in mind, it can be suggested that this campsite was occupied sometime during late March to mid June and possibly into the early part of mid June to late October.

JUNCTION SITE (DkPi-2)

The Junction site is located on the Oldman River approximately 2 km upstream from Fort Macleod at the junction of Highways 2 and 3 (Unfreed 1993:1; Walde et al. 1995:26). The site is a bison kill and processing site (Unfreed 1993:466). The site consists of two distinct topographic zones: 1) an upper prairie level and, 2) a lower river terrace/floodplain level (Unfreed 1993:3). Excavations focused on the lower terrace as it contained bison kill and butchering/processing deposits (Unfreed 1993:3).

The stratigraphy is divided into three components; Component III contained historic material while Components I and II contained Old Women's phase material (Unfreed 1993:102-136). Component I and II were often separated by a layer of fluvial sands. Based on thirty-three radiocarbon dates an age between 500 BP and 700 BP was indicated for Component I and an age between 300 and 500 BP for Component II (Unfreed pers. comm. 1993). Based on foetal remains both components of the site were interpreted to contain events pertaining to late winter and early spring (Unfreed 1993:465-478).

Artifacts recovered from the site include Cayley Series projectile points (Peck and Ives 2001), bifaces, scrapers, choppers, wedges, cores, flakes, and numerous expedient lithic tools. Bone and antler tools, shell ornaments, and Saskatchewan Basin Complex: Late Variant pottery were also recovered from the site (Unfreed 1993; Walde 1993:670-694).

A sample of ten (n=10) molars (all M_1) for an MNI of 10 were analysed using dental cementum increment analysis. Of these specimens, eight indicated a late December to early March kill event. Two specimens were indeterminate (see Table 4). Given the reasonably large sample size, this site is best interpreted as a late December to early March kill event. This interpretation correlates well with the seasonality assigned from the foetal bone.

HEAD-SMASHED-IN BUFFALO JUMP, NORTH KILL (DkPj-1)

Head-Smashed-In Buffalo Jump (DkPj-1) has gone by many other names (including the Spring Point Jump, Elgin Jump, Fort Macleod Jump, McLean Jump, Calderwood Jump, and Dirsch Jump) (Reeves 1978:151). The site is located north of the Oldman River and west of Fort Macleod on the edge of the Porcupine Hills (Reeves 1978:151). The site is a bison jump kill site with an associated processing area.

George Dawson (1885, in Reeves 1978:151) first mentioned the site in the literature in the 1880s while working for the Geological Survey of Canada. In the 1930s, the site was first mentioned in the archaeological literature by Junius Bird (Reeves 1978:151). The first scientific excavations at the site were carried out by Boyd Wettlaufer (Reeves 1978:152). In the late 1960s and early 1970s, Brian Reeves conducted excavations in the north, south, and east portions of the kill site (Reeves 1978:155-161). From these excavations a culture historical sequence was established (Reeves 1978:163-174). In the late 1980s and early 1990s, Brian Kooyman (1990, 1992) excavated in the kill site adjacent to Reeves' (1978:159-160) excavations in the north portion of the kill site deposits.

Following Reeves (1978:151-153), the kill site complex at Head-Smashed-In Buffalo Jump consists of a gathering basin and drive lanes to the west which lead to the jump. The jump consists of a sandstone outcrop running a lateral distance of 350 meters with drops of approximately 11 to 13 meters. At the base of the jump is a bison bone midden. Associated campsites and processing sites are located below the jump, to the east, on flatter ground.

The bison dental sample came from Kooyman's 1989 to 1992 excavations in the north end of the kill site. Old Women's phase material was recovered from the upper three levels (Kooyman 1990, 1992). Projectile points assignable to the Cayley Series assisted in providing the cultural affiliation of the material (Peck and Ives 2001).

A total of eight (n=8) molars (all M_1s) were analysed using dental cementum increment analysis for specimens from levels 2 and 3 from Kooyman's (1990, 1992) kill site excavation. Thus, the specimens came from two independent samples: one sample of three (n=3) specimens for an MNI of three from level 2, and one sample of five (n=5) specimens for an MNI of five from level 3.

For the specimens from level two, one indicated a kill event(s) between late October and late December, and two specimens indicated a kill event(s) between late December and late March (see Table 4). This is best interpreted as a kill event, or series of kill events, starting in late October to late December that possibly continued into late December to late March.

For the specimens from level three, one suggested a mid June to late October kill event, two suggested a late December to late March kill event, and two were indeterminate (see Table 4). A late December to late March kill event provides the best interpretation.

RAMILLIES BISON KILL AND CAMPSITE (EcOr-35)

The Ramillies site (EcOr-35) is located in southeastern Alberta north of Medicine Hat in the central part of the Suffield Military Reserve (Brumley 1976:1-2). The site is a bison pound with an associated campsite/processing area and was utilized during the Avonlea phase and the Old Women's phase (Brumley 1976). Based on foetal remains and bison tooth eruption and wear analysis the site is considered to have been used in the spring, summer, and fall (Brumley 1976:20, 23).

Brumley (1976:1-2) divides the site into three parts: Areas A, B, and C. Area C consists of stone cairn alignments that lead to a oval depression with a rock-capped wall approximately 20 meters long by 12 meters wide by 2 meters deep; these features were interpreted as drive lanes and a pound (Brumley 1976:1-2, 11-14). Area B is a midden along the coulee wall directly adjacent to the pound that exhibits bison bone; the midden is attributed to the dumping of bison remains from the pound down the adjacent slope in order to prepare the pound for subsequent pounding events (Brumley 1976:1-2, 9-11). Area A is a relatively flat area a few hundred meters north of the other Areas; the unearthing of hearths, pits, FBR, butchered faunal remains, lithic debitage, and ceramics, was interpreted as indicative of campsite/processing activities (Brumley 1976:1-2,9)

In Area A, Brumley (1976:8) defined three cultural units in the stratigraphy (i.e., I, II, III). For Area B, no stratigraphy was discernible (Brumley 1976:10). In Area C, three basic stratigraphic units were recorded for the oval depression with rock-capped walls (Brumley 1976:12). The bottom consists of basal gravels, the layer above consists of evidence of wall construction, and the top layer consists of bison bones, projectile points, bone tools, and debitage. It was not possible to differentiate the periods of use by the Old Women's phase from that of the Avonlea phase.

A total of eleven (n=11) molars (five M_1s and five M_2s) for an MNI of eight were analysed using dental cementum increment analysis (see Table 4). Of those specimens, three indicated a late March to mid June kill event, three indicated a mid June to late October kill event, one suggested a late December to late March kill event, and four were indeterminate. The most reasonable interpretation of these data is a kill event or events occurring between late March and late October.

FISH CREEK BISON KILL (EfPm-27)

The Fish Creek bison kill site was discovered in 1969 by students of the University of Calgary, Department of Archaeology, field school (Smith et al. 1977:1, Reeves 1976; Walde et al. 2001:18). In 1976 the site was partially excavated as part of the Fish Creek Park planning process (Smith et al. 1977:1; Walde et al. 2001:18). Late Prehistoric Period material culture was recovered from the uppermost bone bed which included a metal projectile point, 'Plains' Side-notched projectile points, and various other temporally non-diagnostic artifacts (Smith et al. 1977:65). The faunal analysis (i.e., tooth eruption and wear and foetal bone) suggested a series of cow/calf herds (MNI=29) were killed periodically between winter and early spring. In 1979, the University of Calgary, Department of Archaeology, field school revisited the site (Crowe-Swords and Hanna

1980). Crowe-Swords and Hanna (1980) were able to correlate the upper most level with that identified by Smith et al. (1977). Similarly, the faunal assemblage was interpreted as cow/calf herds although some males were present based on metacarpal analysis (Crowe-Swords and Hanna 1980:35). Unlike Smith et al. (1977) no foetal bone was recovered (Crowe-Swords and Hanna 1980).

Yet again, in 1999-2000, the University of Calgary, Department of Archaeology, field school revisited EfPm-27. As before, the uppermost occupation consisted of a bison bone bed. Walde et al. (2001:34) correlated this occupation with Smith's (Smith et al. 1977:65) uppermost bone bed containing the metal projectile point. Corroborating this interpretation, the occupation contained a fragment of iron, four glass beads, and Plains Side-notched projectile points (Walde et al. 2001:34-35). No evidence of a pound structure was found (Walde et al. 2001:34). Faunal remains include large amounts of bone as well as some horn sheaths and bison feces. Analysis of a foetal element from the northeast part of the site suggested a kill event between January and the end of March, while a second foetal element from the south-central part of the site suggested a kill event between February and the middle of April (Walde et al. 2001:37).

A sample of five (n=5) molars (all M_1s) with an MNI of 4 were analysed using dental cementum increment analysis. Although from different levels (see Table 4), four of the specimens indicated a kill event(s) between late December and late March, and one specimen was indeterminate. The site appears to be a late December to late March kill event(s). This interpretation of the dental cementum increments corresponds well with the seasonal interpretation of the tooth eruption and wear analysis and the foetal analysis.

EgPn-440

EgPn-440 is a bison kill site located just south of the Bow River and west of Calgary (Tischer 2000:1-6). Western Heritage Services Ltd. discovered the site during an Historical Resources Impact Assessment (HRIA) in 1996 and undertook mitigative action in 1997 (Tischer 2000:1). Component I, the lowest level, was interpreted as possibly representing one or more kill events at a bison pound (Tischer 2000:15, 44). Few other cultural materials were recovered above Component I (Tischer 2000:16-18).

Among the lithics recovered were early Cayley Series projectile points (n=56), a drill, a knife, an end scraper, three bifaces, and a retouched flake (Tischer 2000:25-44). Based on an analysis of continuous variables from the projectile points an age of 750 BP was estimated for the site (Tischer 2000:44). This age estimate does not correspond well with the radiocarbon dates for the bone bed of 1280 +/- 50 BP (Beta-141209) and 1240 +/-50 BP (Beta-141211); as Tischer (2000:19) noted, there is no reason not to accept the radiocarbon dates. Further analysis of the projectile points suggested that more than one kill episode may have occurred at the site (Tischer 2000:44).

The analysis of the faunal assemblage produced ambiguous results. Tooth eruption sequences (n=2) suggested kill events in the fall and the spring (Tischer 2000:104). Tooth eruption and wear sequence analysis for M3 (n=2) suggested kill events in late June/early July and November (Tischer 2000:104-107). Sexing of the specimens, on the other hand, provided very consistent results. Males were largely represented in the sample (Tischer 2000:151). Considering that the sample represents a minimum of 67 animals, Tischer (2000:151) suggested a late summer/early fall kill owing to the congregation of animals during the rut.

A total of five (n=5) specimens for an MNI of three were analysed using dental cementum increment analysis. Of these specimens, one indicated a mid-June to late October event and four indicated a late December to late March event. The most reasonable interpretation of these data is a kill event or events between late December and late March.

BODO BISON SKULLS SITE (FaOm-1)

The Bodo Bison Skulls site is located southwest of Bodo in southeastern Alberta (Gibson 2001:ii). More specifically, the site is located just south of Sounding Basin Creek, which contains Eyehill Creek, and is situated within an area of stabilized sand dunes (Gibson 2001:2). The site exhibited remains consistent with an interpretation of a bison kill and/or butchering and/or processing area. The deposits cover a large area which appears to measure 1.84 km east/west and 0.9 km north/south (132.62 ha) (Gibson 2001:32)

A thick bed of bison bone was encountered at the site. Included in the bone bed was decomposed bison viscera and hair (Gibson 2001:21). The dental specimens in this study were taken from a pile of mandibles considered to represent some part of a specific butchering process (Gibson pers. comm. 2001). A large number of projectile points were also recovered (Gibson 2001:21). Inspection of digital images of the projectile points allowed the author to classify the specimens as Cayley Series projectile points (Peck and Ives 2001). Pottery recovered at the site is likely Saskatchewan Basin Complex: Late Variant pottery (Gibson pers. comm. 2001). The site is considered to represent an Old Women's phase occupation (Gibson 2001:3).

A sample of five (n=5) molars (all M_1s) for an MNI of four were analysed using dental cementum increment analysis. Of these specimens, one suggested a late October to late December kill event and four specimens suggested a late December to late March kill event. It is not unreasonable to interpret these data as kill events starting in late October to late December and continuing into the late December to late March period.

SASKATCHEWAN SITES

ESTUARY BISON POUND SITE (EfOk-16)

The Estuary site is located in southwestern Saskatchewan (Adams 1977:4). It is positioned at the head of a substantial coulee along the south bank of the South Saskatchewan River below its confluence with the Red Deer River (Adams 1977:iv). The arid dune environment of the Great Sand Hills lies to the south while immediately north is the well wooded river bottom of the South Saskatchewan River (Adams 1977:26-30). The site consists of two major occupations: the upper level was interpreted as a processing and habitation component and the lower level as a bison pound and butchering area (Adams 1977). The site was excavated in 1971 and 1972 by Gary Adams (Adams 1971:3).

The upper level, Level I, contains a series of hearths (n=6 to 8) fueled by wood, Prairie Side-notched projectile points (n=40) [most recently reclassified as Cayley Series projectile points (Peck and Ives 2001:175-179)], bifaces (n=38), end and side scrapers (n=30), and some large pointed bone tools (n=64) (Adams 1977:40-61). Faunal remains were limited and largely included bison (Adams 1977:62-63). An assessment of seasonality was not attempted on these remains. Based on the presence of specialized hearths, numerous bone tools and projectile points, and abundant bison remains, Adams (1977:66) interpreted the assemblage as a butchering-processing activity area for an as yet undiscovered kill. Two radiocarbon dates from this level include a date on charcoal from feature C-2 of 1020 +/- 80 BP (GaK-3809) and a second on bone collagen of 1070 +/- 70 (S-640) (Adams 1977:38).

The lower level, Level II, contains hearths (n=2), a series of carbon stains (n=4), numerous post-holes (n=21), Prairie Side-notched projectile points (n=23) [most recently reclassified as Cayley Series projectile points (Peck 1996:90; Peck and Ives 2001:175-179)], Avonlea projectile points (n=31), bifaces (n=12), enscrapers (n=9), unifaces (n=47), numerous flakes (n=141), fire broken rock (n=53), abundant bone tools (n=185), and ceramics (n=2) (Adams 1977:68-91). The faunal remains were very abundant and almost entirely bison. The minimum number of individuals was twenty-nine (Adams 1977:98). Importantly, the extensive bison remains were distributed such that their relation to the post holes strongly supports an interpretation of a bison pound (Adams 1977:73). Thirteen mandibles were assessed for seasonality purposes. "Five of these were identified as an even year while four were at half a year" (Adams 1977:92). For Adams (1977:92) this suggested the 'actual' seasonality of the site lies at the quarter year (i.e., either late summer or late winter). Foetal bone recovered from the site supported an interpretation of a late winter kill event (Adams 1977:96). A radiocarbon date on bone collagen of 1190 +/-165 (S-641) was obtained for this level (Adams 1977:38). Adams (1977:98) interpreted the level as a bison capture and processing site.

A sample of eight (n=8) molars (all M_1s) for an MNI of four were analysed using dental cementum increment analysis. Of these specimens, five indicated a late December to late March event, one indicated a late December to mid- June event, one indicated a mid-June to late October event, and one is indeterminate (Table 4). A reasonable interpretation of these data is a kill event between late December and late March with a possible continuation into the late March to mid-June period. This interpretation corresponds reasonably well with the foetal bone interpretation of late winter and the tooth eruption and wear interpretation of late winter.

TSCHETTER SITE (FbNr-1)

The Tschetter site is located in south-central Saskatchewan 16 km west and 10 km north of Saskatoon (Prentice 1983:1, 5; Linnamae 1988:91). The site consists of a bone bed which is interpreted as a bison kill site within a constructed pound or corral structure (Prentice 1983:35-36; Linnamae 1988:91). It is situated in the central Saskatchewan Aspen Parkland on the northeast edge of the Dunfermline Sand Hills (Prentice 1983:1, 5; Linnamae 1988:91, 94, 108-109). The site has been interpreted to be a single component occupation (Prentice 1983:27 Linnamae 1988:108-209). The occurrence of Prairie Side-notched projectile points and Saskatchewan Basin Complex: Late Variant pottery was used to suggest an Old Women's phase occupation (Meyer 1988:59; Peck 1996:89; Peck and Ives 2001:175-179). Based on age profiles created using tooth eruption and wear analysis the kill was interpreted to have occurred in late fall and winter or sometime between November and January (Linnamae 1988:91; Walker 1979:53).

The Tschetter site has been repeatedly investigated in the past including test excavations in 1971 by Ian Dyck, University of Saskatchewan field school excavations under the direction of Urve Linnamae in 1971-1976, test excavations to delimit the site by Jean Prentice in 1979, and test excavations to find an associated campsite in 1980 (Prentice 1983:26; Linnamae 1988:101). The site consists of a thick single component bone bed contained within an area of approximately 70 meters by 50 meters (Linnemae 1988:104). Eight post holes indicate where the walls of the pound may have been. Patches of charcoal and ash were discovered within the pound area (Linnamae 1988:105; Prentice 1983:55). Artifacts recovered include Prairie Side-notched/Cayley Series projectile points (Prentice 1983:99-114; Linnamae 1988:109; Peck and Ives 2001:175-179), Saskatchewan Basin Complex: Late Variant pottery (Prentice 1983:128-134; Linnamae 1988:111-112), a variety of lithic tools that one would expect to be recovered at a kill site (i.e., bifaces, unifaces, endscrapers, retouched flakes, and cobble spalls), and numerous bone piercing tools among others (Prentice 1983:58-142; Linnamae 1988:108-113).

A sample of ten (n=10) molars (all M_1s) for an MNI of ten were analysed using dental cementum increment analysis. Of these specimens, eight indicated late December to late March events and two were indeterminate (see Table 4). The sample strongly suggests a kill event or events between late December and late March. This is in partial agreement with the previous tooth eruption and wear analysis (i.e., Linnamae 1988:91; Walker 1979:53).

DAVIES/GARRATT SITE (EcNj-6/7)

The Davies site is located in south-central Saskatchewan, southeast of Moose Jaw, on the flood plain of Moose Jaw Creek (Krozer 1985:56). The site is interpreted to be a campsite (Krozer 1985:78). The presence of Prairie Side-notched points and undiagnostic pottery suggests the site is an Old Women's phase site. Given the site's location in a sheltered valley, it was interpreted as a winter occupation. Importantly, the Garratt site (Morgan 1979) is located a few hundred meters southwest of the Davies site and exhibits similar cultural remains possibly indicating coeval deposition (Krozer 1985:56, pers. comm. 2000)

The Davies site has been repeatedly investigated in the past including two 10 x 10 ft squares excavated by the Saskatchewan Museum of Natural History in 1969, test excavations for assessing a borrow pit area by Pat Froese and Gil Watson in 1983, and test excavations to delimit the extent of the site in 1984 (Krozer 1985:56-58). In the latter of these excavations, in one of the four 1m x 1m excavations, a 'kitchen' or living area was uncovered as evidenced by hearths, numerous faunal remains of which most were bison, bifaces, endscrapers, and a Prairie Side-notched projectile point (Krozer 1985:63)

A sample of three (n=3) molars (all M_1s) for an MNI of two were analysed using dental cementum increment analysis. Of these specimens, one specimen indicated an event between late December to late March and two specimens were indeterminate (see Table 4). The small sample size made this interpretation tenuous; still, a campsite occupation between late December and late March is tentatively indicated. The dental cementum increment analysis roughly corresponds with the seasonal assessment inferred from geographic location.

MONTANA SITES

BOARDING SCHOOL BISON DRIVE (24GL302)

The Boarding School bison drive is located in north-central Montana approximately 10 km north of Browning along Cut Bank Creek (Kehoe 1967:1-6). Thomas Kehoe (1967:88) excavated the site in the late 1950s and interpreted it as a bison drive and kill site. Prairie Side-notched and Plains Side-notched projectile points were recovered from the site (Kehoe 1967:40-49), but no pottery was recovered (Kehoe 1967:91). The projectile points alone suggest the site can be assigned to the Old Women's phase (Peck and Ives 2001:175-179). Based on ethnographic documents, Kehoe (1967:89) suggested that the first bone layer represented a summer event, the second bone layer represented a late summer or early fall kill (i.e., rut), and the third excavated bone layer represented a late fall or winter drive covered in the summer by the aforementioned geological depositional event.

The excavations at the Boarding School bison drive consisted of a series of trenches. There is a main trench excavation that crosscuts the site from hillslope/kill site to the flats/processing area. Roughly perpendicular to the main trench are trenches running east and west. As well, a series of test pits occurs within meters of the main trench (Kehoe 1967:28).

Kehoe (1967:19-26) defined 42 stratigraphic levels on the hillslope/kill site and 9 levels on the flats below the hill. Bone layers occurred in level 7 (first bone layer), level 15 (second bone layer), and level 18 (third bone layer). As well, levels 25 and 28 contained substantial amounts of bone, as did level 31 (Kehoe 1967:32). Plains Side-notched projectile points generally occurred in levels 1 through 25. Prairie Side-notched projectile points were rare in the upper levels (levels 1-10) but occurred more frequently in levels 11 to 25 (Kehoe 1967:44-47). A single large Late Woodland Point was recovered in level 31 (Kehoe 1967:46).

A sample of fifteen (n=15) molars (all M_1s) for an MNI of fifteen were analysed using dental cementum increment analysis. The stratigraphic positions of these specimens were not determined for this analysis. Of these specimens, twelve indicated a kill event or events between late December and late March, one indicated an event between mid-June and late October, and two were indeterminate (see Table 4). This sample can be interpreted as a kill event or events between late December and late March. This interpretation only agrees with one of Kehoe's three seasonality assessments.

WAHKPA CHU'GN SITE (24HL101)

The Wahkpa Chu'gn site is located in north-central Montana just west of Havre at the base of some bluffs bordering the southern edge of the Milk River Valley (Davis and Stallcop 1966:6). The site is a multicomponent bison kill site and campsite (Davis and Stallcop 1966; Brumley 1971, 1975).

The Wahkpa Chu'gn site was initially reported by John Brumley in 1961 (Davis and Stallcop 1966:6). Since the initial report a number of excavations have been conducted at the site (Brumley 1971:11). Between 1962 and 1965, the Milk River Archaeological Society conducted excavations at the site (Davis and Stallcop 1966). At this time, the site was divided into five areas (A, B, C, D, and E): Area A contained evidence of successive bison kill site deposits, Areas B and C contained both campsite and bison kill site deposits, Area D contained campsite deposits, and Area E consisted of the unexcavated river valley bluff edge (Brumley 1971:1; Davis and Stallcop 1966:6-7). Leslie Davis conducted brief excavations in 1969 (Brumley 1971:11). Most recently, Brumley (1971) conducted excavations in 1970.

In Area A, the kill site, Plains and Prairie side-notched projectile points were recovered in levels 2 to 9 (Brumley and Peck 2000:113-115). Brumley (1971:111-112) initially assigned this material to the Old Women's phase, but subsequently attributed these levels to the Saddle Butte phase. Recall from Chapter 1, the Saddle Butte phase is defined as Plains and/or Prairie Side-notched points in association with: 1) largely complete bison crania in association with post-pits apparently reflecting some form of ritualism, and 2) socketed teeth exhibiting green bone tooth damage from use as bison jaw mandible choppers (Brumley and Rennie 1993:36; Brumley and Dau 1988:56-57). Again, as noted in Chapter 1, this interpretation is rejected here and Plains/Prairie projectile points are taken to represent the Old Women's phase.

In Area C, the kill site/campsite deposits, Davis and Stallcop (1966:20) reported three occupations with such similar side-notched projectile point types that they are considered related. Importantly, a fossil ammonite was associated with this material (Davis and Stallcop 1966:20). Subsequent excavations adjacent to the aforementioned excavations interpreted the recovered material similar to the Old Women's phase material described above (Brumley 1971:111-112). The earliest level of Old Women's Phase material produced radiocarbon age values on charcoal of 930 +/- 100 BP (RL 565) and 990 +/- 100 BP (RL 566) while the most recent level produced a date on unburned bison bone of 560 +/-90 BP (GX 2192) (Brumley 1975). An extensive analysis of tooth eruption and wear and foetal material indicated increasing site use starting in fall, peaking in late winter, and gradually diminishing into summer (Brumley 1995:59-61; Brumley and Peck 2000:113-120)

A sample of twenty-nine (n=29) specimens for an MNI of 23 were analysed using dental cementum increment analysis. The stratigraphic positions of these specimens were not determined for this analysis. Of these specimens, two indicated an event between late March and mid June, three indicated an event between mid June and late October, twelve indicated an event between late October and late December, seven indicated an event between late December and late March, and five were uninterpretable (see Table 4). These data suggest year-round use of the site with a strong emphasis during late October to late March and more limited use between late March and late October.

BEAVER CREEK PARK SITE (24HL411)

The Beaver Creek Park site is located south of Havre in north-central Montana (Stallcop 1973:47). The site is positioned along Beaver Creek were it emerges onto the plains in front of the northern margins of the Bear's Paw Mountains (Stallcop 1973:49; Brumley and Peck 2000:120). To the west and southwest of the kill area is a bench that likely served as a gathering 'basin' although no drive lanes were observed (Stallcop 1973:51). The site consists of a communal bison kill and adjoining campsite (Stallcop 1973; Brumley and Peck 2000:120).

The kill site, a six inch thick bone bed about 60 ft long was interpreted as representing a single event. It lies on a terrace remnant along the west site of Beaver Creek valley about 2.5 to 4 m above the flood plain (Stallcop 1973: Brumley and Peck 2000:120) [Apparently the campsite, located across Beaver Creek from the kill, was destroyed before salvage excavations could be conducted (Stallcop 1973:47-49; Brumley and Peck

2000:120)]. No formal analysis of the bone bed has been conducted. Still, Stallcop (1973:51) suggested: "A few bones appeared to be from short 'yearling' animals [i.e., absence of calves?]. If this holds true, the kill would have been made in the late fall or winter".

Of the few artifacts recovered, six were projectile points considered similar to those at both the Boarding School and Old Women's bison drive sites. Four of the points were made of obsidian; obsidian hydration dates for each of these were obtained suggesting an average age of AD 276 +/-70 (Stallcop 1973:52). More recently, a radiocarbon date on an unburned bison bone produced a date of 190 +/- 60 BP (Beta-89943).

Brumley and Peck (2000:121) suggested the radiocarbon dates and projectile point morphology indicate the site could be classified with the Prairie/Plains Complex sites. More specifically, following Peck and Ives (2001), visual inspection of illustrations (Stallcopp 1973:52, Fig. 3) by the author suggested the points were similar to Cayley Series projectile points, thus, affiliating the site with the Old Women's phase (Peck and Ives 2001).

A sample of four (n=4) molars (all M_1s) for an MNI of two were analysed using dental cementum increment analysis. Of these specimens, three indicated a mid-June to late October event and one specimen was indeterminate (see Table 4). The site is best interpreted as a small kill and associated camp occupied between mid-June and late October. This interpretation is not entirely at odds with Stallcop's suggestion of a late fall or early winter kill event.

KING SITE (24PH2886)

The King site is located in north-central Montana on the eastern margins of the Little Rocky Mountains (Brumley and Rennie 1999:43). The site is situated just above the bottom of Bear Gulch on a series of terraces (Brumley and Rennie 1999:43). This site was interpreted as varying in use through time including a campsite, bison kill site, and bison kill processing area. Cultural complexes identified at the site include Oxbow, Pelican Lake, Besant, Avonlea, Plains/Prairie (i.e., Old Women's), and Mortlach Phases (Brumley and Rennie 1999:43). The Old Women's phase was represented by Prairie and Plains Side-notched projectile points (Peck and Ives 2000).

The Old Women's phase material was recovered from two different excavation blocks. Excavation unit one had Old Women's phase material in occupation level 2 and 3. Level 2 represented one or two brief occupations as reflected in the scatter of faunal material. The occupation was assigned to the Plains/Prairie Complex based on the overlying Mortlach Phase material and a radiocarbon date from underlying material (Brumley and Rennie 1999:43-44). Analysis of foetal bone indicated the site was occupied during mid-spring to early summer (Brumley and Peck 2000:134). Level 3 is interpreted to be a small scale bison kill site and/or a primary processing area. The occupation had a radiocarbon date on bone of 600+/-50 BP (Beta-60246) (Brumley and Rennie 1999:46).

Excavation unit 19 had Plains/Prairie Complex material in occupation levels 2/3 and 3 (Brumley and Rennie 1999:75-78). Brumley and Rennie (1999:78) assigned this level to the Prairie/Plains Complex. They interpreted the site as a kill site and/or primary butchering site. Faunal elements from bison and deer were present. Both occupation 2/3 and 3 contained a seasonally sensitive new born bison calf. They suggest that the elements may be from the same animal as they both represent a mid-spring occupation (Brumley and Rennie 1999:78).

A single (n=1) molar (M2) was analysed using dental cementum increment analysis. The specimen suggested a mid-June to late December event. The foetal material suggested a mid-spring occupation which is marginally consistent with a June event. The small sample size and large range estimated for the occupation means that this estimation should be taken as tenuous.

BOOTLEGGER TRAIL SITE (24TL1237)

The Bootlegger Trail site is located in north-central Montana approximately 45 km southeast of Shelby on the Tiber Reservoir of the Marias River (Roll and Deaver 1980:3-7). The site was interpreted as a bison kill and processing area (Roll and Deaver 1980:95). The projectile points recovered from the site have recently been reclassified as Cayley Series projectile points (Peck and Ives 2001:176-179) and the ceramics are considered to be Saskatchewan Basin Complex: Late Variant pottery (Roll and Deaver 1980:135-141) suggesting this site belongs to the Old Women's phase (Peck and Ives 2000). The

Bootlegger Trail site was interpreted as a spring event based on foetal bone analysis and tooth eruption and wear analysis (Roll and Deaver 1980:67).

Roll and Deaver (1980) divided the site into five areas labeled A through E. The site consisted of stone alignments at the valley's edge leading to a kill area (Area D) which exhibited a single cultural level. Another area (Area C) occurred in a coulee adjacent to the kill area but exhibited little cultural material. Two processing areas were distinguished, one down slope from the kill (Area B), exhibiting two distinct cultural levels, and one up slope (Area E), exhibiting one cultural level. Eight radiocarbon dates on charcoal secured from features in the two distinct cultural levels produced dates between 185 +/- 120 BP (GX-4712) and 760 +/- 80 BP (I-9204). Test excavations (Area A) down slope near the reservoir's edge were conducted but abandoned due to the recovery of insufficient material.

A sample of fourteen (n=14) molars (all M_1s) for an MNI of 14 were analysed using dental cementum increment analysis. Of these specimens, twelve indicated a late December to late March event and two specimens indicated late March to mid June (see Table 4). The best interpretation of these data is that the kill site was used between late December and late March and likely experienced some use between late March and mid June. This interpretation corresponds with the interpretation of a spring event from foetal bone and tooth eruption and wear.

SETTLEMENT PATTERN ANALYSIS

A strong settlement pattern emerges once the sites are considered in the context of both their geographic position and seasonal assessment. Before illustrating this pattern it is important to recognize the bias in the sampling strategy. Both the geographic nature of the sample and the nature of the site types themselves are biased.

The geographic location of the sites is biased towards plains periphery areas. Of the 19 sites used in the study, 12 of the sites are located at or near the periphery of the plains. The remaining 7 sites are located in the plains; 6 of those are along major waterways while only 1 is located any distance from a waterway.

Similarly, the sample is biased in terms of the site types utilized. Of the 19 sites used in the study, the sample is clearly biased towards kill sites (n=16) compared to campsites (n=3). As well, Old Women's phase sites from the Prehistoric Period (n=15) dominate the record relative to Old Women's phase sites from the Protohistoric Period (n=4). Even with this bias a pattern within the Prehistoric Period sites can be witnessed.

Figure 5 illustrates both the geographic position and the seasonal assessment of the Old Women's Phase sites from the Prehistoric Period. Importantly, Malainey and Sherriff's (1996:336-341) reconstruction of the parkland belt is used on these maps for the purpose of providing an environmental context for sites. Of the 15 sites, there is a distribution of kill events that occurred between late December and late March around the periphery of the plains, including: Head-Smashed-In Buffalo Jump (DkPj-1), the Junction site (DkPi-2), the Fish Creek bison kill (EfPm-27), EgPn-440, the Bodo Bison Skulls (FaOm-1), and the Boarding School bison drive (24GL302). Other kill events that occurred between late December and late March on the plains, however, are located in well wooded valleys, including the Estuary Pound site (EfOk-16) and the Bootlegger Trail site (24TL1237). Four other kill sites are present in the Prehistoric Period sample. The Ramillies site (EcOr-35), located well out in the plains, was an event(s) that occurred during late March to mid June period. The Beaver Creek site (24HL411), a camp and kill site near the Bear's Paw Mountains, was an event that occurred between mid June and late October. The Wahkpa Chu'gn site (24HL101), in north-central Montana, consists of a series of events that occurred throughout the year with the majority likely occurring in late fall to spring. The King site (24PH2886), with its very minimal sample, appeared to suggest an event that occurred between mid June and late December event in an area of ephemeral drainage on the eastern slope of the Little Rockies.

In terms of Prehistoric Period campsites, the Davies/Garratt site (EcNj-6) and DjPm-100 were both assessed as late December to late March events. The Davies/Garratt site is located in south-central Saskatchewan in a well wooded valley. DjPm-100 is located at the base of a well wooded coulee along a well wooded section of the Oldman River.

Figure 6 illustrates both the geographic position and the seasonal assessment of the Old Women's phase sites in the Protohistoric Period. Given that there is only a sample of four sites, recognizing a pattern within the sites may be difficult. Still, some parallel and contrasting trends to the Prehistoric Period sites are worth mentioning.

The two Protohistoric Period kill sites, Castle Forks Buffalo Jump (DjPm-126) and the Crowsnest River Kill (DjPm-80), do not entirely follow the Prehistoric Period site pattern of winter kills around the parkland periphery or in wooded river valleys in the plains. While the Castle Forks Buffalo Jump conforms to this trend, the Crowsnest River kill, however, is a mid-June to late October kill event in the Oldman River Dam area which is the setting of the winter sites in the Prehistoric Period.

The two Protohistoric Period campsites, DjOu-62 and Blakiston (DjPm-115), fit the general trend of the Prehistoric Period sites. The Blakiston site was seasonally assessed as late December to late March and is located in the valley of the Oldman River Dam area. Thus, it is a winter camp site located in a well wooded river valley at the edge of the plains. DjOu-62 was assessed as a mid-June to late October campsite located well out on to the plains at Forty Mile Coulee. It, too, fits the Prehistoric Period trend as it was interpreted as a spring/summer site out on the open plains.

SUMMARY

The seasonal assessment of fifteen Prehistoric Period and four Protohistoric Period sites using dental cementum increment analysis produced a fairly pronounced settlement pattern. For the Prehistoric Period, fall and winter sites are strictly distributed around the periphery of the plains and in large river valleys. These are considered the wintering localities of the people of the Old Women's phase. In contrast, summer sites are located out on the plains along small streams or a substantial distance from any flowing water. Localities on the open plains are considered summering localities of the people of the Old Women's phase.

In the Protohistoric Period the sites very are similarly distributed, with fall and winter sites found on the periphery of the plains and summer sites on the plains. A potential exception is a small kill (DjPm-80), possibly conducted on horse back, that occurred between mid-June and late October. The data are not present to address the apparently aberrant nature of this site.

CHAPTER SEVEN: LANDSCAPE USE DURING THE OLD WOMEN'S PHASE ON THE NORTHWESTERN PLAINS

> ...the idea that the movements of the buffalo were precisely regular, would mean two things. All the Indians would have to do would be to intercept the migrating herds as they galloped through their territories...They did not 'intercept' the migrating herds in any real sense. And if one thing is clear from the literature, it is that the Indians did not know exactly where the herds would be; they had to send out scouts to look for them, and the scouts were frequently gone for many days.
>
> (Oliver 1962:15)

> Because bison killing and processing was clearly practiced year round by Late Old Women's peoples, this settlement pattern may be related to the seasonal cycle of bison movements as they moved into sheltered valleys during the winter and out onto the open plains during warmer seasons.
>
> (Walde et al. 1995:36)

INTRODUCTION

The migratory behaviour of bison, in terms of moving to the parkland in winter and the plains in summer, has been demonstrated (see Chapter Four). Similarly, the settlement pattern of Old Women's phase sites has been shown to exhibit a similar trend to that of the bison in that winter sites were located around the periphery of the plains and in large river valleys and summer sites were located on the plains (see Chapter Six). This dichotomy, the parkland in winter and the plains in summer, illustrates the cyclical movements of people, within a year, between locations as resources become seasonally available -- this generalized movement is what Plains archaeologists have called the 'seasonal round'.

In the first section of this chapter, to complement the aforementioned interpretation, a model of the seasonal round is presented based on Blackfoot oral tradition concerning the *Iniskim* or Buffalo Stone. It is argued that, imbedded in the *Iniskim* stories, the Blackfoot have provided their view of their prehistoric movements across the landscape. In addition, lines of evidence regarding overwintering on the plains are addressed as they challenge the established seasonal round model (e.g., Arthur 1978; Epp 1988; Grasspointer 1981; Meyer and Epp 1990; Morgan 1979, 1980; Moodie and Ray 1976; Vickers 1991). Some researchers have argued that there is ethnographic evidence that indicates both Native people and Freemen wintered 'far out on the open plains' and not in the parkland or river valleys (Malainey and Sherriff 1996). This challenges the current 'seasonal round' model and will be addressed. Lastly in this section, the timing and nature of communal bison hunting events in the ethnographic record are shown to coincide with the general movements of bison to further corroborate the seasonal round model.

Then, in the second section, attempts are made to build on to the seasonal round model by proposing theoretical approaches to understand the reasons for site selection on the northwestern Plains. Following Vickers (1987), it is argued that critical resources such as trees, in the winter, and berry patches and water, in the summer, influenced the selection of specific kill sites and campsites, respectively. In the fall and winter, it is illustrated that 'intercept' sites of bison herds were positioned as far out on the plains as wood, for pound construction and fuel for campfires, would allow. In the summer, it is argued that berry patches were visited in order to conduct vital preparations for the winter months. Berry patches were generally located on the plains, hence people exploited these when the bison were in their summer range and were still required for subsistence purposes. The section concludes by wedding information exchange theory and storage theory with the nature of plains subsistence; that is to say, the importance of successful bison kills or abundance at berry patches to the survival of the group-at-large is apparent in the comings and goings of 'runners', etc., who are imbedded within information exchange strategies.

SEASONAL ROUND MODEL

Following the definition of the seasonal round -- the cyclical movements of people, within a year, between locations as resources become seasonally available -- this section attempts to further illustrate that the movement of bison highly influenced the general movement of people on the northwestern Plains. As alluded to above, this affirmation of the seasonal round is couched in the evidence from historic records concerning bison migratory behaviour (Chapter 4) and its correlation with the settlement pattern inferred from dental cementum increment analysis of bison dentition from Old Women's phase sites (Chapter 6).

ORAL TRADITION AND THE SEASONAL ROUND

In Chapter Two, two fairly detailed models of the Blackfoot seasonal round were presented. Both Uhlenbeck (1912) and Ewers (1955, 1958) described equestrian Blackfoot people wintering in the foothills and river valleys and summering on the open plains. As noted above, the advantage of these ethnographies is that they document an account of equestrian people on the plains by the people who actually lived that lifestyle. Their shortcoming, for archaeologists, lay in the fact that these informants lived an equestrian lifestyle which, to a greater or lesser extent, must differ from the earlier pedestrian lifestyle.

Ideally, archaeologists would like information concerning pedestrian life from the 'people who lived that lifestyle'. One possible approach to achieving this may be found in examining oral tradition. "An oral tradition is the passing of knowledge from one generation to the next orally (by speaking)" (Hart 1995:3). Many skills (e.g., hunting, tool making, medicine, and religious practitioning), are conveyed directly in oral tradition (Hart 1995:3). Other times ideas are imbedded in stories and passed on by story telling (Hart 1995:3). Given the nature of oral tradition, it is not surprising that elders of a community are usually the most knowledgeable (Hart 1995:3). Their knowledge has been gained over a lifetime and passed on to them by people who also gained information over a lifetime, and so forth (Hart 1995:3). Thus, the likelihood that oral traditions hold information of the pedestrian past is strong.

The oral tradition concerning the '*Iniskim*' or Buffalo Stone of the Blackfoot provides a possible example of a story from pedestrian times that implicitly has embedded within it an account of the seasonal round. *Iniskim* is a Blackfoot term meaning buffalo stone (e.g., Branch 1929:35-36; Frantz and Russell 1989:337). *Iniskim* are usually fossilized septa of ammonites that resemble animate objects (esp. bison). Occasionally, oddly shaped nodules of flint or other rocks bearing a resemblance to bison have also been referred to as *Iniskim* (Curtis 1911:66; Grinnell 1962:126; Wissler 1912:242-245). Wissler (1912:244) also noted that: "Some rocks too large to be moved were spoken of as *Iniskim*", however, Reeves (1993:201) stated that *Iniskim* were generally: "...small in size and portable...".

Numerous accounts of the first discovery of the *Iniskim* among the Blackfoot have been recorded. One of the most detailed accounts was recorded by Clark Wissler and D.C. Duvall (1908:85-87) in the early 1900s. The account begins at a place called Elbow-on-the-Other-Side, in Canada, at a cutbank in the curve of a river called the Place-of-the-Falling-off-without-Excuse. Here, a woman named Weasel-Woman was out berry picking as her people were starving. She heard a noise and followed the sound to its source. She discovered the sound came from a rock lying on some bison hair and sage grass. The rock stated that it was powerful and taught the woman the songs associated with its power. That is, the rock taught the woman the ability to charm bison. Weasel-Woman returned to camp where she informed her husband, Chief-Speaking, of her discovery. Chief-Speaking, a beaver bundle owner, and the other men of the camp were then taught the rites involved in using the *Iniskim* [Similarly detailed accounts of this event have been recorded by many authors, including R.H. Lowie for the North Blackfoot (Wissler and Duvall 1908:87-89), S.A. Barrett (1921:82-84) for the Blackfeet, E.S. Curtis (1911:22-23) for the Peigan, G.B. Grinnell (1962:125-126) for the Blackfoot; A. Hungry Wolf (1977) for the Blood, R.F. McDonnell (1984:118-121) for the Peigan; and C.C. Uhlenbeck (1912:12-13) for the Southern Peigan].

Recently, based on the aforementioned oral histories, Reeves (1993) provided evidence for where the *Iniskim* was first encountered by the Blackfoot. Peigan oral tradition states the first *Iniskim* was discovered at Elbow-on-the-Other-Side (Wissler and Duvall 1908:85). In addition, North Blackfoot oral tradition states that the cutbank was a place where: "...the earth was sliding down..." (Wissler and Duvall 1908:87). Reeves (1993:197) further noted that, in the 1950s, South Peigan Elders informed Claude Schaeffer that the original *Iniskim* was discovered on the Bow River where the Siksika (North Blackfoot) currently live.

While there are many locations in Alberta and Montana at which ammonites can be recovered (e.g., St. Mary River, Little Bow River, Milk River, Cypress Hills), Reeves (1993:221) stated that one of the best known locations is on the Bow River near the Siksika Reserve. This location is called 'Baculite Beach' by fossil hunters and consists of an outcrop in the cliff face approximately 35 meters above the current river. As oral tradition describes, material is eroding from this cliff face and sliding down to its base. Reeves (1993:221) summarized these correlations between oral history and geography as follows:

> Geological maps indicate that the upstream outcrop of Bearspaw Shale on the Bow River ends below a major elbow of the Bow [River]... The Bow River bends to the south just above this elbow. This is the 'Elbow-on-the-other-side' and the steep-cliffed bend downstream - Baculite Beach (The-Place-of-Falling-off-Without-Excuse) - described in the Peigan Inisk'im origin story recorded by Clark Wissler.
>
> (Reeves 1993:221)

Upon the discovery of the first *Iniskim*, it likely became part of the *Koskstakjomopista* or Beaver Bundle (Recall that Chief-Speaking, a Beaver Bundle owner, was entrusted by Weasel-Woman with the first *Iniskim* and the rites of buffalo charming). Whether *Iniskim* were included in the Beaver Bundle at this time or not is academic, the fact is that Beaver Bundles do contain *Iniskim* (e.g., Wissler 1912:243-244). The Beaver Bundle is the oldest bundle of the Blackfoot and is used not only in calling bison, but also tobacco planting and harvesting. Importantly, the ability of the Beaver Bundle owner to conduct bison calling rituals rests primarily in the possession of the *Iniskim* (Wissler 1912:243-244; see also Reeves 1993:209-217).

Iniskim also occur in another important bundle of the Blackfoot -- the Buffalo Catcher Society Bundle (Reeves 1993:218-221; Wissler and Duvall 1908:121; Wildschut 1928). Wissler and Duvall (1908:121) documented how the Buffalo Catchers Society Bundle related to *Iniskim*. They were informed that Weasel-Woman, who found the original *Iniskim*, instructed Chief-Speaking, her husband, of another dream relating to the *Iniskim*. His subsequent vision led Chief-Speaking to organize the Catchers Society (Wissler and Duvall 1908:121). Reinforcing this scenario, Wildschut (1928:431) noted that *Iniskim* are included in Buffalo Catchers Society Bundles owing to the fact the original owner was a buffalo caller (i.e., Chief-Speaking). Importantly, Chief-Speaking had been instructed by Weasel-Women to 'sleep on the buffalo-drive hill' to receive his vision (Wissler and Duvall 1908:121). Similarly, Wildschut (1928:423-424) noted that the vision of the Catchers Society Bundle occurred five miles above the town of Fort McLeod along the Oldman River at a buffalo jump called '*Piskun*' [This place has been inferred to be Head-Smashed-In Buffalo Jump by Reeves (1993:219)]. At this location, Chief-Speaking built a corral at the base of the cliff where he was to 'call the buffalo' as he was a buffalo caller himself (Wildschut 1928:424).

Iniskim were also associated with the bundles of sacred tipis (Reeves 1993:204-209; Wissler 1912:221). Wissler (1912:221) noted that there were three main classes of tipi rituals associated with the painted tipis, the flag-painted tipis, and the buffalo-painted tipis, respectively, as well as a few 'special' tipis with a separate class of rituals. Of the three main classes of rituals, Wissler (1912:221) stated that only the painted tipis used *Iniskim* while other tipis made little or no use of them. Wissler's (1912:221) reference to 'special' tipis likely included the Crow (Raven) Lodge, Yellow *Iniskim* [Buffalo] Tipi, and the Black *Iniskim* [Buffalo] Tipi. Each of these tipis contained *Iniskim* in their associated bundles and were important in charming bison (Grinnell 1901:658-660; Reeves 1993:204-209; Wissler 1912:202-241).

The first owners of the Black and Yellow *Iniskim* Tipis initially saw them in the Bow River near Blackfoot Crossing on the current Siksika Reserve (Grinnell 1901:658; Wissler 1912:232). The Tipis "...came to the tribe long, long ago, 'in about the second generation after the first people'..." (Grinnell 1901:658). Two men had sat down along the bank of the Bow to peel cherry shoots for making arrows (Grinnell 1901:658). Eventually they noticed a black buffalo lodge and then a yellow buffalo lodge under the water (Grinnell 1901:658). Each man, in turn, entered one of the lodges. Later, the men built lodges as they had encountered in the river. At this time the people wanted to cross the river but it could not be forded due to its depth. The two men who originally envisioned the Black and Yellow Tipis, while smoking their pipes, led their people across the river in ankle deep water. "Ever since that day this has been a shallow crossing" [Blackfoot Crossing] (Grinnell 1901:660). Notably, Wissler (1912:208) indicated that the Black and Yellow *Iniskim* [Buffalo] Tipis received songs for charming the buffalo from the 'women who found the Iniskim' [presumably Weasel-Woman] (Wissler 1912:231).

These three fragments of Blackfoot oral tradition share a number of commonalties that suggest they may, in fact, form a larger story when taken together. First, they all concern *Iniskim* and the incorporation of these into important Blackfoot Bundles (i.e., Beaver Bundle, Catchers Bundle, and Black and Yellow Iniskim Tipis). Second, the characters of Chief-Speaking and/or Weasel-Women occur in each oral tradition suggesting the events occurred at roughly similar times in the past. This is also supported by the sequence between the three stories: first, the Iniskim is discovered; it is later incorporated into the Catchers Society bundle and into the Black and Yellow Iniskim Tipis. Third, the importance of the Iniskim to charm buffalo is reiterated in each story.

Having said this, the following presents an interpretation of the '*Iniskim* Stories' in terms of the seasonal round. The *Iniskim* story begins with the discovery of the first Iniskim southeast of the current Siksika Reserve on the Bow River at a location called Falling-Off-Without-Excuse (Reeves 1993:221-222, 257). The *Iniskim* was likely found during late summer as Weasel-Women is stated to have been collecting berries. Importantly, she is collecting berries because her people are starving at this time. Weasel-Women's discovery of the Iniskim was a sure indication that buffalo would soon feed her people.

Following the discovery, another '*Iniskim* Story' indicates the people were camped just upstream from Fort McLeod and had built a pound at the base of the 'Piskun' [i.e., Head-Smashed-In Buffalo Jump (Reeves 1993)] (Wildschut 1928:424). Chief-Speaking, being in possession of the original Iniskim (mentioned above) and being a buffalo-caller, was to summon the animals to the cliff (Wildschut 1928:424). Importantly, in ethnographic records and historic documents the Blackfoot generally pound buffalo in the fall and winter, as did most Native bison hunters (e.g., Grinnell 1893:234; Uhlenbeck 1912:1-41; Verbicky-Todd 1984:34) (However, a section below entitled 'A Time to Pound' provides evidence that pounding occurred over a more extensive part of the year, but this detracts little from the notion that most pounding occurred in the fall and winter). At this time, Chief-Speaking was instructed that he will receive a vision. This vision lead him to form the Buffalo Catchers Bundle and Society. The Buffalo Catchers, of course, are an important society with regards to buffalo charming.

Another '*Iniskim* Story' concerns the incorporation of Iniskim into the Black and Yellow Iniskim Tipis. These tipis were first encountered in a vision near Blackfoot Crossing on the current Siksika Reserve (Grinnell 1901). Not surprisingly, one of the first 'tasks' of the owners of the Black and Yellow Iniskim Tipis appears to have been charming buffalo for their starving people. Another early task of the Tipis involved creating a safe fording location of the Bow River at what is now Blackfoot Crossing (Grinnell 1901). This fording location links the find site of the first Iniskim (Falling Off Without Excuse) to the location where the Buffalo Catchers Bundle was envisioned (Head-Smashed-In Buffalo Jump).

In summary, the pedestrian seasonal round model based on the '*Iniskim* Stories' places people well out onto the plains in summer (i.e., Falling Off Without Excuse), collecting berries and in desperate need of bison. In cooler months, pounding appears to be the method of choice. Starvation was not indicated as ritualistic practices (i.e., Iniskim) ensured plenty. The people occupied the foothills (i.e., 'Piskun'/Head-Smashed-In Buffalo Jump) and associated river valleys (i.e., Oldman near Fort McLeod). With subsistence concerns under control, concern focused on moving between different subsistence areas. The creation of a fording location at Blackfoot Crossing, by the Black and Yellow Iniskim Tipis, provided a physical land link between the subsistence areas. In relation to this story, Grinnell (1901) captured the significance of safe passage over a river when he stated: "Now the people wished to cross the river below Blackfoot Crossing, but as the stream was deep it was always a hard matter for them to get across. The dogs and the travois were often swept away, and the people lost many of their things". For comparative purposes, Figure 7 illustrates Uhlenbeck's (1912) equestrian seasonal round in relation to the '*Iniskim* story' pedestrian seasonal round.

NATIVES WINTERING 'FAR OUT ON THE OPEN PLAINS'

Malainey and Sherriff (1996) presented one of the more powerful lines of evidence against the current seasonal round model and the model expressed by this research. They claimed that bison wintered on the plains and support this position by presenting evidence that winter campsites and associated pounds were, likewise, 'located far out on the open plains' (Malainey and Sherriff 1996).

Based on the previous discussions in this dissertation, the present seasonal round model maintains that, almost invariably, the pounds in the historic literature are located within the parkland and near timbered river valleys and uplands owing to the requirement of wood for campfires and pound construction. Restriction to these geographic locations is most clearly seen by examining examples from peripheral areas of the parkland. For comparative purposes, examples are restricted to those used by Malainney and Sherriff (1996) to support their stance to the contrary.

Malainey and Sherriff (1996:344) presented evidence from Alexander Henry the Elder's narratives to support their claims that bison wintered on the 'open plains' and, thus, people were forced to inhabit the same area for subsistence purposes. Using material from Henry's travels in central Saskatchewan they stated:

> Numerous accounts suggest that herds of bison were first encountered on the northern edge of the grasslands and the number of animals increased as one proceeded farther into the plains. When the Assiniboine group which Henry the Elder accompanied was within one day's journey from the camp, situated near Humboldt (Bain 1969:285), they encounter "a herd of oxen extending a mile and half in length, and too numerous to be counted" (Henry 1969:283). Several herds were observed in the vicinity of the Assiniboine camp and on 13 February, 72 bison were successfully pounded (Henry 1969:300-301).
>
> (Malainey and Sherriff 1996:344)

More careful consideration of this document indicates, on February 5, 1776, Henry the Elder left Fort des Prairies (known later as the Upper Nippeween located immediately below the junction of the North and South Saskatchewan Rivers) in the company of some Assiniboine (Bain 1969:275-278). They traveled through an area of 'little wood' or 'no wood, nor even the smallest shrub', but still managed to camp every night within 'small woods' (Bain 1969:282).

The importance of wood is exemplified by the following statement by Henry the Elder:

> ...we discovered, and presently passed by, a diminutive wood, or island. At four in the afternoon, another was in sight. When I could see none I was alive to the danger to be feared from a storm of wind, which would have driven the snow upon us. The Indians related, that whole families often perish in this manner.
>
> It was dark before we reached the wood. A fire, of which we had much need, was soon kindled by the women. Axes were useless here; for the largest tree yielded easily to the hand.
>
> (Bain 1969:282-283)

The next night, Henry the Elder camped by "...a small lake, surrounded with wood, and where the trees were of a size somewhat larger than those behind." (Bain 1969:284). At this time they encountered scouts who informed them that they were within one day's march of the main Assiniboine encampment (Bain 1969:285).

The party experienced a storm that night:

> In the morning, we were alarmed by the approach of a herd of oxen, who came from the open ground to shelter themselves in the wood. Their numbers were so great, that we dreaded lest they should fairly trample down the camp; nor could it have happened otherwise, but for the dogs, almost as numerous as they, who were able to keep them in check.
>
> (Bain 1969:286)

The party remained at this location until the wind fell (Bain 1969:286). They departed on February 11 only to camp in "...a little scrub, or bushy tract..." (Bain 1969:286).

Then, on February 12:

> ...we were in sight of a wood, or island, as the term not unnaturally is, as well with the Indians as others: it appeared to be about a mile and a half long. Shortly, after, we observed smoke rising from it, and were informed that it was the smoke of the village.
>
> (Bain 1969:287)

On the morning of February 13th:

> ...we went to hunt accordingly. The chief was followed by about forty men, and a great number of women. We proceeded to a small island on the plain, at a distance of five miles from the village. On our way, we saw large herds of oxen [bison], at feed; but, the hunters forebode to molest them, lest they should take alarm.
>
> Arrived at the island, the women pitched a few tents, while the chief led his hunters to its southern end, where there was a pound, or enclosure. The fence was about four feet high, and formed of strong stakes of birch-wood, wattled with smaller branches of the same.
>
> (Bain 1969:299-300)

The occurrence of numerous 'islands' of 'wood', some of these very substantial in size, indicates that Henry was skirting along the edge of the parkland; he was not 'far out on the open plains'. He was simply as far out on the plains as the availability of wood allowed him to venture skipping from wooded island to wooded island well aware of what the failure to find wood might entail (Bain 1969:282-283).

Similarly, Malainey and Sherriff (1996:348) used excerpts from Daniel Williams Harmon's journals from the eastern plains/parkland interface. They stated:

> The records of Harmon's trading expeditions show winter encampments were located on the plains and that proximity to trees, for shelter and fire, was not necessarily a priority. On 1 February 1801, Harmon went out to "trade with about fifty Families of Crees and Assiniboine and in going to their Camp or Village we were three Days always in Plain Country" (Harmon 1957:72). In February 1804, Harmon (1957:72) visited a winter camp consisting of 30 lodges of Cree and Assiniboine located "several Days march farther into the Plains' from the Fishing Lakes. Their camp was situated on the summit of a hill, "from whence was had an extensive view of the surrounding Country, which lay low and level and not a Tree to be seen, but thousands of Buffaloe were grazing in different parts of the Plains..."
> (Malainey and Sherriff 1996:348)

As mentioned earlier, Malainey and Sherriff (1996) do not mention the manner by which the Native people in this campsite procured the 'buffaloe'. As noted above, one form of capture was the use of a park or pound which requires substantial amounts of wood. Harmon indicated how bison were pounded (using the same citation): "The Natives look out for a small grove of trees, surrounded by a plain. In this grove of trees they make a yard, by falling small trees, and interweaving them with brush..." (Lamb 1957:285-287). As suggested above, Harmon's observations of the country side as: "...low & level and not a Tree to be seen..." likely reflected his impression of the area. Thus, it is not too unreasonable to interpret this camp located 'several days march farther into the plains' as lying along the Qu'Appelle River Valley; the Qu'Appelle River Valley, of course, is the same wooded river valley from which he started his journey from at the Fort at Lac la Peche days earlier (Lamb 1957:72). Hence, Harmon's 'treeless' view is a vista away from the river valley.

Importantly, Harmon referred to the area four times using the term 'plains' and only used the term 'large or spacious plains' when referring to the nature of the Native people which he visited (i.e., 'those Indians who reside in the large plain') (Lamb 1957:72). From his previous use of language this suggests he is within the edge of the parkland.

Malainey and Sherriff (1996:345) also used Peter Fidler's journals from Chesterfield House to illustrate how both bison and people existed on the plains in winter. They stated:

> At the turn of the century, bison were abundant and available throughout the fall and winter in the vicinity of Chesterfield House, located far out on the plains (Fidler 1967:268). Bison were so plentiful in the fall of 1800 that Fidler ran out of trade goods on 1 December, having already accumulated 2000 lbs of bladder fat and 2000 lbs of back fat and dried bison meat (Fidler 1967:277-278). The following year, bison were abundant by 15 November (Fidler 1967:300). On 11 January 1802, Fidler (1967:306) wrote, "Millions of buffalo all round the house not ¼ mile off...".
>
> (Malainey and Sherriff 1996:345)

Geographically, Chesterfield House was located well out onto the plains at the confluence of the Red Deer River and the Saskatchewan River. Still it was implicit in Fidler's Journal that the fort was situated there to make use of the wooded river valley at the confluence of the two rivers. On the 25th of September, 1800, Fidler reached the confluence of the two rivers and stated: "The woods here are few and bad for building" (Johnson 1967:268). As noted earlier, however, over the next few weeks Fidler's party and another trading company built their winter forts, etc., out of the 'few woods' locally available (Johnson 1967:268). Beyond this, Chapter Four provided a full review of other references to the wooded river valley. This review illustrated there was a substantial amount of wood around Chesterfield House.

The use of the area by Native people also attested to wood as a critical resource anchoring activities to the river valley. Pounds were frequently made near Chesterfield House. On November 27, 1801, Fidler noted: "Several Blackfeet pitched away to make a pound not six miles from the House" (Johnson 1967:32). On January 4, 1801, Fidler noted: "Two Fall Indians came in with furs from a pound about twenty miles off" and eight days later, on January 12, 1801, they brought in: "...a few tongues from the pound" (Johnson 1967:283). On January 15, 1802, Fidler noted: "Three Fall Indians came in with furs. They say the whole nation is at three pounds and that they are not hunting furs scarcely at all" (Johnson 1967:307). Although not unequivocal, it is not unreasonable to infer the extensive use of pounds by Native people in the area of Chesterfield House tied them to the river valley to procure trees for pound construction.

Still, Peter Fidler noted exceptions to the rule of wooden pounds. While traveling near the western foothills he observed buffalo jumps. For example:

> ...a high steep face of rocks on the East Bank of the Creek, which the Indians use as the purpose of a Buffalo Pound, by driving whole herds before them & breaking their legs, necks, &c. in the fall, which is perpendicular about 40 ft. Vast quantities of Bones was laying there, that had been drove before the rock. This kind of Places in the Plains are very useful for the Indians where no wood is to be had to make one of.
>
> (Haig 1990:25)

Buffalo jumps, such as Head-Smashed-In Buffalo Jump, present situations where large winter kills occur at some distance from wood supplies. Still, Head-Smashed-In Buffalo Jump is located a few miles from the Oldman River Valley where wood was abundant. As noted earlier, Blackfoot oral tradition concerning the *Iniskim* supports this interpretation. Recall, Chief-Speaking created a bundle with the *Iniskim* for calling the bison -- the Buffalo Catchers Bundle. At the time that he created this bundle:

> ...the Blackfeet camp was situated about five miles above the site of the present town of Fort MacLeod, Alberta, and along the Oldman River...Near this camp was a buffalo fall, called piskun [interpreted by Reeves (1993) to be Head-Smashed-In Buffalo Jump], at the foot of which the chief of the camp had a corral built.
>
> (Wildschut 1928:423-424)

Still there were times when bison jumps were situated far from wood or a bison pound had exhausted its locally available wood supply. This problem was solved by sending people for wood. For example, on December 27, 1792, Fidler arrived at a pound: "...the 3 sides of which was made of Wood, being a strong fence about 5 foot high, in a creek, one side of which was steep where the Buffalo came on" (Haig 1990:39). The next day, on the 28th, he noted: "No firewood here. The women fetch it from a small hammock, about 2 miles off towards the Mountains" (Haig 1990:41). While it would appear that wood in the immediate area had been exhausted in the pound construction, etc.; firewood was hauled in from local sources.

Malainey and Sherriff (1996:344) also presented evidence from Matthew Cocking's (Burpee 1908:11) journal which recorded his travels in central Saskatchewan. They indicated:

> In early December 1772, Atsina Fall Indians told Cocking's Cree Companions "the season is past"; there were too few animals in the

> Bear Hills of west-central Saskatchewan to successfully operate a pound (Cocking 1908:11; Russell 1991:107). Cocking's companions had intended to spend the entire winter in the area [i.e., the open plains] but due to a shortage of bison they were forced to move to land between the branches of the Saskatchewan River.
>
> (Malainey and Sherriff 1996:344)

In 1772, Matthew Cocking traveled with a group of Cree to an Atsina pound located southeast of the Eagle Hills (Bear Hills) in west-central Saskatchewan. During Cocking's sojourn to the pound in the Bear Hills, he noted on the 10th of October a "...ridge of small poplars..." and, similarly, on the 16th of October "...a ledge of poplars...". By the 22nd of October, Cocking's party had reached their destination. Cocking described the pound: "It is a circular fenced round with trees laid one upon another, at the foot of a hill, about 7 feet high and an hundred yards in Circumference" (Burpee 1908:109). Clearly, numerous trees would be required to make such a 7 ft. high structure; it can be inferred that Cocking was camped at the edge of the parkland with ample trees to build a pound.

In short, the argument that bison wintered on the plains based on the location of historic native campsites on the open plains is flawed. The use of winter pounds limited the location of bison kill sites to the parkland periphery and river valleys owing to the requirement of substantial amounts of wood for pound construction. Similarly, wood was required for fuel in camp fires. Sites which do not conform to this pattern are expected to be rare. Malainey and Sherriff's (1996) examples of winter campsites on the 'open plains' have been illustrated to be situated in the parkland periphery or river valleys within reach of ample supplies of trees for shelter, fuel, and pound construction.

FREEMEN WINTERING 'FAR OUT ON THE OPEN PLAINS'

A fairly common statement in historic journals indicates that, during the winter, a number of individuals may leave the forts and travel to the 'plains' to subsist on buffalo meat, alleviating the need back at the establishments (e.g., Spry 1968:219; Morton 1929:32; Lamb 1957:41). For example, in the journals of the Palliser Expedition, on February 13, 1858, Hector noted: "We found the priests, M. Le Combe and his coadjutor nearly alone, the population of the settlement being absent in the plains hunting buffalo" (Spry 1968:219). Similarly, on October 7, 1794, Duncan M'Gillivray while at Fort George stated: "About 15 men who are permitted to pass the Winter in the Plains, have been this day equipped with ammunition &c. and whatever furs they chance to Kill will be traded on the Indian terms" (Morton 1929:32). Daniel Harmon, writing on January 4, 1801, at Fort Alexandria, stated: "In the morning the greater part of our People (Men, women & Children) were sent to go and pass the remainder of the Winter in the Plains about two Days march from this, and where they will live upon the flesh of Buffaloe which they will kill themselves, and during their stay there, their Dwellings Will be Tents or Lodges made of skins of either Buffaloe, Moose or Red Deer..."(Lamb 1957:41).

When the comments listed above are placed in proper context, the term 'plains' can be illustrated to have been used in a different sense than that of modern geographers. The following argues that the term was used in contrast to the location the people were inhabiting. Thus, people inhabiting the thickly wooded parkland would call any area with less cover the plains. For example, while exploring the Thickwood Hills, Hector made an interesting observation of the Indians subsistence strategies in the area of the Thickwood Hills. He stated:

> Their principle food is moose deer, elk, and bears, and in the winter they live a good deal on rabbits, and on the Canadian lynx, which is very abundant wherever rabbits are found. They some times make short excursions to the *plains* for buffalo when the herds come north of the [North] Saskatchewan River.
>
> (Spry 1968:181, italics mine)

The vast majority of the North Saskatchewan River lies well into the parkland even in prehistoric times (see vegetation construction of Malainey and Sherriff 1996:336-341).

Similarly, on October 26, 1857, Hector came across free traders at Muskeg Lake near the Thickwood Hills. He stated:

> On regaining the Muskeg Lake, distant from our camp seven miles, we passed round the north end of it, and came on a party of *free traders*, who were busy building a rough log shanty in which to winter. There were three families of them, wives, children, and all, and they had left their comfortable homes in the Red River Settlement, and traveled all this distance into the wild country to pass the winter, more I fear from the love of a wandering life than from any hope of bettering their condition by the wrenched pittance of profit which they make in their trading as middle-men between the Indians and Americans. We stayed

> with them and dined on fresh buffalo meat, a stock of which they had just arrived with from the plains, five days' march distant.
>
> (Spry 1968:181, italics mine)

This reference speaks to two issues: first, the bison were on the plains [as we think of them today] to the south (i.e., 'five days march') of the Thickwood Hills in October, and second, these 'free traders' intended to overwinter near the Thickwood Hills, which lie in the parkland, rather than further south on the plains.

The next spring, on March 7, 1858, Hector met with M. Le Combe's freemen, mentioned above, who had wintered on the 'plains' and were returning to the mission at Lac St. Anne (Spry 1968:218-221). Hector intercepted the freemen at Hay Lake about 40 miles SW of Edmonton (Spry 1968:221). Importantly, the camp was moving only a few miles per day (Spry 1968:222). Given that they were moving in from a winter hunting on the plains (about 80 km south of their current location at Hay Lake), and knowing that the camp was moving only a few miles each day (Spry 1968:222), it is not unreasonable to suggest that the freemen, like the free traders mentioned above, did not winter on the 'true' plains but were more likely encamped in the parkland periphery (about 60 km south of their Hay Lake position, somewhere north of Buffalo Lake).

In fact, this is the situation that Peter Fidler described on March 18, 1793 (Haig 1990:92). During Fidler's return trip to Buckingham House from his winter with the Peigan, he encountered an abandoned freemen camp well north of the Battle River (Haig 1990:92). He stated:

> One mile before we put up, passed a Tent place where Canadian *free men* have been remaining at all Winter, hunting for themselves, but now lately removed a little distance Westerly, as no Buffalo is near here.
>
> (Haig 1990:92, italics mine)

At this point in his return journey to Buckingham House, Peter Fidler was just south of the Vermilion (Paint) River and described the area: "Our route this Day pretty thicketty of small asp & willows with several small open plains" (Haig 1990:93). These freemen are not wintering on the plains but rather in the parkland periphery with access to overwintering bison and firewood.

Above (Chapter Four), an argument was presented that illustrated how Daniel Harmon applied the terms 'plains' in different contexts. Here, that argument is reiterated to illustrate people were not overwintering on the true 'plains'. On January 4, 1801, at Fort Alexandria, Daniel Harmon noted sending people into the 'plains' for the winter (Lamb 1957:41). To reiterate, he stated: "In the morning the greater part of our People (Men, Women & Children) were sent to go and pass the remainder of the Winter in the Plains about two Days march from this, and where they will live upon the flesh of Buffaloe which they will kill themselves, and during their stay there, their Dwellings Will be Tents or Lodges made of skins of either Buffaloe, Moose or Red Deer..."(Lamb 1957:41). As already noted, a few weeks earlier, on December 2, 1800, he recorded the environment within one day's march of Fort Alexandria as 'a large Plain with here and there a Grove to be seen' (Lamb 1957:39-40).

Recall, it has already been argued that Harmon used the term 'a large Plain' to describe the area with substantial tree cover but modified the term 'plains' when he traveled to the more open 'true' plains with the term 'large' or 'spacious'

Although the same terminology was not used by the Palliser Expedition, a similar incident occurred in April of 1858 when numerous members of the party were required to leave Fort Carlton for lack of provisions. Although it was spring and not winter, these men supported themselves by hunting bison in the Eagle Hills (Spry 1968:174-175). They were not on the plains.

As well, during Hind's (1971:332) exploration he came across a freemen winter camp just east of the junction of the Qu'Appelle Valley and the valley occupied by Last Mountain Lake. He observed:

> ...six or seven loghouses, occasionally inhabited during the winter months by *freemen*, that is, men no longer in the service of the Company. The prairie above the freemen's house slopes gently to the edge of the valley from the distant horizon on both sides. Clumps of aspen vary its monotonous aspect, and though clothed with green herbage, due to the late abundant rains, the soil is light and poor. Some finer particles not having been washed out of it; the grass there is longer and more abundant, but the greatest drawback is the want of timber.
>
> (Hind 1971:332, italics mine)

Even 'far out on the open plains', like the Qu'Appelle Valley, freemen chose winter camps at the bases of valleys where ample wood to build loghouses could be found. In fact, Hind acknowledged the importance of wood for shelter and fuel when he spoke of the location. He stated '...the greatest drawback was the want of timber.'

In summary, people sent to 'winter on the plains' were encamped well within the parkland or in sheltered river valleys. Each example of Freemen wintering far out on the open plains has been demonstrated to be located at the edge of the parkland or within a river valley.

A TIME TO POUND

It has been argued that, on the Canadian Plains, bison pounds and jumps occurred throughout the fall and winter (e.g., Arthur 1975, Verbicky-Todd 1984). The explanation for the restricted operations is often ascribed to need for the bison to migrate in the fall from the plains to the wooded valleys, foothills, and parkland. For example, Verbicky-Todd examined a large number of ethnographic and historic sources concerning bison pounding and stated:

> Buffalo pounds, also known as buffalo parks, corrals, pens, drives, and among the Blackfoot tribes, as "piskuns" (Grinnell [1893:228] translated this word as "deep-blood-kettles") are almost exclusively described as fall and winter hunts in ethnographic and historic literature. Impounding was conducted after the buffalo had migrated to the timbered river valleys, parkland and foothills for shelter during the winter season.
>
> (Verbicky-Todd 1984:34)

In the quote above, Verbicky-Todd (1984:34) indicated that bison pounding mainly occurred in the fall and winter after the bison had migrated to the timbered valleys, parkland, and foothills. Although not explicitly stated, this suggests that the explanation for temporally restricted bison pounding operations was twofold: first, the bison must be in the area via migration, and 2) this migration must be through specific environments (timbered valleys, parkland, foothills) with the required resources to pound bison.

There is substantial evidence to support this position as it is based on numerous historic and ethnographic observations (Verbicky-Todd 1984:34-35). The following reiterates this sentiment by paraphrasing previous research by Verbicky-Todd (1984:34-35). Grinnell (1893:234) noted that the Blackfoot tribes repaired their pounds in the early fall in preparation for the winter season. Maximillian (1906, Vol. 23;108) also noted the Blackfoot used pounds in the winter. Fall and winter pounds of the Blackfoot were emphasised by Ewers (1968:163) and Schaeffer (1978:244). Fidler observed the Blackfoot pounding and jumping of bison throughout the winter of 1792/3 (Haig 1990). Hector and Vaux (1861:279) indicated that the Plains Cree constructed winter pounds. Alexander Henry noted the construction of pounds by the Assiniboine in the winter (Coues 1965:518). McDonnell (1889:279) noted the Assiniboine made winter pounds. Skinner (1914:497) indicated the Ojibway pounded in the winter. Similarly, Arthur (1975:121) concluded, after review of the historic and ethnographic data concerning bison pounding and driving, that drives began in the fall and continued throughout the winter.

Still, Verbicky-Todd (1984:35-36) also noted that pounding events occurred in seasons other than fall and winter. Again, paraphrasing Verbicky-Todd (1984:35), Henry Hind observed the results of a pounding event from 10 days earlier on July 29, 1858. Audubon (1969, Vol. 2:145), although never seeing an operating pound, indicated that they were used throughout the year but especially for hides in October and November. Robert Jefferson (1929:93) indicated the Crees pounded animals in the summer or winter. As well, Jenness' (1938:17) Sarcee informants clearly recalled pounding bison in the summer but not the winter.

From the exceptions, Hind provided the only calendrically dated example of a 'summer' pounding event. Specifically, in late July of 1858, Henry Youle Hind (1971 Vol. 2:142-143) observed a Plains Cree pound operating just east of the elbow of the South Saskatchewan in south-central Saskatchewan. The pound had been 'filled' ten days prior to Hind's (1971:357) arrival on the 29th of July, with about 240 animals being taken. Due to the carnage, a new pound was being constructed and Hind (1971:356-364) was invited to watch the proceedings but departed before the event transpired.

Verbicky-Todd (1984:89) considered this account unusual, in part, because it described a summer kill event using a pound. In fact, James Hector of the Palliser Expedition recorded his impression of Hind's summer pound, and stated: "Mr. Hind has indeed given a circumstantial account of the construction of one of these pounds during summer; but though we were in this country for three years, and at the very place which Mr. Hind describes, we never heard of this practice of the Indians at a period of the year when the snow was off the ground" (Hector and Vaux 1861:249-250 in Verbicky-Todd 1984:92).

Closer examination of Hind's (1971:365) experiences at the pound indicated that, on July 30th, as he left the pound he noted the tenor of the bison in the surrounding area. He stated: "The buffalo were crossing the South Branch a few miles below us in great numbers, and at night, by putting the ear to the ground, we could hear them bellowing" (Hind 1971:365). This strongly suggests that the rut had begun and the animals were gathering in larger numbers. It seems to be more than a coincidence that this 'summer' pounding event appears to have occurred just as the rut commenced.

Thus, it is not unreasonable to suggest that the season of pounding coincides with, not just the arrival of the bison at the parkland, etc., but the entire course of bison migration beginning with the rut. Of course, the coincidental occurrence of the migration with pounds in the parkland has already been noted. Hind's example shows that pounding occurred well before animals reached the parkland. In Hind's case, the aggregation of bison for the rut (the beginning of the migration to the parkland) is well out in the plains, just east of the elbow of the South Saskatchewan, and not in the parkland.

The rut signals the commencement of pounding because it is at this time that the animals assemble in much larger herds. And larger herds are key to a successful bison drive; it is the momentum of large herds that carries the whole herd into the pound or over a jump (Frison 1991:232-233). As the animals migrate into the parkland, etc., the restricted area of the parkland compresses the animals more densely in relatively larger numbers compared to the open plains, keeping 'herd' size high over the winter. Alternatively, Morgan (1980:128) has argued that overwintering bison aggregate in the parkland to take advantage of superior forage and availability to water. Regardless, the return migration to the plains keeps large numbers of the animals together. An important difference between the fall and spring migration is that the spring migration was abrupt relative to the fall migration (see Chapter Four). From the hunter's perspective, the bison's activities were largely predictable, within certain parameters, with the only problem occurring in the spring. Due to the uncertainty of spring weather, Native people were unlikely to pursue the bison on to the plains (Vickers 1991:60). Thus, although bison would still be in large herds through April and May, few pounding events would be expected as the herd would have been a substantial distance onto the plains. In the summer months, of course, the bison were more dispersed and less amenable to communal pounding and driving. The dispersal of bison into smaller herds on the plains in the summer may be related to relatively low productivity of the summer ranges (Morgan 1980:121)

This pattern of pounding events is evidenced in the seasonal distribution of historically and ethnographically known communal hunts. For example, Table 5 summarizes the occurrence of pounding events, mentioned in Chapter Four, by calendrical month. These data suggest that bison pounding occurred in the late summer and early fall (i.e., July, August, September, October, November); however, these events are infrequent. The majority of pounding occurred in December, January, February, and March. After March pounding events quickly taper off in early April with none recorded for May and June.

Pounding events coincide precisely with the time bison are most aggregated, from the initial migration off the plains which commences with the rut, to the compressing of large numbers of animals into the smaller space of the parkland, to the return migration to the plains in the spring when the animals quickly outdistance the hunters who were unlikely to proceed onto the plains during spring's unsettled weather.

SETTLEMENT PATTERNS AND MOBILITY STRATEGIES

The seasonal round of movements on and off the plains by Native people provide a synopsis of the annual cycle. A more detailed understanding of people's movement can be determined through the examination of critical resources within the seasonal round. In winter, trees are required as wood for fuel in heating campsites and building materials in constructing pounds. The location of Old Women's phase winter sites was determined, in part, by their relationship to wood. In summer berry patches are required as berries provide important resources stored for winter use. Movements during the summer are expected to coincide with known berry patches.

WOOD: A CRITICAL RESOURCE IN WINTER

In 1987 at the annual meetings of the Canadian Archaeological Association, Rod Vickers (1987) argued that current approaches to the seasonal settlement pattern were based on the movement of bison, migratory or otherwise. Vickers (1987) concurred that winter campsite selection was based on anticipated bison herd distributions at the regional level. However, given the rather fluid nature of bison movement at the local level due to various factors (e.g., weather conditions, pasture quality, fires, and hunting pressure), he suggested that the critical resource with the most restrictive distribution would most influence campsite selection at the local level rather than bison herd locations. He defined critical resources as: "...ones with limited spatial distributions which assume primacy in settlement decisions over and above the specific location of bison" (Vickers 1987; see also Vickers and Peck 2001).

To paraphrase Vicker's (1987) argument, he first listed the attributes of a Blackfoot winter camp, originally noted by John Ewers (1958:88), as including shelter by trees and terrain, firewood, grass for horses, and food. Horse fodder was considered irrelevant in the Prehistoric Period, while water and ruggose terrain were available in river valleys. He concluded the item with the most restricted distribution was wood as it was confined to the parkland, segments of river valley bottoms, and the northeast flanks of uplands such as the Cypress, Hand, and Wintering Hills.

Vickers (1987) provided evidence that wood was a critical resource in winter by comparing its value as a fuel to bison chips. He cited Milt Wright's (Brink et al. 1986:285) research on bison chip combustion which demonstrated that chips burn hotter than wood, if exposed to an open breeze, but radiate less heat due to the formation of an insulating ash layer. As well, chips were more difficult to find and retrieve under snowfall while trees, by-and-large, are easy to see when upright.

Then, citing the journal of Matthew Cocking (Burpee 1908:112-117), Vickers (1987) used ethnographic evidence for Native campsite movements within the parkland in winter due to the failure of a pound. In stark contrast, Vickers (1987) cited observations of Reverend John McDougall regarding a Cree winter camp near Battle River in 1865:

> ...we were discouraged to find that these people were living from hand to mouth -- that while the buffalo were within from sixty to one

> hundred and fifty miles distant, they have not yet attempted to come north. The camp was still waiting and hoping for this...
>
> (McDougall 1898:191)

Vickers (1987) cited the Reverend John McDougall again, reiterating that the reason for not entering the plains after the bison was due to: "...the rigor of the winter and condition of the grass [for the horses?] and wood forbidding the camp moving any nearer to them..." (McDougall 1898:16). In short, Vicker's (1987) point was that there were camp movements within the parkland (i.e., Cocking) but reluctance to move into the plains due to a lack of firewood (McDougall). More recently, Vickers and Peck (2001), reworking the critical resource argument, noted the preponderance of winter pounding in the ethnographic record and modified the critical resource model for wood by noting it was required for *both* campsite fuel and for pound construction. Evidence of the latter is presented below as an integral part of bison herd intercept strategies.

INTERCEPT STRATEGY

The quote by Oliver (1962:15) at the beginning of this chapter suggests bison were not predictable in their movements and that, had they been, the Native people would need only to intercept them during their migration to put up substantial stores. The evidence provided for this statement is the common sense notion that the Native people did not know exactly where the bison were as their scouts were gone for days in search of the animal (Oliver 1962:15). Given the demonstration that bison movements were predictable, at least at a regional level, the following argues bison were intercepted.

Quite recently, Clow (1995:267) argued that bison movements were predictable (see Chapter 3). Using historic data from the Middle Missouri area, he indicated that bison spent the summer months on the plains away from the Missouri River and wintered in the river valley. Further, he noted that these patterns were predictable enough that they strongly influenced the Lakota and Yankton Sioux hunting practices:

> The winter of 1832-33 also reveals Lakota and Yankton fall and winter hunting practices. Instead of breaking into small winter camps, they gathered and waited in larger encampments near the Missouri River, planning their communal fall and winter bison hunts as the animals sought shelter near the Missouri River. This illustrates that

> Brulé and Yankton people did not follow the herds but tried to intercept the animals at the Missouri.
>
> (Clow 1995:267)

This pattern is consistent with historic records and ethnographies for Native people on the northwestern Plains. For example, above it was argued that Matthew Cocking spent October to December 1772 encamped at the edge of the parkland at an 'Archithinue' pound located southeast of the Eagle Hills (i.e., Bear Hills) in west-central Saskatchewan (Burpee 1908:108-109). To restate the earlier point, Cocking and his Cree party were as far out in plains as they could be while still having access to enough wood for pound construction.

By October 23, 1772, Cocking and the Cree were repairing the bison pound in the Bear Hills. Starting October 25th, the Cree attempted to pound bison. They failed to pound many animals even after the Archithinue arrived in early December and further repaired the pound. Then, on December 6, Cocking noted: "No success in pounding: the Strangers say the season is past" (Burpee 1908:111). By December 17, Cocking's party left the pound traveling north further into parkland and then, once well in to the parkland, they moved on to a second pound further east (Burpee 1908:112-113). After traveling over barren ground and plots of wood for some time, Cocking stated:

> A Young man joined us from the Beast pound to the Eastward of us where we intend to go: He says the Buffalo are so scarce that the Indians are distressed for want of food & therefore had unpitched intending to build a pound further on the Eastward, where Buffalo are said to be numerous.
>
> (Burpee 1908:113)

The group continued to travel east through 'straggling scrubby small woods' and 'straggling trees and small poplars' and crossed the Saskatchewan River (Burpee 1908:113). They passed hills which the Indians stated: "...produces plenty of large spruce, & Birch..." (Burpee 1908:114). On February 23, they were informed by some visiting Natives that female bison were plentiful with them to the west (Burpee 1908:115). Then, on February 27, after crossing through 'Woody hummocks, with some large ponds' they arrived at the pound near the Birch Hills (Burpee 1908:115-116).

This travel sequence by Matthew Cocking and his party illustrates an attempt to intercept bison as the animals leave the plains in October and November to take up residence in the parkland between December and March. Initial attempts to pound bison were conducted on October 23. On December 6, after very little success, even with the 'Archithinue's' assistance, it was noted that 'the season is past'. In short, the time for attempting to intercept the bison during their movements off the plains and into the parkland was in the past (i.e., October to November). Then, on December 6, with the animals theoretically in the parkland, Cocking and his party mimic the path of the bison by first traveling into the parkland and then traveling parallel to its borders looking for the animals. Eventually they find their prey in the Birch Hills.

Similarly, the travels of Peter Fidler in the winter of 1792/1793 also suggest an intercept method of procuring bison was being employed by the Blackfoot. Fidler traveled from Buckingham House to southwestern Alberta to winter with the Peigan. On his route south Fidler crossed the Bow River, on December 9, some distance east of modern Calgary (Haig 1990:28). Then, on December 13, Fidler camped at the Sheep River and noted: "No woods to be seen to the East & only small hammocks towards the Mountains" (Haig 1990:33). December 14, Fidler arrived at a camp of 150 tents of Muddy River (i.e., Blood) Indians on the Highwood River. Like his crossing point on the Sheep River, the current camp was situated near the most eastern stand of wood available; he stated:

> No woods to the Eastwards & very little to the westwards, only here 2 good Hammocks of pretty large Poplars, one here & the other about 3 miles to the N. Eastwards down the river, called by these Indians Oo oose spitcheyee, signifying a small hammock of Poplars. The hammock that we now encamp at is about 4 miles long close along the Banks of the river.
>
> (Haig 1990:33)

Just like the Brulé and Yanton near the Missouri, the Blood have encamped as far out on the plains as possible, while remaining within reach of wood, to intercept the bison. Importantly, they had a term for a small cluster of poplars -- *Oo oose spitcheyee*. Then, on December 16, all but twenty-seven of the Muddy [Blood] Indians tents move to two nearby buffalo jumps (Haig 1990:34). Fidler (Haig 1990:34) noted: "All the Tents moved but 27 to two different Pounds (Jumps) to the Southward, to rocky precipices as there is no woods to make another sort of Pound off". Significantly, the next day Fidler's party was informed that '2 large heards [sic] of Buffalo' had been killed at one of the two aforementioned pounds

(Haig 1990:35). Presumably, scouts had been out and alerted the large camp of the approaching bison. Immediately, the camp split into two groups both of which headed south to jumps at the eastern edge of the foothills to intercept the herds on their migration into the western foothills and parkland. The Native people had been waiting as far out on the Highwood River as wood allowed awaiting to learn the location of the migrating herd. When the word came, they quickly split to intercept the animals.

From December 19 to 29, Fidler traveled west, near the base of the Rocky Mountains, to a number of jumps and pounds. Importantly, when the jump sites were located some distance from a wood supply: "Several Young men took horses & went for firewood to a small Hammock of asp about 5 miles SE of us" (Haig 1990:37). Similarly, but on a different occasion: "The women fetch it [wood] from a small hammock, about 2 miles off towards the Mountain" (Haig 1990:41). The westward movement of Fidler in mid-December is significant as this appears to coincide with where the bison had moved. For example, on December 26, he was about 10 miles from the base of the mountains and stated: "The men running buffalo towards the Mountains and killed a few. On December 27, he moved to Sheppard Creek where he noted great numbers of bison (Haig 1990:39). Here he witnessed a very successful pound near the base of the Rocky Mountains: "Several high ridges of hills betwixt us and the Mountain, pretty high running parallel with it, well covered with small pine &c." (Haig 1990:39).

In a very general sense, this part of Peter Fidler's journey parallels that of Matthew Cocking's travels. Fidler encountered a large camp of the Blood Indians established well out on the plains but within the well wooded parts along the Highwood River. Almost certainly alerted by scouts, the camp split into two and these groups both moved south to use exposed sandstone cliffs of the eastern edge of the foothills for jumping bison. These locations served to intercept bison herds as they moved up against the mountains.

Then, in mid December, Fidler moved west towards the mountains. He stopped at a series of camps with pounds, the most successful of which was very near the base of the Rocky Mountains. These locations were similar to Cocking's movement deeper into the parkland once 'the season was past'. Interestingly, in both cases, the fall back into a more sheltered area occurs in early December, the time of year stated by John Ewers (1955:124) to be the start of the coldest weather. More informative is Longley's (1972:44) position that, for the Canadian plains, the period of snowcover is four or five months between November to April.

Unlike the scenario described for Cocking's travels (where there is substantial spatial separation of the plains, parkland, and forest), the western parkland and foothills are quite compressed. The 'compression' of the bison into this zone of about 50 miles wide has certain ramifications. Jumps, whether used as intercept sites, or otherwise, require the animals to approach from the west. Given the confined wintering area west of the front range of the foothills, the jumps were likely used fall, winter, and spring, making differentiation of these sites in historical texts difficult.

These 'intercept' sites are likely to be common at the plains-parkland interface across the northwestern Plains. The Palliser Expedition, for example, appeared to remark about such a site as they entered the south end of Moose Hills on the South Saskatchewan River. In keeping with the need for wood in pound construction and fuel, Palliser first noted an environmental change while approaching the Moose Hills: "We now observe a marked change as we proceeded, and were no longer in prairie as before, passed through quantities of scrubby wood and young poplars one and two feet high" (Spry 1968:158). Later that day, October 4, 1857, he stated: "Reached the Woods. Old Buffalo Pound" (Spry 1968:158). He further stated: "...passed on to the north of a clump we named Three Tree Point, and camped in the evening, where we found plenty of good water; passed an ancient buffalo pound, where the Indians in winter decoy and drive buffalo to slaughter in great quantities" (Spry 1968:158).

The journals of Matthew Cocking and Peter Fidler present relatively ideal scenarios of intercept sites and their related fallback sites. Of course, the situation is much more complicated. It is possible that the intercept sites were not abandoned in the early winter. In the previous discussion of bison movements it was indicated that herds often failed to enter deeply into the parkland. In such a case, the intercept sites could be used all winter if the animals stayed at the periphery of the parkland. As well, even if the bison did move deeply into the parkland, the intercept sites could again be used as the animals passed them on their return migration to the plains in the spring.

Evidence at the edge of the parkland for spring use comes from the journal of William Pink, on May 2, 1769, near the elbow of the North Saskatchewan River (Russell 1991:101). He wrote:

> Mooved None Eare I found Staying a pounding of Bouflou 31 tents of Sinnapoits So heare the Indaines are Gowing up for provysions this is the First pound I have seen in this Land Contry it is Made in a Dale it is Railed Round with Large woodn it is Consisting of to Hundred and Nointey Feat Round and 7 feet High the Down way or the way that the Beast Come in it is 40 Feet Broade and at the Side of the Hill that Slopes Down in to the pound the Lardge Stikes are Lef Slooping down Hill and other ones Laide on the top of them for the Boffow to Ron down and Jump of in to the pound.
>
> (HBCA B.239/a/61 2 May 1769 in Russell 1991:102)

Similarly, Cocking, in reference to the pound in the Eagle Hills described above, noted: "This pound was made by our Archithinue friends last spring, who had great success, many Skulls & Bones lying in the pound" (Burpee 1908:109). Evidently the 'Archithinue' had used the intercept site the previous spring.

Evidence that people stayed at the periphery of the parkland all winter comes from the journal of Henry the Elder. As described above, through the month of February, Henry the Elder traveled to an Assiniboine pound at the edge of the parkland near modern Humboldt, Saskatchewan (Bain 1969). Henry's party traveled by moving from one patch of wood to another until they reached the well wooded camp of the Assiniboine. Then, on February 13, in another heavily wooded patch near the main camp a herd of seventy-two bison were pounded.

The camp and associated pound locations occupied in the fall, winter, and spring, cannot be differentiated based on geographic location. Fall intercept sites are expected to be located as far out on to the plains within the limits that wood places on pound construction and camp fuel. These sites may also be used throughout the winter and into spring depending on variables surrounding bison movements. However, fall sites located away from the edge of the parkland, well back in the 'woods', would not be expected.

From an archaeological perspective, there are seasonally assessed Old Women's phase archaeological sites that could be considered candidates for intercept sites. The 'best' candidates include Head-Smashed-In Buffalo Jump and the Bodo Bison Skulls site. Both of these sites are geographically located at the edge of the parkland with seasonal assessments of late October to late December kill events.

The geographic location of the Junction site, just southwest of Head-Smashed-In Buffalo Jump on the Oldman River, also seems like a good candidate as an intercept site. Yet, seasonal assessment failed to discover evidence of a late October to late December event. Similarly, the Boarding School Bison Drive, located just north of Cut Bank, Montana, within twenty-seven miles of the base of the Rocky Mountains, is also a good candidate for an intercept site. Again, seasonal assessments showed no sign of late October to late December events. The reason for the lack of evidence for fall kill events at these sites is difficult to address.

Conversely, the lack of evidence for fall kill events in these sites may just be indicating that they are winter kill events. Winter kill events might be located at the very periphery of the plains owing to chinook conditions dissuading animals from penetrating further into the parkland and foothills. As well, even under normal winter conditions the animals are expected to range along the plains-parkland periphery, regardless.

Interestingly, none of the river valley sites assessed as winter events showed signs of late October to late December events including Castle Forks Buffalo Jump, EgPn-440, Fish Creek Bison kill site, Davies/Garratt, and Bootlegger Trail. This suggests river valleys were largely inhabited as winter occupations.

The Tschetter site, situated some distance into the parkland, only exhibited evidence for an event between late December and late March. This site fulfills the expectation that bison moved into the parkland some distance and that permanent camps could be maintained at these wooded locations.

Interestingly, the Estuary site and the Blakiston site both had seasonal indicators of late December to late March sites. They also had seasonal indicators suggesting late March to mid June events. Trying to suggest these are specifically spring intercept sites is difficult as such sites do not have anything restricting their location in the parkland or in the river valley. In short, there is no independent test for the interpretation of a spring intercept site.

BERRIES: A CRITICAL RESOURCE IN SUMMER

Just as wood acted as a critical resource in determining winter campsite locations, berry patch locations strongly influenced the location of summer campsites. For the most part, people were required to be on the plains in the summer to remain in close proximity to their prey -- the bison. Within this generalized area, people selected campsite locations at productive berry patches. The importance of berries was not in immediate food requirements, although this was important, but their use as dried vegetable stores in winter (Ewers 1958:86).

Research concerning plant utilization on the plains is sparse (e.g., Peacock 1992:22). Still, the movement of camps to berry patches has been recorded. Uhlenbeck's (1912:4) transcription of a Peigan seasonal round noted going to Manyberries. A scout confirmed the berries there were ripe including sarvis-berries, goose-berries, and red-willow-berries (Uhlenbeck 1912:4). Similarly, the camp next moved to Buffalo-Head at the west end of the Cypress Hills to collect berries. At this time, Uhlenbeck transcribed:

> We shall camp at Buffalo-Head [a local name]. There are many berries [of all kinds], [especially] cherries. They took them. When they had brought them home, they mashed them with the whole seed in them. They were picked for future use [for winter-time].
>
> (Uhlenbeck 1912:4)

Sometime later, the group again encamped for berries at Writing-on-Stone:

> There are many berries, [especially] cherries. They camped there. The women did not go far for picking berries. And the mashed cherries were dried. They put them away. They put them in calfsacks. They were the berries for future use. In the winter they would skim the grease with them, they would mix them with their pemmican, and they would make soup with them.
>
> (Uhlenbeck 1912:6)

Keeping in mind that Uhlenbeck (1912) transcribed an equestrian seasonal round, the importance of collecting berries for winter-use is obvious. The reason, of course, rests in the use of berries as a winter store to maintain nutrition. McClintock (1968:385) further illustrated the notion that specific berry resources were annually reused, as well as the importance of berries as a winter store:

> We pitch our tipis in this grove of cottonwoods every summer, to gather sarvis berries for future use, when the snows are deep. You find many kinds of berries on all sides. You can eat them now, or gather and dry them for your winter supply, just as we do. I ask, however, that you will be careful not to injure the trees, or break the branches of the berry bushes. I make this request because I am looking ahead for the tribe. I am anxious to preserve these big trees and the berry bushes for our children.
>
> (McClintock 1968:385-386)

Similarly, McClintock (1968:466) further noted that:

> ...the women were gathering their winter supply of sarvis berries. The bushes, which the old chief so carefully guarded, were loaded down with the ripe fruit. Their method was to strike the bushes with sticks, catching the berries in blankets, and then spreading them in the sun to dry...Large quantities are dried for winter use.
>
> (McClintock 1968:466)

Wissler (1910:21) also noted the movement of Blackfoot summer camps to known berry resources. He stated:

> During the berry season, the Blackfoot camps were shifted to favourable localities where the women and girls worked industriously gathering the fruit into rectangular rawhide bags, or similar bags of soft dressed skin, which when filled were emptied into larger storage bags. The gathered fruit was taken to camp and dried in the sun, after which it was stored in parflech or other bags.
>
> (Wissler 1910:21)

Given the importance of berries to subsistence, it is not unreasonable to speculate that these places underwent a sophisticated strategy of management and utilization by Native people. Following Politis' (1996) notion of 'moving to produce', it is suggested that the Native people concentrate the berry bushes, or any other botanical species, in specific areas, and possibly assisted their growth via discriminatory thinning, etc. Thus, concentrations of berries could have been, in part, 'created' on the plains. The concern of a Native Chief in the previous quotes attests to a conscious concern over the maintenance of berry resources.

From an archaeological perspective, one would expect substantial numbers of palimpsests campsites around large berry patches. As well, one would expect the berry patches and associated camp sites to be spaced across parts of the plains in case of failure at any one patch. Thus, initially berry resources may have lured people to a certain area, but over time, people created berry locations and perpetuated this through the redundant use of the landscape.

In ending this discussion, in addition to the use of berries, the use of other botanical species by Native people could enhance our understanding of the seasonal round. The ripening of berries and/or the maturation of other species occurs at specific times and specific places. Assessing the natural schedule of plant species known to have been used by Native people might refine our understanding of the seasonal movements of people. Peacock (1992) provides examples of the value of such an approach:

> The complementary nature of Piikáni subsistence strategies is exemplified by the role of the "buffalo bean" (*Thermopsis rhombifolia*) in the spring buffalo hunt. According to the Piikáni (BSWAG, JSC), when the buffalo bean bloomed, "the old people knew to kill the buffalo" because they were "fat and good to eat". Ewers (1955) noted that the buffalo bull moved to their summer grazing territory on the plains in the spring and were considered prime for a relatively short time. Thus, plants even played a role in the timing of the hunt!
>
> (Peacock 1992:110)

Of course, such a synthesis is well beyond the scope of this research. Still, an independent study of plant resource utilization based on a calendrical schedule of species maturation might provide an interesting refinement of any understanding of the settlement pattern or seasonal round (e.g., Flannery 1968).

INFORMATION STRATEGIES

The use of intercept sites and berry patch locations share a common problem. Both require information regarding the resource in order to instigate an informed response regarding the utilization of the resources. Put more simply, people need to be in the right place at the right time to make use of these resources. Hegmon and Fisher (1991:141) argue that: "...hunter-gatherer information strategies tend to have a predictable relationship with the structure of resources". They suggest there are two general types of information, long term and short term, which play different roles in societies (Hegmon and Fisher 1991:128).

"Long-term information is defined as permanent, or unchanging over the life time of an individual" (Hegmon and Fisher 1991:128). This type of information does not need to be monitored and includes such things as topography and the location of permanent resources (Hegmon and Fisher 1991:128). This information can be acquired through wandering over the landscape or through oral tradition, etc. The use of this type of information on the northwestern Plains is beyond the scope of this research. Still, the *Iniskim* myth, noted above, could be interpreted as an example of long term information regarding the generalized movement of bison resources.

"Short-term information concerns the current state and availability of resources" (Hegmon and Fisher 1991:128). This information concerns the immediate condition of resources such as ripening berries or the location of herds of animals. In order for this information to be of value it must be timely and may require updating (Hegmon and Fisher 1991:128). This is the type of information that is required in order to intercept bison or to arrive at the right time to pick ripe berries.

There is substantial evidence that Native groups monitored bison herds whether for the purpose of intercepting animals, or otherwise. For example, Grinnell (1962:234) noted:

> In the last days of summer and early fall, they always had runners out, looking for the buffalo, to find where they were, and which way they were moving. In the early autumn, all the pis'kuns were repaired and strengthened, so as to be in good order for winter.
>
> (Grinnell 1962:234)

Similarly, Uhlenbeck's (1912:7-8) transcription of a seasonal round account, noted:

> When it snowed [first] in the fall, then they began to hurry, that they moved down [to the lower country]. There [down] on the river, there they would be camped about. There they waited, where the buffalo would come nearest. To that place they would move. They would carefully look, where they [themselves] would be during winter.
>
> (Uhlenbeck 1912:7-8)

The journal of Matthew Cocking's experiences in central Saskatchewan also contain evidence for the monitoring of bison and the propagation of the information. After having failed to pound bison in the Bear Hills, Cocking moved farther north and east into the parkland to search for more productive pounds (Burpee 1908:109-113). While near a branch of the Saskatchewan, Cocking and his party encountered a messenger:

> A Young man joined us from the Beast pound to the Eastward of us, where we intended to go. He says the Buffalo are so scarce that the Indians are distressed for want of food & therefore had unpitched intending to build a pound further on to the Eastward where Buffalo are said to be numerous.
>
> (Burpee 1908:113)

This reference is significant for two reasons. First, the camp that was forced to move (i.e., the camp Cocking was heading to), sent out runners to inform those who may be heading there of the camp's relocation, and second, the camp that was forced to move had obtained information by some source that there were bison to the east.

As Cocking's party continued to move east the young men were often out looking for Buffalo (Burpee 1908:114). Then, a second messenger found Cocking's camp: "This morning the Indian arrived from those we intend to go to, with information that all the Natives were pitched further on towards Waskesew-Wachee [Birch Hills], intending to build a Beast-pound there..." (Burpee 1908:115).

Importantly, runners were not just used to seek out bison, they were also used to communicate successful forays. For example, recall that a large camp that Peter Fidler had been staying with split into three with the two large groups going south to hunt bison. Significantly, the next day a runner informed Fidler's party that '2 large heards of Buffalo' had been killed by one of the aforementioned groups (Haig 1990:35).

A similar case can be made for monitoring berry patches. Uhlenbeck (1912:4), although discussing an equestrian seasonal round, recorded evidence of berry patches being monitored:

> The chief said: Come on, we shall move to the Manyberries [a local name]. We shall camp there. There is a young man who went far, he found out [that] the berries are ripe. Come on, you women, you may go for berries.
>
> (Uhlenbeck 1912:4)

Still, all this monitoring has a cost. The cost of monitoring depends on: 1) the ease or the difficulty of spotting or tracking the resource and 2) the distribution of resources

(Hegmon and Fisher 1991). In short, the nature of bison availability, in that they are concentrated in both time and space, suggests the Native people should devote substantial effort to monitoring this resource. In the case of bison, they migrated in concentrated numbers through restricted locations which were not entirely predictable. Both Grinnell (1962:34) and Uhlenbeck (1912:7-8), above, noted the importance to the Blackfoot of determining where the bison were going to winter.

Similarly, given the importance of berries in winter subsistence they should also be closely monitored. The use of runners in this situation is also noted. Still, while there is some ethnographic evidence that bison herds and berry patches were closely monitored, further evidence from historic records or oral tradition could clarify the nature of this information strategy.

OLD WOMEN'S PHASE SETTLEMENT AND MOBILITY: A HYPOTHESIS

The seasonal round has been established. People lived on bison in the parkland in the winter and bison on the plains in the summer. Beyond bison procurement a secondary influence on the movement of people was wood in the winter for campsite fuel and pound construction and berries in the summer as food items for both immediate consumption and for using in winter as a stored good. The seasonal round defines the movement of people at its basic level. The utilization of wood and berries relates specific resources intertwined into the larger seasonal round. The following attempts to synthesize these multi-scalar approaches into a model of the Old Women's phase settlement and mobility.

SEASONAL DIFFERENCES IN BISON CONCENTRATIONS

Numerous authors have noted their views concerning the seasonal differences in bison distributions and the effect they had on the distribution of Native people (e.g., Arthur 1978:239-240; Oliver 1962;15-18; Morgan 1979,1980; Quigg 1978:54). Oliver (1962:17) suggested the bison were dispersed in winter and congregated in summer; similarly, the Native people who followed the bison were dispersed in winter and aggregated in summer. In contrast, Morgan (1980:158) argued for the dispersal of bison on the plains in the summer and the aggregation of bison in the parkland in the winter. Similarly, she indicated that the Native people, with their strong dependence on the bison, exhibited a parallel social organization; they dispersed in summer and aggregated in winter (Morgan 1980:158). There are other authors who have spoken to this issue (e.g., Arthur 1978:239-240; Quigg 1978:54) but the aforementioned conflicting views summarise the perspectives.

WINTER DISTRIBUTION OF BISON

In the winter 1857/1858, James Hector travelled from Fort Carlton to Rocky Mountain House via Fort Augustus (Edmonton). On December 15, 1857, he left Fort Carlton where bison were available but apparently not in any great quantity; for example, on the day of his departure he observed a band of bison bulls near Red Berry Lake (Spry 1968:186-188). The next day the party came across more bison in a large open plain within the parkland (Spry 1968:188). However, near the Whitewood Lakes Hector and his party came across a Native bison pound about which he noted: "...they [the Native people] are very hard up this winter, as the mildness of the season has allowed the buffalo to stay much longer then usual out in the plains this year..." (Spry 1968:189). The same day they encountered a frozen lake where Native people had dispatched 'a band of bison cows numbering fourteen' (Spry 1968:191).

On December 19, near the confluence of the English River and the North Saskatchewan, the party fell in with 'immense' numbers of bison (Spry 1968:193). The party reached Fort Pitt on December 20 and again noted the prevalence of bison (Spry 1968:195). Leaving Fort Pitt, heading west along the south bank of the Vermilion River, they continued passing large numbers of bison (Spry 1968:196).

A successful Native pound was encountered somewhere south of modern Derwent (Spry 1968:197). Similarly, during December 26 to 28 the party travelled through the Vermilion Lakes area amongst 'immense' herds of bison. Upon reaching Fort Edmonton on December 30, Hector recorded that the inhabitants were well off this year given the close proximity of the bison (Spry 1968:200-201).

Hector continued west to Rocky Mountain House arriving there on January 14, 1858. At this location the bison were 'far out in the plains' as a result of an 'open winter' and the people were suffering from the shortage of bison meat (Spry 1968:210).

In contrast, the following year, 1859, sometime between late January and early February Palliser travelled to Rocky Mountain House amongst 'plenty of buffalo' (Spry 1968:342). This same year, Hector travelled from Fort Edmonton to visit the mountains around the Devils' Head (Spry 1968:346). South of modern Sundre, Hector learned that the bison were located at the edge of the woods (Spry 1968:149). Not surprisingly, on December 18, 1858, near the confluence of the Little Red Deer and the Red Deer River, the party observed a 'large' herd of bison to the east with the 'plains quite covered' (Spry 1968:359).

Hector's initial journey in the winter of 1857/1858 provides an important avenue for understanding winter bison herd distributions. Hector traveled from Fort Carlton (leaving December 15, 1857) to Rocky Mountain House (arriving on January 14, 1858) in one month's time. As Hector left Fort Carlton, the establishment appeared to have been reasonably well off for provisions. As he approached Whitewood Lakes, however, he commented on the suffering of the Native people due to the 'open winter' and the scarcity of bison. Fort Pitt, farther west, however, was well supplied with bison. Similarly, Hector's travels along the Vermilion River occurred amongst large numbers of bison. Fort Augustus (modern Edmonton), situated almost in the forest also had substantial bison resources nearby. Yet, at Rocky Mountain House, to the southwest of Fort Augustus, Hector recorded that the open winter had kept the bison on the plains. The next year, 1858, both Palliser and Hector record plenty of bison in the area of Rocky Mountain House (Spry 1968). These observations illustrate the patchy nature of bison distributions in the parkland and the tendency for the patchy distribution to change from year to year.

The patchy distribution of bison is an important phenomenon of overwintering in the parkland. In the past, when bison were found they tended to occur in very large numbers. In between these large patches of 'immense' herds of bison were areas where almost no bison were present. The importance of this distribution of bison rests in its influence on hunting methods employed by Native people.

In a previous section it was argued that during the fall, winter, and spring the most common form of hunting was pounding (see above, A Time to Pound, this Chapter). Beyond the historically known timing of the pounding phenomenon, there are theoretical reasons why the majority of bison kills (especially bison) occurred during these seasons. Recently, Driver (1990, 1995) examined hunter-gatherer societies from around the world to determine under what circumstances communal hunting occurred. From this research he argued that:

> First, in high latitudes [farther than 40° N or S], quality of meat and hides is of major importance in the decision to hunt communally, whereas in low latitudes the nutritional quality of meat and the properties of the hide are rarely stressed. Second, animal density is of major importance, although in higher latitudes animals tend to occur in dense groups during migrations, whereas in low latitudes the prey density may be attributed to a variety of factors. Third, there are fewer resource options available in many high latitude environments, and large mammal hunting by communal hunting is often a major subsistence strategy. Fourth, when scheduling decisions are made, communal hunting appears to rank as relatively undesirable when compared to agriculture, horticulture, seed gathering, and fishing.
> (Driver 1990:20-21)

From this Driver (1990:21) concluded hunter-gatherers living in high latitudes could be predicted, with substantial certainty, to conduct communal hunts especially during the fall. The fall was a period when the bison migrated in immense herds, their hides were well grown for winter, and the cows had reached a peak in nutrition quality and palatability (e.g., Speth and Spielmann 1983:3).

Driver (1990:21) then asked why communal hunts occur at all, when other methods are also possible (e.g., solitary stalking). In short, Driver (1990:21-28) suggested that, when the variables mentioned above occur, it is likely true that individual hunting is more efficient but communal hunting is more reliable. Given the migratory and clustered nature of the animals in question, Driver (1990:24) noted that reliability may be of more concern than efficiency. He summarised the reasons for communal hunting as follows:

> First, communal methods seem to provide a more efficient method for killing a good proportion of a herd of animals in societies where killing must occur at quite close range. Second, communal hunting methods are apparently able to provide great quantities of meat per day of hunting when prey is densely aggregated. This does not mean that communal hunting is necessarily more efficient in terms of energy gained as against energy expended. However, communal hunting often occurs in situations in which production of a surplus for long-term needs is more important than maintaining a short-term efficient use of

> energy. This is particularly true of higher latitudes in which few alternative food sources are available and in which acquisition of a winter supply of fat meat is of major significance for survival.
> (Driver 1990:29)

The interpretation of the 'buffalo year' and the timing of bison pounding from historic records correlate well with Driver's (1990) interpretation. In the historic literature Native people appear to congregate in large numbers at bison pounds through the fall, winter, and spring in relatively sedentary camps (e.g., Verbicky-Todd, also see above). Similarly, the vast majority of seasonally assessed archaeological pound/jump sites examined by this research were also assigned to fall, winter, and spring seasons. Likewise, the nature of bison behaviour, as determined in this research, suggests the animals occurred in large numbers when they migrated in the fall, remained clustered in large groups in the winter, and occurred in large numbers again during the migration in spring.

SUMMER DISTRIBUTION OF BISON

In sharp contrast, during the summer when bison were on the plains, the distribution of the animals seems to have been more continuous. Again, this can be illustrated by an example from the Palliser Expedition. On June 15, 1858, the second season of the Palliser expedition set out (Spry 1968:230). By June 21, the party was south of the Eagle Hills and had fallen in with a herd of bulls (Spry 1968:235). On June 23, they also note bison in large numbers near their position (Spry 1968:235). Importantly, on June 23, the expedition noted: "...as we were in want of meat, some of us ran a band of buffalo (Spry 1968:236). Again, on June 25, the expedition ran more bison (Spry 1968:238).

On July 1, the party observed that the buffalo were all in motion as if being hunted (Spry 1968:240). July 2, about two thousand bison were observed lying in a valley. On July 6, the party observed that bison were numerous, in fact, bison were so numerous the party formed a regulation to stop the useless kill of animals to conserve ammunition (Spry 1968:243). By July 13, provisions were low so Captain Palliser and two hunters went in search of meat and returned with six cows (Spry 1968:248). July 14, hunters set out for more meat and returned on July 15 with eleven animals (Spry 1968:248). Similarly, on July

16, the hunters went out in search of bison and returned with seven animals (Spry 1968:249).

By mid-July, the party is within site of the Devil's Head near modern day Innisfail (Spry 1968:255). However, the rut had commenced and the party encountered difficulty finding bison for the first time since they arrived on the plains. On July 24, the party noted that their provisions were getting low and hunters were sent off for food (Spry 1968:255). On July 25, they noted: "No animals to be got in the neighbourhood..." (Spry 1968:256). The situation worsened such that, on July 29: "We were then so driven for provisions that we were obliged to move to the south" (Spry 1968:256). However: "Our hunters had returned, but no buffalo were seen..." (Spry 1968:257). Finally, on July 30, near Beiseker and out of provisions the party found bison, lots of bison.

On July 31, Palliser and his party approached an intermingled herd of male and female bison (Spry 1968:258). The party noted: "...their peculiar grunt sounded like the roar of distant rapids in a large river, and causing a vibration also something like a trembling in the ground" (Spry 1968:258). As already noted in Chapter 4, there can be little doubt that the clustering of the animals, with males and females together, the continuous vocalizations, and the date (i.e., July 31) indicate the rut had commenced.

This sequence of encounters with bison on the plains illustrates an important phenomenon regarding bison herd distributions in summer. In the latter half of June and the first half of July, the Palliser Expedition continually encountered bison herds during its travels from the Eagle Hills towards headwaters of the Bow River as it enters the plains. Sometimes they encountered fairly large 'herds' of animals numbering in the thousands, but more commonly the herds were smaller. It was not until the rut began in mid-July that the animals became much more clustered. In fact, this clustering made encountering bison more difficult. Recall that George Catlin (1995:281) made this same observation.

Dodge (1883:282-286 in Roe 1951:525-526), writing from various locations along the Arkansas River in the modern U.S.A. between 1869 and 1873, noted the nature of bison spring migrations and the subsequent dispersal of bison on the plains; he wrote:

> Early in spring, as soon as the dry and apparently desert prairie had begun to change its coat of dingy brown to one of palest green, the horizon would begin to be dotted with buffalo, single, or in groups of

> two or three, forerunners of the coming herd. Thicker and thicker and in larger groups they come, until by the time the grass is well up the whole vast landscape appears a mass of buffalo, some individuals feeding, others standing, others lying down, but the herd moving slowly, moving constantly, to the northward...
>
> Some years, as in 1871, the buffalo appeared to move northward in one immense column, oftentimes from twenty to fifty miles in width, and of unknown depth from front to rear. Other years the northward journey was made in several parallel columns, moving at the same rate, and with their numerous flanks covering a width of a hundred or more miles.
>
> The line of march of this great spring migration was not always the same, though it was confined within certain limits. I am informed by old frontiersmen that it has not within twenty-five years crossed the Arkansas river east of Great Bend nor west of Big Sandy Creek. The most favoured routes crossed the Arkansas at the mouth of Walnut Creek, Pawnee Fork, Mulberry Creek, the Cimarron Crossing, and Big Sandy Creek.
>
> As the great herd proceeds northward it is constantly depleted, numbers wandering off to the right and left until finally it is scattered in small herds far and wide over the vast feeding-grounds where they pass the summer...
>
> (Dodge 1883:282-286 in Roe 1951:525-526)

This descriptive account of the spring migration to the plains illustrates that the large migrating herd slowly broke up into much smaller groups of animals. And that these small groups of animals summered as scattered herds across the plains.

Winterhalder (1981:31), using optimal foraging theory, has argued that evenly distributed resources are optimally recovered by dispersed individuals or small social units while mobile-clustered resources are optimally recovered by the aggregation of the individuals or social units at a central location. As just discussed, this research suggests bison were relatively more scattered and evenly distributed during the summer on the plains. Not surprisingly, ethnographic accounts of communal hunting in the summer are rare (e.g., Verbicky-Todd 1984). As well, only one seasonally assessed archaeological pound/jump site examined during this research was assigned to the summer season (i.e., Ramillies). As well, ethnographic records indicate that summer was a period of high group mobility (e.g., Uhlenbeck 1912; Ewers 1955, 1958).

Still, communal bison kills apparently occurred on the plains in the summer. The technique employed, called a surround, differed from those previously mentioned (i.e., pound and jump) in that it: "...was executed by a group of people on foot and/or horseback by stealthily forming a circle around a herd, closing in upon it, causing the buffalo to mill around inside the gradually contracting circle; as the Indians advanced, they shot the animals, usually with bows and arrows" (Verbicky-Todd 1984:133). Grinnell (1962:234), Ewers (1958:11), and Uhlenbeck (1912:41) considered the surround on foot as a method commonly employed by Native people on the pedestrian plains in the summer. In fact, Grinnell (1962: 233-234) recorded the circumstances under which the surround would be used: "Occasionally it would happen that for a long time the buffalo would not be found in a place favourable for driving over the cliff or into a pen". Still, Henry Kelsey provided the only account of a surround on the northern plains, he wrote:

> This Instant y^e Indians going a hunting Kill'd great store of Buffillo Now y^e manner of their hunting these Beasts on y^e Barren ground is when they see a great parcel of them together they surround them w^{th} men w^{ch} done they gather themselves into a smaller Compass Keeping y^e Beast still in y^e middle & so shooting y^m till they break out at some place or other & so gett away from y^m our women Likewise pitched according to order dist 12 Miles.
>
> (Warkentin 1994:8)

The ability of Henry Kelsey's party to kill a 'great store of buffalo' seems to contradict the notion that bison were scattered and dispersed on the plains in summer. Yet, the above passage was dated August 23, 1691, a date consistent with the middle of the rut when large numbers of bison would be expected to have congregated. Perhaps the surround was the technique used, as Grinnell observed, when a cliff or pound was not available on the plains in the summer. But, it was only used on the plains in the 'summer' once the rut had commenced (roughly mid-July) and the animals were in large gatherings. It is still suggested that once the spring migrations had reached the plains in late April or May communal hunting was largely not possible until mid-July when the animals congregated for the rut.

OVERWINTERING AND THE IMPORTANCE OF STORAGE

One of the explanations that Driver (1990) provided with regards to 'why' communal hunting occurred was that it provided surplus that could be stored for future use. Storage, in itself, "...is a principal means of averaging the temporal availability of resources...", and in the case used here stored goods: "...serve as a dietary staple during periods of seasonal scarcity" (Goland 1991:107-108). Similarly, Goland (1991: 108-109) theorises that storage is expected to occur when the resource to be stored can be collected in predictable high yields. Predictability, however, can be understood in terms of two concepts: constancy and contingency. The former occurs when the resource occurs in an unchanged state throughout the year while the latter occurs when the resource associated with some interval within the year, returns to that state year after year (Goland 1990:109). Thus, a resource that exhibits temporal constancy provides no need for storage. However, a resource that exhibits temporal contingency would be expected to be stored as it presents people with periods of seasonal resource scarcity (Goland 1991:110; Driver 1990). Still, if resource yield during availability is too low to provide surplus, the site might still be seasonally occupied but storage would not occur. Alternatively, if resource yields during availability are very high, full-time occupation of the site via storage is possible (Goland 1991:110).

It can be argued that one of the most challenging aspects of the lives of past Native people on the northwest Plains was overwintering. For example, Matthew Cocking provided a telling remark about hunger in the parkland periphery; he stated: "The Natives suffer hunger, &c. with surprising patience. Several stragglers from the Asinepoet Natives joins us, who all complain of want of food" (Burpee 1908:113). People dependent on the bison had learned to cope with periods of hunger.

Still, the movement of bison to their wintering grounds congregated the animals into large groups. This process was highly predictable from year to year, at a regional level, and produced high yields at bison pounds throughout the parkland. "The highly contingent availability of resources, high productivity of the resource base, and the year-to-year predictability make storage an appropriate and efficacious choice for solving the problem of temporal availability" (Goland 1991:111).

On the plains in summer the bison were scattered more evenly throughout the environment. This high level of temporal constancy was unlikely to elicit storage. Ideally, the availability of bison was relatively constant and there were few fluctuations in bison populations to be averaged (Goland 1991:110).

STORAGE, INFORMATION, AND THE TIMING OF THE SUN DANCE

There is a problem concerning the previous argument regarding the storage of bison resources during high yields of animals especially in the fall, but in winter and spring as well. The argument accommodated the temporal resource availability of bison but it failed to accommodate the spatial resource availability. Pooling resources through population mobility and/or resource exchange, that is moving people to food or food to people, respectively, is a principal means of averaging the spatial availability of resources (Goland 1991:107; Wiessner 1982).

It has been demonstrated that in fall, winter, and spring there were bison in the parkland. This was highly predictable. Even during open winters the bison occurred in the parkland (e.g., Fidler's overwintering of 1792/3). The patchy distribution of the animals through the parkland, however, presented problems for the spatial constancy of bison resources. Following the previous example from the Palliser Expedition, while Native people enjoyed high yields at a bison pound near Fort Augustus, another group of Native people were starving at a pound prepared near Rocky Mountain House.

An obvious solution to this asynchronous spatial distribution of bison would be to move the people in need to the location of resource surplus or, vice versa, move the resource surplus to the people via storage. There is a problem, however, with this solution. The people in need have no way of finding out the others have been successful or how to locate them. Of course, a good opportunity to gather information about the future plans of other members of the larger group is during communal encounters such as communal hunts and ceremonial gatherings.

Even better, the best time to have gathered information on the likely distribution of bison through the winter and the people who followed them occurred as the bison moved towards their wintering grounds in late summer. At this time, the rut commenced around the periphery of the plains and the animals were in large enough numbers to support communal hunting by a large group of people (e.g., Hind 1971 Vol. 2:142-143). To avoid disturbing the bison, the gathering would have occurred 'in behind' the bison migrations towards the open plains. From this vantage point on the plains, looking towards the rutting bison near the parkland, Native people could have observed their movements and predicted their likely wintering locations. Observations of this kind were recorded for the Blackfoot by Uhlenbeck (1912:7-8) and Grinnell (1962:234) (transcribed above in 'Information Strategies').

From these locations, each group could have assessed their observations of bison and, thus, have determined the wintering locality they felt might bring success in pounding bison. Upon having taken up residence at a desired wintering locality, each group likely shared any and all information regarding subsistence, etc. with the other groups via runners. Hence, runners announced the success or failure of pounding events throughout the parkland and those in need would be informed of where there were surpluses (Ethnographically, it does not appear that runners took surpluses with them, rather they informed people where to move to get surpluses).

Based on historic observations, the timing of the proposed gathering with the purpose of information sharing corresponds roughly with the annual occurrence of the Sun Dance. The Sun Dance of the Blackfoot has been noted to occur in summer when the saskatoon berries were ripe (Dempsey 1965:6; Grinnell 1962:264; McClintock 1968:178; Ewers 1955:128). Today these berries ripen from early July through August (Kuhnlein and Turner 1991:234) or the same time as the bison were rutting. In the past, the Sun Dance of the Blackfoot was: "...essentially a religious festival, undertaken for the bodily and spiritual welfare of the people according to their beliefs" (Grinnell 1962:268; see also McClintock 1968:170).

It is hypothesised that the timing of the Sun Dance was originally determined by the need to observe bison going to the parkland to take up wintering locations. Just when this gathering for bison reconnaissance and the Sun Dance were initially wedded is difficult to determine. Regardless, this hypothesis dictates that Sun Dance lodges should be located on the open plains some distance 'behind' the migrating bison herds during their rut around the periphery of the plains.

A number of Sun Dance lodges are known from equestrian times while bison were still numerous. In 1858, John Palliser 1858, noted a Blackfoot Sun Dance lodge two miles south of the Battle River near upper Ribstone Creek (Spry 1968:244). Interestingly, on July 9, 1859, Palliser recorded a large gathering of Blackfoot people (n = 400-500 tents) on the south side of the Red Deer river near its confluence with Bull Pound Creek. This gathering did not appear, however, to be related to the Sun Dance (Spry 1968:410).

Wissler (1911) recorded numerous Sun Dance localities of the Blackfoot. In Elk-horn's winter count, starting in 1845, Wissler (1911:45-46) noted a Sun Dance at Crow Garden in 1845, a Sun Dance at the Yellow River in 1846 and 1851, a Sun Dance near the wintering place on the Marias in 1847, two Sun Dances in one year down the Missouri from the Teton, and a Sun Dance at High Ridge in 1859. Wissler (1911:48) noted a second winter count by Big-brave in which a Sun Dance occurred in the Sweet Grass Hills. As well, Jackson (2000:131) noted Rising Head's participation in a Sun Dance near the mouth of Badger Creek on Two Medicine Lodges River in the 1820s.

Although some of the locations of these Sun Dance lodges could not be located precisely, those that were located occured very near to the plains-parkland interface or near the edge of the most western foothills of the Rocky Mountains. These locations would have been very close to the aggregations of rutting bison at the parkland periphery.

SUMMARY

In the summer months, when the bison were located on the plains in relatively small scattered herds, the people of the Old Women's phase travelled across the plains in small family groups from berry patch to berry patch following in the footsteps of their ancestors. Scouts were sent ahead to determine when each patch was ripe for harvesting. The close monitoring of the berries was due to their roles as important foods during the summer and even more importantly as dried foods used to overwinter during the extreme cold months of the plains winter.

As the weather grew cooler the people of the Old Women's phase began to move towards the parkland or river valleys to enjoy the comfort of the treed areas in winter. Bison aggregated for the rut at the plains-parkland periphery; the aggregation of bison made pounding the animals more feasible. The people of the Old Women's phase began to gather at predetermined localities in order to observe the bison as they moved toward the parkland and to conduct the Sun Dance. From some distance behind the rutting animals these people sent out scouting parties to determine where the animals might winter.

While congregated, the people of the Old Women's phase agreed upon the overwintering locations of all the family groups based on their observations of the rutting/migrating bison. Thus, in the absence of bison at one predicted locality, the unfortunate group would know where their nearest neighbour was residing. This arrangement was significant as the bison became quite clustered in the parkland. Thus, when any group was fortunate enough to have camped close to numerous wintering bison they pounded the animals and made as much stored meat as possible. One could never be too sure when the bison might move or when less fortunate people might arrive needing food.

CHAPTER EIGHT: CONCLUSIONS

INTRODUCTION

The aim of this research was twofold. The first aim was to address the lack of consensus concerning the nature of bison movements on the northwestern Plains. The second aim was to describe and understand the corresponding response of Native people. The former was achieved while the latter has been addressed in a substantial manner.

THE BUFFALO YEAR

Three general models of bison movements have been suggested for the northwestern Plains. Most commonly, researchers have argued that bison herds summered on the open plains and wintered in the parkland, large river valleys, and wooded uplands. The movements of Native people were considered largely to parallel this seasonal movement between plains and parkland. As well, the relatively regular and predictable movement of the bison provided the opportunity for Native people to consistently use intercept strategies to procure them.

In contrast, numerous researchers have argued that bison were erratic and unpredictable except, perhaps, in terms of movements at the local level. Still other researchers have suggested that large scale movements did not occur and bison herds largely remained on the plains throughout the year. In these two scenarios, Native people could have only procured bison based on an encounter strategy or a herd-following strategy.

An evaluation of historic documents containing references to bison in the context of the 'buffalo year' suggested that bison migrated from the plains in summer to the parkland in winter. The 'buffalo year' -- or the annual cycle of bison behaviours -- was developed from modern bison ethology. Five periods were differentiated within the 'buffalo year'. In Period I (mid-April to the end of June), the bison are on their wintering grounds and beginning to move to their summering grounds. The cows deliver most of their calves in this period with a calving peak in the first two weeks of May. Since the animals are migrating at this time, bison calves tend to be born near the plains-parkland interface. The animals leave abruptly with the males often lagging behind. Usually by the end of May the vast majority of bison, with the exception of a few bulls, are on their summering grounds.

Period II (end of June to mid-July) is the time during which the animals feed on their summering grounds with few other distractions.

Period III (mid-July and end of September) is the bison's mating season -- the rut. At this time the animals congregate at the edge of their summering ground as part of their migration to the wintering grounds. Males display (i.e., pawing, horning, wallowing, and bellowing) in order to arrange themselves in a mating hierarchy. Females apparently scent mark treed areas to announce their receptiveness. The proximity of the rut to the wintering grounds make it possible for animals to be born in roughly the same area they were conceived.

In Period IV (end of September to mid-November) the migration that began with rut ends with the arrival of the animals in their wintering grounds. Usually, the bull groups arrive first followed by the mixed groups.

Period V (mid-November to mid-April) can be divided in three sub-periods. From mid-November to December the animals begin to settle in to their wintering grounds. In January and February, typically the coldest months of the winter, the animals occur in their largest numbers in the wintering grounds. And in March and mid-April the animals become restless as they prepare to move to their summering grounds, they begin shedding their coats, and some calves are born.

The application of this model to references to bison in historic documents allowed for an understanding of the nature of bison movements in prehistory. In mid-April to the end of June (Period I) bison in the historic literature were in the parkland on their wintering grounds. They began to migrate to their summering grounds on the plains and conducted most of their calving. As well, calving did occur predominantly at the plains-parkland interface. The animals were largely out on the plains by the end of May.

Between the end of June and mid-July (Period II) the animals were on their summering grounds on the plains. Foraging was the main concern at this time.

From mid-July to the end of September (Period III) was the mating season of the bison in the historic literature. Just like their modern counterparts the bulls arranged themselves into a hierarchy by displays involving pawing the ground, horning trees, wallowing, and bellowing. The location of the rut can be demonstrated to have occurred on the summering grounds of the plains around the plains-parkland periphery. The rut also provided the initial stage of the bison's return migration to their wintering grounds in the parkland.

Between October and mid-November (Period IV) the bison completed their migration off their summering grounds. Historic documents illustrated that, just like today, bulls arrived first on the wintering grounds with the mixed groups arriving within weeks of the males.

From mid-November to mid-April (Period V) a number of developments occurred. Between mid-November and the end of December the bison settled into their wintering grounds in the parkland. In January and February, with the onset of the coldest part of winter, the bison usually aggregated in very large numbers on their wintering grounds. Then, between March and mid-April, the bison appeared to be restless, they had begun to shed their coats, the odd calf was born, and there were inklings of a shift to the summering grounds on the plains.

Warm temperatures, burning, and over hunting were a few variables that altered the scenario described above. On a regional level, bison behaviour was relatively predictable, but, on a local level, bison behaviour became less predictable.

THE SEASONAL ROUND AND MORE

A firm understanding of the movements of bison on the prehistoric northwestern Plains presents numerous implications for archaeology. Simply, the seaonal round appears to involve movements on and off the plains during summer and winter, respectively. The development and implementation of dental cementum increment analysis indicated that the settlement pattern of people during the Old Women's phase largely paralleled the movements of bison. In the summer, sites were located on the plains. In winter, sites were located on the parkland periphery and large river valleys. All but one kill site were winter events. The seasonal round or the annual cyclical movements of the people of the Old

Women's phase illustrated that 'ultimately' their subsistence was largely focused on bison procurement.

Still, these people did not simply follow the bison around. In spring, the bison would leave the parkland and return to the plains. Owing to the unpredictable weather the people of the Old Women's phase did not follow the bison immediately. Stored food from winter bison kills may have been vital at this time of year. In late spring the people of the Old Women's phase moved onto the plains and found the animals in relatively small scattered herds. This made daily encounters with bison common allowing relatively small groups of people to travel from berry patch to berry patch with few subsistence concerns. Scheduling of visits to berry patches were determined from reports brought in by scouts. Large amounts of berries were dried in the summer for use in winter.

As fall approached the bison began to aggregate for the rut. At this time people of the Old Women's phase also congregated in substantial groups. These groups followed in behind the bison watching their movements for signs of where the animals would winter. When the people separated to begin their fall hunts at intercept sites, they were cognizant of where other groups of their people would be wintering. If the bison failed to behave as predicted the unfortunate group of people could always visit a neighbour for assistance. It is possible that this information gathering process was wedded with the Sun Dance known in historic times as they are hypothesised to co-occur geographically and temporally.

The location of fall bison kills were often as far out on the plains as possible but still within reach of wood for pound construction and fuel for campfires. These were intercept sites prepared for the predicted arrival of the animals after the rut. The migratory bison entered the parkland in large groups. When a kill site was successful, large stores would be put up in case of later shortages or the arrival of less fortunate people from another area.

Bison kills occurred throughout the winter in the parkland. Sometimes the bison were deeper into the parkland than other years, but the animals rarely ventured much beyond the plains-parkland interface. Here, winter forage was good, shelter was nearby if needed, and there were open spaces allowing young bison to avoid predation.

With the arrival of spring, the annual cycle began anew.

REFERENCES

Adams, Gary F.
1977 *The Estuary Bison Pound Site in Southwestern Saskatchewan.* Mercury Series No. 68. National Museum of Man, Archaeological Survey of Canada, Ottawa.

Allen, Joel A.
1876 *The American Bisons, Living and Extinct.* Memoirs of the Museum of Comparative Zoology, IV No. 10. Cambridge, Mass.

Armstrong, G.G.
1965 An Examination of Cementum of the Teeth of Bovidae with Special reference to its Use in Age Determination. Unpublished MA Thesis, Department of Zoology, University of Alberta, Edmonton, Alberta.

Arthur, George W.
1962 The Emigrant Bison Drives of Paradise Valley, Montana. In *Symposium on Buffalo Jumps*, Montana Archaeological Society, Memoir 1, May. Edited by Carling Malouf and Stuart Conner.

1974 An Introduction to the Ecology of Early Historic Communal Bison Hunting Among the Northern Plains Indians. Ph.D. Dissertation, University of Calgary, Calgary, Alberta.

1975 *An Introduction to the Ecology of Early Historic Communal Bison Hunting Among the Northern Plains Indians.* National Museum of Man Mercury Series No. 37. National Museums of Canada, Ottawa.

1978 A Re-Analysis of the Early Historic Plains Indian Bison Drives. *Plains Anthropologist* Memoir 14, 23(82):236-242.

Audubon, Maria
1969 *Audobon and His Journals*, 2 vols. Dover, New York.

Bain, James
1969 *Travels and Adventures in Canada and the Indian Territories Between the Years 1760 and 1776.* M.G. Hurtig Ltd., Edmonton.

Bamforth, Douglas B.
1987 Historical Documents and Bison Ecology on the Great Plains. *Plains Anthropologist* 32(115):1-16.

1988 *Ecology and Human Organization on the Great Plains.* Plenum Press. New York.

1999 Theory and Inference in Plains Archaeology. *Plains Anthropologist* 44(169):209-229.

Barrett, S. A.
1921 The Blackfoot Iniskim or Buffalo Bundle. *Year-book of the Public Museum of the City of Milwaukee* I:80-84.

Bar-Yosef, Ofer
1998 Introduction. In *Seasonality and Sedentism: Archaeological Perspectives From Old and New World Sites.* Edited by Thomas R. Rocek and Ofer Bar-Yosef, pp. 1-8, Smithsonian Institution Press, Washington, D.C.

Beardsley, Richard, Preston Holder, Alex Krieger, Betty Meggers, John B Rinaldo, and Paul Kutsche
1956 Functional and Evolutionary Implications of Community Pattering. *Seminars in Archaeology 1955, Society of American Archaeology Memoir 11*:129-157.

Beasley, M.J., W.A.B. Brown, and A.J. Legge
1992 Incremental Banding in Dental Cementum: Methods of Preparation for Teeth from Archaeological Sites and for Modern Comparative Specimens. *International Journal of Osteoarchaeology* 2:37-50.

Berger, Joel, and Carol Cunningham
1991 Bellows, Copulations, and Sexual Selection in bison (*Bison bison*). *Behavioural Ecology* 2(1):1-6.

Bettinger, Robert
1991 *Hunter-gatherers: Archaeological and Evolutionary Theory*. Plenum Press, New York.

Bettinger, Robert, and Martin Baumhoff
1982 The Numic Spread: Great Basin Cultures in Competition. *American Antiquity* 47(3):486-503).

Billman, Brian R.
1999 Settlement Pattern Research in the Americas. In *Settlement Pattern Studies in the Americas: Fifty Years Since Viru.* Edited by Brian R. Billman and Gary M. Feinman, pp. 1-5, Smithsonian Institution Press, Washington, D.C.

Binford, Lewis R.
1962 Archaeology as Anthropology. *American Antiquity* 28:217-225.

1965 Archaeological Systematics and the Study of Cultural Process. *American Antiquity* 31(2):203-210.

1978 Dimensional Analysis of Behavior and Site Structure: Learning from an Eskimo Hunting Stand. *American Antiquity* 43(3):330-361.

1980 Willow Smoke and Dogs' Tails: Hunter-gatherer Settlement Systems and Archaeological Site Formation. *American Antiquity* 45(1):4-20.

1982 The Archaeology of Place. *Journal of Anthropological Archaeology* 1:5-31.

1983 Long-term Land-use Patterning: Some Implications for Archaeology, In *Lulu Linear Punctuated: Essays in Honor of George Irving Quimby*. edited by R. Dunnell and D. Grayson. Ann Arbor; University of Michigan, Museum of Anthropology, Anthropological Papers no. 72:27-53.

Bodkin, James L., Jack A. Ames, Ronald J. Jameson, Ancel M. Johnson, and Gary M. Matson

1997 Estimating Age of Sea Otters with Cementum Layers in the First Premolar. *Journal of Wildlife Management* 61(3):967-973.

Bourque, Bruce J., Kenneth Morris, and Arthur Spiess

1978 Determining the Season of Death of Mammal Teeth from Archeological Sites: A New Sectioning Technique. *Science* 199:530-531.

Bowyer, R. Terry, Xavier Manteca, Amund Hoymork

1998 Scent Marking in American Bison: Morphological and Spatial Characteristics of Wallows and Rubbed Tree. In *International Symposium on Bison Ecology and Management in North America.* Edited by L. Irby and J. Knight, pp. 81-91. Montana State University, Bozeman, Montana.

Branch, E. Douglas

1929 *The Hunting of the Buffalo*. University of Nebraska Press, Lincoln (Reprinted 1997).

Brink, Jack, Milt Wright, Bob Dawe, and Doug Glaum

1986 *Final Report of the 1984 Season at Head-Smashed-In Buffalo Jump, Alberta.* Manuscript Series No. 9, Archaeological Survey of Alberta.

Brown, Jennifer S.H., and Elizabeth Vibert

1996 Introduction. In *Reading Beyond Words: Contexts for Native History*. Edited by Jennifer S.H. Brown and Elizabeth Vibert. Broadview Press, Peterborough.

Brumley, John H.

1971 Preliminary Report on Area A, Wahkpa Chu'gn Site (24HL101): Results of the 1970 Field Season. *Archaeology in Montana* 12(1):11-39.

1973 Quantitative Methods in the Analysis of Butchered Faunal Remains: A Suggested Approach. *Archaeology in Montana*, Vol. 14, No. 1, pp. 1-40.

1975 Radiocarbon Dates from the Wahkpa Chu'gn Site. *Archaeology in Montana* 16(3):105-116.

1976 *Ramillies: A Late Prehistoric Bison Kill and Campsite Located in Southeastern Alberta Canada*. National Museum of Man Mercury Series, Archaeological Survey of Canada, Paper No. 55. Ottawa.

1995 *Prehistoric Settlement and Subsistence in the Plains of Southern Alberta and Northern Montana: The Seasonality Evidence*. Report on file with Alberta Public Works, Supply and Services. Edmonton.

Brumley, John H., and Barry J. Dau
1988 *Historical Resource Investigations Within the Forty Mile Coulee Reservoir*. Manuscript Series No. 13, Archaeological Survey of Alberta, Edmonton.

Brumley, John H., and Carol Rushworth
1983 A Summary and Appraisal of Alberta Radiocarbon Dates. In *Archaeology in Alberta 1982*. Edited by David Burley, pp. 142-160, Occasional Paper No. 21, Archaeological Survey of Alberta, Edmonton.

Brumley, John H., and Patrick J. Rennie
1993 The Results of Investigations at the King Site along the Eastern Margins of the Little Rocky Mountains - *Part I: Text*. Unpublished Manuscript in Possession of the Author.

1995 A Culture History Model For the Plains of Northern Montana and Surrounding Regions. Unpublished Manuscript in Possession of the Author.

1999 The King Site Along the Eastern Margins of the Little Rocky Mountains. *Archaeology in Montana* 40(1):31-107.

Brumley, John H., and Trevor R. Peck
2000 On the Seasonal Nature of Prehistoric Settlement and Subsistence in the Plains of Southern Alberta and Northern Montana (2 Volumes). Report on file with the Bureau of Land Management, Lewiston Field Office, Lewiston.

Burke, Ariane M
1995 *Prey Movements and Settlement Patterns During the Upper Palaeolithic in Southwestern France*. Oxford: British Archaeological Reports, International Series no. 619.

Burke, A., and J. Castanet
1995 Histological Observations of Cementum Growth in Horse Teeth and Their Application to Archaeology. *Journal of Archaeological Science* 22:479-493.

Burpee, Lawrence J.
1908 *Journal of Matthew Cocking, From York Factory to the Blackfeet Country, 1772-73.* Royal Society of Canada Section 11:89-121.

1973 *The Journal of Anthony Hendry, 1754-55, York Factory to the Blackfeet Country.* Edited by Lawrence Burpee, pp.1-51, Canadiana House, Toronto.

Byrne, William J.
1973 *The Archaeology and Prehistory of Southern Alberta as Reflected by Ceramics* (3 Volumes.). National Museum of Man, Mercury Series, Archaeological Survey of Canada, No. 14, Ottawa.

Calef, George W., and Jack Van Camp
1987 Seasonal Distribution, Group Size and Structure, and Movements of bison herds. In *Bison Ecology in relation to Agricultural Development in the Slave River Lowlands, NWT.* Edited by H.W. Reynolds and A.W.L. Hawley. Occasional Paper Number 63, Canadian Wildlife Service.

Callenbach, Ernest
1996 *Bring Back the Buffalo! A Sustainable Future for America's Great Plains.* University of California Press, Los Angeles.

Carbyn, L.N., S.M. Oosenbrug, and D.W. Anions
1993 *Wolves, Bison...and the Dynamics Related to the Peace-Athabasca Delta in Canada's Wood Buffalo National Park.* Circumpolar Research Series Number 4, Canadian Circumpolar Institute, University of Alberta. Art Design Printing Inc. Edmonton.

Carbyn, L.N., and T. Trottier
1987 Responses of Bison on Their Calving Grounds to Predation by Wolves in Wood Buffalo National Park. *Canadian Journal of Zoology* 65:2072-2078.

1988 Descriptions of Wolf Attacks on Bison Calves in Wood Buffalo National Park. *Arctic* 41(4):297-302.

Catlin, George
1995 *Letters and Notes on the North American Indians* (2 Vols.) JG Press. Mass.

Chang, Kwang-Chih
1958 Study of the Neolithic Social Grouping: Examples from the New World. *American Anthropology* 60(2):298-334.

1962 A Typology of Settlement and Community Patterns in Some Circumpolar Societies. *Arctic Anthropologist* 1(1):28-41.

Chatters, James C.
1987 Hunter-gatherer Adaptations and Assemblage Structure. *Journal of Anthropological Archaeology* 6:336-375.

Chisholm, Brian, Jonathan Driver, Sylvain Dube, and Henry P. Schwarcz
1986 Assessment of Prehistoric Bison Foraging and Movement Patterns via Stable-Carbon Isotopic Analysis. *Plains Anthropologist* 31(113):193-205.

Close, Angela E.
2000 Reconstructing Movement in Prehistory. *Journal of Archaeological Method and Theory* 7(1):49-77.

Clow, Richmond
1995 Bison Ecology, Brule and Yankton Winter Hunting, and Starving Winter of 1832-33. *Great Plains Quarterly* 15:259-270.

Cocking, Matthew
1908 *Journal of Matthew Cocking, From York Factory to the Blackfeet Country, 1772-73.* Edited by Lawrence Burpee. Royal Society of Canada Section 11:89-121.

Coppedge, Bryan R., and James H. Shaw
1996 Effects of Horning and Rubbing Behaviour by Bison (*Bison bison*) on Woody Vegetation in a Tallgrass Prairie Landscape. *American Midland Naturalist* 138(1):189-196.

Coues, Elliott
1965 *The Manuscript Journals of Alexander Henry, Fur Trader of the Northwest Company, and [1897] of David Thompson, Official Geographer and Explorer of the same Company 1799-1814* (2 Vols.). Ross and Haines, Inc., Minnesota, Minneapolis.

Cowie, Isaac
1913 *The Company of Adventurers: A Narrative of Seven Years in the service of the Hudson's Bay Company During 1867-1874 on the Great Buffalo Plains with Historical and Biographical Notes and Comments.* William Briggs, Toronto.

Coy, J.P., R.T. Ross, and K.A. Turner
1982 Absolute Ageing of Cattle from Tooth Sections and its Relevance to Archaeology. In *Ageing and Sexing Animal Bones from Archaeological Sites.* Edited by Bob Wilson, Caroline Grigson, and Sebastian Payne. BAR Bristish Series 109.

Coy, Pamela L., and David L. Garshelis
1992 Reconstructing Reproductive Histories of Black Bears from the Incremental Layering in Dental Cementum. *Canadian Journal of Zoology* 70:2150-2160.

Crowe-Swords, David B., and Margaret Hanna
1980 EfPm-27: Report on the 1979 Excavations. Report on file at Fish Creek Provincial Office.

Curtis, Edward S.
1911 *The North American Indian*, Volume 6. Johnson Reprints.

Dau, Barry
1990 Oldman River Dam Prehistoric Archaeological Mitigation Programme Stone Feature Study: Investigations at the Blakiston Site (DjPm-115). ASA Permit 90-18, Volume 1 and 2. Consultant Report (Ethos Consultants Ltd.) for Alberta Public Works, Supply and Service. Copy on file, Alberta Culture and Multi-Culturalism, Archaeological Survey of Alberta, Edmonton.

Davis, Leslie B., and Emmett Stallcop
1966 The Wahkpa Chu'gn Site (24HL101): Late Hunters in the Milk River Valley, Montana. *Archaeology in Montana, Memoir 3*. Milk River Archaeological Society, Havre.

Dempsey, Hugh A.
1965 *A Blackfoot Winter Count*. Glenbow Foundation, Calgary.

Dodge, Colonel Richard Irving
1883 *Our Wild Indians*. Hartford, Connecticut.

Driver, Jonthan C.
1990 Meat in Due Season: The Timing of Communal Hunts. In *Hunters of the Recent Past*. Edited by L.B.Davis and B.O.K. Reeves, pp. 11-33. Unwin Hyman, London.

1995 Social Hunting and Multiple Predation. In *Before Farming: Hunter-gatherer Society and Subsistence*. Edited by Douglas V. Campana, pp. 23-38, MASCA Research Papers in Science and Archaeology, Supplement to Volume 12. MASCA, University of Pennsylvania Museum of Archaeology and Anthropology.

Dyck, Ian
1983 The Prehistory of Southern Saskatchewan. In *Tracking Ancient Hunters: Prehistoric Archaeology in Saskatchewan*. Edited by Henry T. Epp and Ian Dyck, pp. 63-139. Saskatchewan Archaeological Society, Saskatoon.

Epp, Henry T.
1988 Way of the Migrant Herds: Dual Dispersal Strategy Among Bison. *Plains Anthropologist* 33(121):309-320.

Ewers, John C.
1955 *The Horse in Blackfoot Indian Culture, with Comparative Material from Other Western Tribes.* Bureau of American Ethnology, Bulletin 159.

1958 *The Blackfeet: Raiders of the Northwest Plains.* University of Oklahoma Press, Norman.

1968 *Indian Life on the Upper Missouri.* University of Oklahoma Press, Norman.

Fandos, Paulino, Jorge F. Orueta, and Yolanda Aranda
1993 Tooth Wear and its Relation to Kind of Food: The Repercussion on Age Criteria in *Capra pyenaica. Acta Theriologica* 38(1):93-102

Fidler, Peter
1967 *Saskatchewan Journals and Correspondence: Edmonton House 1795-1800, Chesterfield House 1800-1802.* Edited by Alice M. Johnson. The Hudson's Bay Company. London.

Fish, Suzanne
1999 The Settlement Pattern Concept from an Americanists Perspective. In *Settlement Pattern Studies in the Americas: Fifty Years Since Virú.* Edited by Brian R. Billman and Gary M. Feinman, pp. 203-208, Smithsonian Institution Press, Washington, D.C.

Flannery, Kent V.
1968 Archaeological Systems Theory and Early Mesoamerica. In *Anthropological Archaeology in the Americas.* Edited by B.J. Meggers. pp. 67-87. Anthropological Society of Washington, Washington, D.C.

Forbis, R. G.
1960 Some Late Sites in the Oldman River Region, Alberta. *Contributions to Anthropology, 1957.* National Museum of Canada Bulletin 162:119-164. Ottawa.

1970 *A Review of Alberta Archaeology to 1964.* Publications in Archaeology, No. 1. National Museum of Canada. Ottawa.

Frantz, Donald G., and Norma Jean Russell
1989 *Blackfoot Dictionary of Stems, Roots, and Affixes.* University of Toronto Press: Toronto.

Frison, George
1967 *The Piney Creek Sites, Wyoming*. University of Wyoming Publications, XXXIII, Nos. 1, 2, and 3.

1968 Site 48SH406: An Early Middle Period Bison Kill in the Powder River Basin of Wyoming. *Plains Archaeologist*, Vol. 113, No. 39, pp. 31-40.

1970a The Kobold site: A Post-Altithermal Record of Buffalo-jumping for the Northwestern Plains. *Plains Anthropologist*, Vol. 13, No. 39.

1970b The Glenrock Buffalo Jump, 48CO304. *Plains Anthropologist*, Memoir No. 7, Vol. 15, Part 2.

1971 The Buffalo Pound in Northwestern Plains Prehistory: Site 48CA302, Wyoming. *American Antiquity*, Vol. 36, No. 1.

1973 *The Wardell Buffalo Trap 48SU301: Communal Procurement in the Upper Green Basin, Wyoming*. Museum of Anthropology, Anthropological Papers, No. 48. University of Michigan, Ann Arbor.

1974 *The Casper Site*. Academic Press, Inc., New York.

1991 *Prehistoric Hunters of the High Plains*. Academic Press, Inc., Second Edition, Toronto.

Frison, George C., and Charles A. Reher
1970 Age Determination of Buffalo by Teeth Eruption and Wear. In The Glenrock Buffalo Jump, 48CO304. *Plains Anthropologist* Memoir 7, Part 2.

Frison , George C., Michael Wilson, and D. N. Walker
1978 *The Big Goose Creek Site: Bison Procurement and Faunal Analysis*. Occasional Papers on Wyoming Archaeology No. 1 Department of Anthropology, University of Wyoming. Laramie, Wyoming.

Fuller, W.A.
1959 The Horns and Teeth as Indicators of Age in Bison. *Journal of Wildlife Management* 23(3):342-344.

1960 Behaviour and Social Organization of the Wild Bison of Wood buffalo National Park, Canada. *Arctic* 13(1):3-19.

Gard, Wayne
1960 *The Great Buffalo Hunt*. Alfred A. Knopf, New York.

Garretson, S. Martin
1938 *The American Bison, The Story if its Extermination as a Wild Species and its Restoration Under Federal Protection*. New York Zoological Society, New York.

Gasaway, William C., David B. Harkness, and Robert a. Rausch
1978 Accuracy of Moose Age Determinations from Incisor Cementum Layers. *Journal of Wildlife Management* 42(3):558-563.

Geist, Valerius
1996 *Buffalo Nation: History and Lengend of the North American Bison*. Fifth House Publishers, Calgary.

Gibson, Terrance
2001 Management Summary of Archaeological Work Undertaken in the South Bodo Oilfield (FaOm-1) for Murphy Oil Company in 2000. Permit 2000-116. Alberta Western Heritage, St. Albert, Alberta.

Giering, Karen L., and Trevor R. Peck
1998 A Ceramic Vessel from the Blakiston Site (DjPm-115), S.W. Alberta. *Alberta Archaeological Review* 28:20-24.

Goland, Susan K.
1991 The Ecological Context of Hunte-Gatherer Storage: Environmental Predictability and Environmental Risk. In *Foragers in Context: Long-term, Regional, and Historical Perspectives in Hunter-Gatherer Studies*. Edited by Preston T. Miracle, Lynn E. Fisher, and Jody Brown, pp. 107-126. Michigan Discussions In Anthropology Vol. 10. Department of Anthropology, University of Michigan, Ann Arbor.

Goldberg, Susan K.
1986 Bison Dental Annuli. In *Papers in Northern Plains Prehistory and Ethnohistory*. Edited by W.R. Wright. Special Publication of the South Dakota Archaeological Society:184-185.

Gordon, Bryan H.C.
1979 *Of Men and Herds in Canadian Plains Prehistory*. National Museum of Man Mercury Series. Archaeological Survey of Canada, Paper No. 84. Ottawa.

1982 *Tooth Sectioning as an Archaeological Tool*. National Museum of Man, Canadian Studies Report No. 14, Archaeological Survey of Canada, Ottawa.

1988 *Of Men and Reindeer Herds in French Magdalenian Prehistory*. British Archaeological Reports, International Series 390, Oxford.

1991 *Archaeological Seasonality Using Incremental Structures in Teeth: An Annotated Bibliography*. Zooarchaeological Research News, New York.

Graspointner, Andreas
1981 Southern Alberta - The Nomadic Culture. In *Alberta Archaeology: Prospect and Retrospect*. Edited by T.A. Moore. The Archaeological Society of Alberta, Lethbridge.

Griffin, J.B.
1965 Prehistoric Pottery from Southeastern Alberta, Canada. In *An Introduction to the Archaeology of Alberta, Canada*, by H. M. Wormington and R. G. Forbis. Proceedings of the Denver Museum of Natural History, No. 11:209-48.

Grinnell, George Bird
1892 The Last of the Buffalo. *Scribner's Magazine* XII(3):267-286.

1893 *Blackfoot Lodge Tales*. David Nutt, London.

1901 The Lodges of the Blackfeet. *American Anthropologist* n.s. 3:650-68.

1962 *Blackfoot Lodge Tales: The Story of a Prairie People*. University of Nebraska Press. Lincoln.

Grue, H., and B. Jensen
1979 Review of the Formation of Incremental Lines in Tooth Cementum of Terrestrial Mammals. *Danish Review of Game Biology* 11(3):115-128.

Gunderson, Harvey L., and Brian R. Mahan
1980 Analysis of Sonograms of American Bison (*Bison bison*). *Journal of Mammalogy* 61(2):379-381.

Haig, Bruce (editor)
1990 *A Look at Peter Fidler's Journal: Journal of a Journey over land from Buckingham House to the Rocky Mountains*. Historical Research Centre, Lethbridge.

Haines, Francis
1970 *The Buffalo*. Thomas Y. Crowell Company, New York.

Hanson, Jeffery R.
1984 Bison Ecology in the Northern Plains and a Reconstruction of Bison Patterns for the North Dakota Region. *Plains Anthropologist* 29(104):93-113.

Harmon, Daniel William

1957 *Sixteen Years in Indian Country: The Journal of Daniel William Harmon 1800-1816*. Edited by W. Kaye Lamb. The Macmillan Company of Canada Limited, Toronto.

Harshyne, Wenid A., Duane R. Diefenbach, Gary L. Alt, and Gary M. Matson

1998 Analysis of Error from Cementum-Annuli Age Estimates of Known-Age Pennsylvania Black Bears. *Journal of Wildlife Management* 62(4):1281-1291.

Hart, Elisa

1995 *Getting Started in Oral Traditions Research*. Occasional Papers of the Prince of Wales Northern Heritage Centre, No. 4. Prince of Wales Northern Heritage Centre, Department of Education, Culture and Employment, Cultural Heritage Division, Government of the Northwest Territories, Yellowknife.

Hawkes, C.

1954 Archaeological Theory and Method: Some Suggestions for the Old World. *American Antiquity* 56:155-168.

Haynes, Gary

1984 Tooth Wear Rate in Northern Bison. *Journal of Mammalogy* 65(3);487-491.

Hector, James, and W.S. Vaux

1861 *Notice of the Indians seen by the Exploring expedition Under the command of Captain Palliser*. Transactions of the Ethnological Society of London 1.

Hegmon, Michelle and Lynn E. Fisher

1991 Information Strategies in Hunter-Gatherer Societies. In *Foragers in Context: Long-term, Regional, and Historical Perspectives in Hunter-Gatherer Studies*. Edited by Preston T. Miracle, Lynn E. Fisher, and Jody Brown, pp. 127-145. Michigan Discussions In Anthropology Vol. 10. Department of Anthropology, University of Michigan, Ann Arbor.

Henry the Elder, Alexander

1969 *Travels and Adventures in Canada and the Indian Territories Between the Years 1760 and 1776*. Edited by James Bain. M.G. Hurtig Ltd., Edmonton.

Higgins, K. F.

1986 Evidence of Historical Occurrence of Woody Plants in Areas of North Dakota Grasslands. Pp 115-117 in *Proceedings of the 9th North American Prairie Conference*, 29 July - 1 August 1984. Edited by G.K. Clambey and R.H. Pemble. North Dakota State University, Fargo.

Hillson, Simon

1996 Dental Anthropology. Cambridge University Press, New York.

Hind, Henry Youle
1971 *Narrative of the Canadian Red River Exploring Expedition of 1857 and of the Assiniboine and Saskatchewan Exploring Expedition of 1858*. M.G. Hurtig Ltd., Edmonton.

Hornaday, William T.
1887 *The Extermination of the American Bison, with a Sketch of its Discovery and Life History*. Report of the National Museum, pp. 367-548.

Hungry Wolf, Adolf
1977 *The Blood People: A Division of the Blackfoot Confederacy*. Harper and Row, San Francisco.

Ingold, Tim
1987 *The Appropriation of Nature: Essays on Human Ecology and Social Relations*. Manchester University Press, Manchester.

Isenberg, Andrew C.
2000 *The Destruction of the Bison: An Environmental History*. Cambridge University Press, New York.

Jackson, John C.
2000 *The Piikani Blackfeet: A Culture Under Siege*. Mountain Press Publishing Company, Missoula, Montana.

Jefferson, Robert
1929 Fifty Years on the Saskatchewan. *Canadian Northwester Historical Society Publications* 1(5)1-160.

Jenness, Diamond
1938 *The Sarcee Indians of Alberta*. Canada Department of Mines and Resources, National Museum of Canada, Bulletin 90, Anthropological Series, No. 23.

Jochim, M.A.
1976 *Hunter-gatherer Subsistence and Settlement: A Predictive Model*. Academic Press Inc., New York.

Johnson, Alice M.
1967 *Saskatchewan Journals and Correspondence: Edmonton House 1795-1800, Chesterfield House 1800-1802*. The Hudson's Bay Company. London.

Joyes, Dennis
1973 The Shippe Canyon Site. *Archaeology in Montana* 14(2):49-85

Kane, Paul

1925 *Wanderings of An Artist Among the Indians of North America*. Vol. 7 of Master-works of Canadian Authors, Edited by John W. Garvin. Radisson Society of Canada, Toronto.

Kay, Marvin

1974 Dental Annuli Age Determination on White-tailed Deer from Archaeological Sites. *Plains Anthropologist* 13(40):103-115.

Kehoe, Thomas

1966 The Small Side-Notched Point System of the Northern Plains. *American Antiquity* 31(6):827-841.

1967 The Boarding School Bison Drive Site. *Plains Anthropologist Memoir 4*.

1973 *The Gull Lake Site: A Prehistoric Bison Drive Site in Southwestern Saskatchewan*. Milwaukee Public Museum Publications in Anthropology and History 1.

Keiss, Robert E.

1969 Comparison of Eruption-wear Patterns and Cementum Annuli Age Criteria in Elk. *Journal of Wildlife Management* 33(1):175-180.

Kelly, Robert L.

1983 Hunter-Gatherer Mobility Strategies. *Journal of Archaeological Research* 39:277-306.

1992 Mobility/Sedentism: Concepts, Archaeological Measures, and Effects. *Annual Review of Anthropology* 21:43-66.

1995 *The Foraging Spectrum: Diversity in Hunter-Gatherer Lifeways*. Smithsonian Institution Press, Washington.

Kent, Susan, and Helga Vierich

1989 The Myth of Ecological Determinism -- Anticipated Mobility and Site Structure. *Farmers as Hunters: The Implications of Sedentism*. Edited by Susan Kent. Cambridge University Press, Cambridge, pp. 96-130.

Keyser, James

1979 Late Prehistoric Period Bison Procurement on the Milk River in North-Central Montana. *Archaeology in Montana* 20(1):vii-241.

Kimura, Makoto

1980 Variability in Techniques of Counting Dental Growth Layer Groups in a Tooth of a Known-Age Dolphin, *Tursiops truncatus*. In *Report of the International Whaling*

Commission. Cambridge. Special Issue No. 3. Edited by A.C. Myrick and W.F. Perrin, pp. 161-163. International Whaling Commission.

Klevezal', G.A.
1970 Retrospective Evaluation of the Individual Features of Mammal Growth Based on the Structure of Dentine and Bone Layers. *Ontogenesis* 1(4):362-372.

Klevezal', G.A., and S.E. Kleinenberg
1967 *Age Determination of Mammals from the Annual Layers in Teeth and Bones.* Israel Program for Scientific Translations, Jerusalem.

Klevezal', Galina A., and Zdzislaw Pucek
1987 Growth Layers in Tooth Cement and Dentine of European Bison and its Hybrids with Domestic Cattle. *Acta Theriologica* 32(9):115-128.

Kooyman, Brian
1990 Final Report of the 1989 Excavation in the North Kill at Head-smashed-In Buffalo Jump (DkPj-1) (Permit 89-53). Report on file, Archaeological Survey of Alberta, Alberta Community Development, Edmonton.

1992 Preliminary Report of the 1991 Excavations in the North Kill at Head-Smashed-In Buffalo Jump (DkPj-1). Report on file, Archaeological Survey of Alberta and the Alberta Historical Resources Foundation, Alberta Community Development, Edmonton.

Kroeber, Albert
1907 *The Arapaho.* American Museum of Natural History, Bulletin 18, XVIII, Parts 1-4.

Krozer, Kit
1985 The 1984 Archaeological Inventory of River Park and Kingsway Park, Moose Jaw, Saskatchewan. Prepared for Archaeological Resource Management Section, Saskatchewan Department of Culture and Recreation, Permit 84-13. report on file Museum of Natural History, Archaeology Manuscript Library.

Kuhnlein, Harriet V., and Nancy J. Turner
1991 *Traditional Plant Foods of Canadian Indigenous Peoples: Nutrition, Botany, and Use.* Gordon and Breach Science Publishers, Philadelphia.

Lamb, W. Kaye
1957 *Sixteen Years in Indian Country; The Journal of Daniel William Harmon 1800-1816.* The Macmillan Company of Canada Limited, Toronto.

Landals, Alison
1991 Oldman River Dam Kill Sites Mitigation 1988/1989. In Archaeology in Alberta 1988 and 1989. Occasional Paper No. 33, edited by Martin Magne, pp. 67-80. Archaeological Survey, Provincial Museum of Alberta, Edmonton.

Landon, David B., Carol A. Waite, Rolf O. Peterson, and L. David Mech
1998 Evaluation of Age Determination Techniques for Gray Wolves. *Journal of Wildlife Management* 62(2):674-682.

Lee, Richard, and Irven DeVore
1968 Problems in the Study of Hunters and Gatherers. In *Man the Hunter*. Edited by Richard b. Lee and Irven DeVore. Aldine Publishing Company, Chicago.

Lieberman, Daniel E.
1993 Life History Variables Preserved in Dental Cementum Microstructure. *Science* 261:1162-1164.

1994 The Biological Basis for Seasonal Increments in Dental Cementum and Their Application to Archaeological Research. *Journal of Archaeological Science* 21:525-539.

Lieberman, Daniel E, and Richard H. Meadow
1992 The Biology of Cementum Increments (with an archaeological application). *Mammal Review* 22:57-77.

Linnamae, Urve
1988 The Tschetter Site: A Prehistoric Bison Pound in the Parklands. In *Out of the Past: Sites, Digs and Artifacts in the Saskatoon Area*. Edited by Urve Linnamae and Tim E.H. Jones, pp. 91-116. Saskatoon Archaeological Society, Saskatoon.

Longley, Richmond W.
1972 The Climate of the Prairie Provinces. Climatological Studies No. 13, Environment Canada, Atmospheric Environment, Toronto.

Lott, Dale F.
1974 Sexual and Aggressive Behaviour of Adult American Bison (*Bison bison*). In *The Behaviour of Ungulates and It's Relation to Management*. IUCN Publications New Series No. 24. Edited by V. Geist and F. Walther. International Union for Conservation of Nature and Natural Resources Morges, Switzerland.

Lott, Dale F., and John C. Galland
1985 Parturition in American Bison: Precocity and Systematic Variation in Cow Isolation. *Zeitschrift für Tierpsychologie* 69:66-71.

Low, William A., and I. McT. Cowan
1963 Age Determination of Deer by annular Structure of Dental Cementum. *Journal of Wildlife Management* 27(3):466-471.

Magne, Martin, and Contributors to the Saskatchewan-Alberta Dialogue
1987 Distributions of Native Groups in Western Canada, A.D. 1700 to A.D. 1850. In *Archaeology in Alberta 1986,* edited by Martin Magne, pp. 220-231. Occasional Paper No. 31, Archaeological Survey of Alberta, Edmonton.

Malainey, Mary E., and Barbara L. Sherriff
1996 Adjusting Our Perceptions: Historical and Archaeological Evidence of Winter on the Plains of Western Canada. *Plains Anthropologist* 42(158):333-357.

Malainey, Mary E., R. Przybylski, and B. L. Sherriff
2001 One Person's Food: How and Why Fish Avoidance May Affect the Settlement and Subsistence Patterns of Hunter-Gatherers. *American Antiquity* 66(1):141-161.

Mandelbaum, David G
1979 *The Plains Cree: An Ethnographic, Historical, and Comparative Study.* Canadian Plains Studies 9. Canadian Plains Research Center, University of Regina, Regina

Mauss, Marcel
1979 *Seasonal Variations of the Eskimo: A Study in Social Morphology.* Routledge & Kegan Paul: London.

Maximilian, Prince of Wied
1906 *Travels in the Interior of North America.* Vols. 22-25 of Early Western Travels, 1748-1846, Edited by Reuben G. Thwaites. Arthur H. Clark, Cleveland.

McClintock, Walter
1968 *The Old North Trail: Life, Legends, and Religion of the Blackfeet Indians.* A Bison Book, University of Nebraska Press, Lincoln.

McCullough, Dale R.
1996 Failure of the Tooth Cementum Aging Technique with Reduced Population Density of Deer. *Wildlife Society Bulletin* 24(4):722-724.

McCutchen, Henry E.
1969 Age Determination of Pronghorns by the Incisor Cementum. *Journal of Wildlife Management* 33(1):172-175.

McDonnell, John
1889 *Some Account of the Red Deer River (About 1797) with Extracts from His Journal 1793-1795.* In Les Bourgeois de la compagnie du Nord-Ouest (vol. 1), Edited by Louis Masson. L'Imprimerie Generale A Cote et Cie, Quebec.

McDonnell, R.F.

1984 Pis'Kun Some Ethnological Considerations of the Blackfoot Communal Buffalo Hunt. Report on file, Archaeological Survey of Alberta, Edmonton.

McDougall, John

1898 *Pathfinding on Plain and Prairie*. William Briggs, Toronto.

McEwan, Eoin H

1963 Seasonal annuli in the Cementum of the Teeth of the Barren Ground Caribou. *Canadian Journal of Zoology* 41(1):11-113.

McHugh, Tom

1958 Social Behaviour of the American Buffalo (*Bison bison bison*). *Zoologica: Scientific Contributions of the New York Zoological Society* 43(1):1-40.

1972 *The Time of the Buffalo*. Alfred A. Knopf, New York.

McKinley, Valerie, and A. Burke

n.d. A New Control Sample for Seasonal Death Estimates for *Equus caballus* from Dental Thin Sections. *Archaeozoologi*a (in press)

McMaster, John Bach

1904 *History of the Expedition Under the Command of Captains Lewis and Clark* (3 Volumes.). A.S. Barnes and Company, New York.

McMillan, Brock R., Michael R Cottam, and Donald W. Kaufman.

2000 Wallowing Behaviour of American Bison (*Bos bison*) in Tallgrass Prairie; An Examination of Alternative Explanations. *American Midland Naturalist* 144(1):159-167.

Meagher, Margaret Mary

1973 *The Bison of Yellowstone National Park*. National Park Service Scientific Monograph Series Number One. Government Printing Office, Washington.

Meyer, David

1988 The Old Women's Phase on the Saskatchewan Plains: Some Ideas. In *Archaeology in Alberta 1987*. Edited by Martin Magne, pp. 55-63. Occasional Paper 32, Archaeological Survey of Alberta. Edmonton.

Meyer, David, and Henry T. Epp

1990 North-South Interaction in the Late Prehistory of Central Saskatchewan. *Plains Anthropology* 54(132):321-342.

Mitchell, Brian
1963 Determination of Age in Scottish Red Deer from Growth Layers in Dental Cement. *Nature* 198(4878):350-351.

Moffit, Steven A.
1998 Aging Bison by the Incremental Cementum Growth Layers in Teeth. *Journal of Wildlife Management* 62(4):1276-1280.

Monk, Gregory R.
1981 Seasonality Studies. In *Advances in Archaeological Method and Theory* Vol. 4. Academic Press, Inc., New York.

Moodie, D.W., and Arthur J. Ray
1976 Buffalo Migrations in the Canadian Plains. *Plains Anthropologist* 21(71):45-52.

Mooring, Michael S., and William M. Samuel
1998 Tick Defense Strategies in Bison: The Role of Grooming and Hair Coat. *Behaviour* 135:693-718.

Morgan, R. Grace
1979 *An Ecological Study of the Northern Plains as Seen Through the Garratt Site.* Occasional Papers in Anthropology No. 1, Department of Anthropology, University of Regina, Regina, Saskatchewan.

1980 Bison Movement Patterns on the Canadian Plains: An Ecological Analysis. *Plains Anthropologist* 25(88):143-160.

Morlan, R.E.
1988 Avonlea and Radiocarbon Dating. In *Avonlea Yesterday and Today: Archaeology and Prehistory*, edited by L. B. Davis, pp. 291-309. Saskatchewan Archaeological Society, Saskatoon.

Morris, P.
1978 The Use of Teeth for Estimating the Age of Wild Animals. In *Development, Function and Evolution of Teeth.* Edited by P.M. Butler and K.A. Joysey, pp. 483-494. Academic Press, Inc., New York.

Morton, Arthur S.
1929 *The Journal of Duncan M'Gillivray of the Northwest Company at Fort George on the Saskatchewan, 1794-5.* The Macmillan Company of Canada Limited, at St. Martin's House, Toronto.

Mulloy, William
1958 *A Preliminary Historical Outline for the Northwestern Plains*. University of Wyoming Publications, Continuation of University of Wyoming Publications in Science XXII (1 and 2):i-235.

Mundy, K.R.D.
1962 Age Determination in the Bison (*Bison bison*). Unpublished manuscript from the Department of Zoology, University of Alberta:1-16.

Murdock, G.P.
1967 Ethnographic Atlas: A Summary. *Ethnology* 6:109-236.

Novakowski, N.S.
1965 Cementum Deposition as an Age Criterion in Bison, and the Relationship of Incisor-wear, Eye-lens Weight, and Dressed Bison Carcass Weight to age. *Canadian Journal of Zoology* 43;173-178.

O'Brien, C.J.
1997 Dental Increment Analysis of Bison Teeth from Site 42SM295, Wyoming. Report on file, Archaeological Services, Western Wyoming College, Rock Springs, Wyoming.

Oliver, Symmes C.
1962 *Ecology and Cultural Continuity As Contributing Factors in the Social Organization of the Plains Indians*. University of California Press, Berkeley.

Park, Ed
1969 *The World of the Bison*. J.B. Lippincott Co., Philadelphia.

Peacock, Sandra Leslie
1992 Piikáni Ethnobotany: Traditional Plant Knowledge of the Piikáni Peoples of the Northwestern Plains. Unpublished MA, Department of Archaeology, University of Calgary, Calgary.

Peck, Trevor R.
1996 Late Side-notched Projectile Points on the Northwestern Plains. Unpublished MA Thesis, Department of Anthropology, University of Alberta, Edmonton

2000 Sex, Flies, and Wallowed Landscapes: The Archaeological Implications of Bison Wallows on the Northern Plains. Paper presented at the 58th Annual Plains Anthropological Conference.

n.d. Archaeological Recovered Ammonites: Evidence for Long-Term Continuity in Blackfoot Ritual. *Plains Anthropologist*, in press.

Peck, Trevor R., and John W. Ives
2001 Late Side-notched Projectile Points on the Northwestern Plains. *Plains Anthropologist* 46 (176):163-193.

Pike-Tay, Anne
1991 *Red Deer Hunting in the upper Palaeolithic of Southwestern France: A Study in Seasonality*. British Archeological Reports, International Series, S569, Oxford.

1995 Variability and Synchrony of Seasonal Indicators in Dental Cementum Microstructure of the Kaminuriak Caribou Population. *Archaeofauna* 4:273-284.

Politis, Gustavo G.
1996 Moving to Produce: Nukak Mobility and Settlement Patterns in Amazonia. *World Archaeology* 27(3):492-511.

Prentice, Jean
1983 The Tschetter Site: A Study of a Late Prehistoric Bison Kill. Unpublished MA Thesis, Department of Anthropology and Archaeology, University of Saskatchewan, Saskatoon.

Preucel, Robert, and Ian Hodder
1996 Nature and Culture. In *Contemporary Archaeological Theory: A Reader*. Blackwell Publishers; Cambridge, Massachusetts, pp. 23-38.

Pyszczyk, Heinz W.
1997 The Use of Fur Trade Goods by the Plains Indians, Central and Southern Alberta, Canada. *Canadian Journal of Archaeology* 21(1):45-84.

Quéré, J.P., and M. Pascal
1983 Comparaison de Plusieurs Méthods de Détermination de L'âge Individuel chez le Cerf élaphe (*Cervus elaphus* L.). *Annales des Sciences Naturelles. Zoologie, Paris.* 13 Séries Vol. 5, pp.235-252.

Quigg, J. Michael
1978 Winter Bison Procurement in Southwestern Alberta. In Bison Procurement and Utilization, A Symposium. Edited by Leslie B. Davis and Michael Wilson, pp. 53-57. *Plains Anthropologist Memoir 14*, 23(82, Pt. 2).

Ransom, A. Brian
1966 Determining Age of White-tail Deer from Layers in Cementum of Molars. *Journal of Wildlife Management* 30(1):197-199.

Reeves, Brian O. K.
1970 Culture Change in the Northern Plains 1000 B.C. - A.D. 1000. Unpublished PhD. dissertation. Department of Archaeology, University of Calgary, Calgary, Alberta.

1976 Fish Creek Provincial Park Archaeological Study Program. Lifeways of Canada Ltd., Calgary. Report on file, Lombard North Group, Calgary.

1978 Head-Smashed-In: 5500 Years of Bison Jumping in the Alberta Plains. In Bison Procurement and Utilization: A Symposium. Edited by L. B. Davis and M. Wilson, pp. 151-174. *Plains Anthropologist Memoir 14*, 23(82, Pt . 2).

1983 *Culture Change in the Northern Plains: 1000 BC-AD 1000*. Occasional Paper No. 20, Archaeological Survey of Alberta. Edmonton.

1990 Communal Bison Hunters of the Northern Plains. In *Hunters of the Recent Past*. Edited by L.B. Davis and B.O.K. Reeves, pp. 168-194. Unwin Hyman, London.

1993 Iniskim: A Sacred Nitsitapii Religious Tradition. In *Kunaitupii: Coming Together on Native Sacred Sites, Their Sacredness, Conservation, and Interpretation*. Edited by Brian O.K. Reeves and Margaret A. Kennedy. Archaeological Society of Alberta, Calgary.

Reher, Charles A.

1974 Population Study of the Casper Site. In *The Casper Site: A Hell Gap Bison Kill on the High Plains*. Edited by George C. Frison, pp. 113-124. Academic Press, Inc., New York.

Reher, Charles A., and George Frison

1980 The Vore Site, 48CK302, A Stratified Buffalo Jump in the Wyoming Black Hills. *Plains Anthropologist Memoir 16*, Part 2.

Reinhardt, Viktor

1985 Quantitative Analysis of Wallowing in a Confined Bison Herd. *Acta Therilogica* 30(7):149-156.

Reynolds, Hal W., and Alexander W.L. Hawley

1987 Introduction. In *Bison Ecology in relation to Agricultural Development in the Slave River Lowlands, NWT*. Edited by H.W. Reynolds and A.W.L. Hawley. Occasional Paper Number 63, Canadian Wildlife Service.

Roe, Frank Gilbert

1951 *The North American Buffalo: A Critical Study of the Species in Its Wild State*. University of Oklahoma Press, Norman.

1955 *The Indian and the Horse*. University if Oklahoma Press: Norman.

Roll, Tom E., and Ken Deaver
1980 *The Bootlegger Trail Site, A Late Prehistoric Spring Bison Kill.* US Department of the Interior. Heritage Conservation and Recreation Service, Interagency Archaeological Services.

Ross, Alexander
1956 *The Fur Traders of the Far West.* Edited by Kenneth A. Spaulding. University of Oklahoma Press, Norman.

Rush, W.M.
1932 Bang's Disease in the Yellowstone National Park Buffalo and Elk Herds. *Journal of Mammalogy* 13(4):371-372.

Russell, Dale R.
1991 *Eighteenth-Century Western Cree and Their Neighbours.* Mercury Series Paper 143, Archaeological Survey of Canada, Canadian Museum of Civilization, Ottawa.

Sanders, William T.
1999 Three Valleys: Twenty-five Years of Settlement Archaeology in Mesoamerica. In *Settlement Pattern Studies in the Americas: Fifty Years Since Virú.* Edited by Brian R. Billman and Gary M. Feinman, pp. 12-21, Smithsonian Institution Press, Washington, D.C.

Savelle, James M., and Owen B. Beattie
1983 Analysis of Dental Cementum annuli in Muskoxen (*Ovibus moschatus*) as an Aid in the Determination of Archaeological site Seasonality. *Canadian Journal of Anthropology* 3(1):123-129.

Saxon, Andrew, and Charles Higman
1969 A New Research Method for Economic Prehistorians. *American Antiquity* 34(3):303-311.

Schaeffer, Claude E.
1962 The Bison Drive of the Blackfoot Indians. In Symposium on Buffalo Jumps, *Montana Archaeological Society, Memoir No. 1*, Edited by Carling Malouf and Stuart Conner:28-34.

1978 The Bison Drive of the Blackfoot Indian. *Plains Anthropologist Memoir 14*, 243-248.

Sergeant, David E., and Douglas H. Pimlott
1959 Age Determination in Moose from Sectioned Incisor Teeth. *Journal of Wildlife Management* 23(3):315-321.

Sears, William

1968 The State and Settlement Patterns of the New World. In *Settlement Archaeology*. Edited by K.C. Chang. National Press Books. California: Palo Alto.

Seton, Ernest Thompson

1953 *Lives of Game Animals*. Charles T. Branford, Company, Boston.

Simons, A.

1979 Pottery Manufacture Analysis: Experimental Assessment of Technological Continuity in the Altamont Region. *Archaeology in Montana* 20(2):1-78.

Skinner, Alanson

1914 *Political Organization, cults and Ceremonies of the Plains-Ojibway*. Anthropological Papers of the American Museum of Natural History 11(6):482-499.

Smith, T., M. Calder, and B.O.K. Reeves

1977 Archaeological Investigations: EfPm-27 -Fish Creek Provincial Park. Lifeways of Canada Ltd., Calgary. Copy on file, Alberta Culture and Multi-Culturalism, Archaeological Survey of Alberta, Edmonton.

Solounias, N., M. Fortelius, and P. Freeman

1994 Molar Wear Rates in Ruminants: A New Approach. *Annales Zoologici Fennici* 31:219-227.

Soper, J. Dewey

1941 History, Range, and Home Life of the Northern Bison. *Ecological Monographs* 11(4):349-412.

Speth, John D., and Katherine A. Spielmann

1983 Energy Source, Protein Metabolism, and Hunter-gatherer Subsistence Strategies. *Journal of Anthropological Archaeology* 2:1-31.

Spry, Irene M. (editor)

1968 *The Papers of the Palliser Expedition 1857-1860*. The Champlain Society, Toronto.

Stallcop, Emmett

1973 Beaver Creek Park Site (24HL411): An Exercise in Salvage Archaeology. *Archaeology in Montana* 14 (1):47-54.

Stallibrass, Sue

1982 *The Use of Cement Layers for Absolute Ageing of Mammalian Teeth: A Selective Review of the Literature, with Suggestions for Further Studies and Alternative Applications*. Edited by Bob Wilson, Caroline Grigson, and Sebastian Payne. BAR British Series 109.

Steward, Julian
1955 *Theory of Culture Change*. University of Illinois Press, Urbana.

Taylor, Dee C.
1962 Panel Discussion on Buffalo Jumps. In Symposium on Buffalo Jumps, *Montana Archaeological Society, Memoir No. 1*, Edited by Carling Malouf and Stuart Conner:40-57.

Tischer, Jennifer C.
2000 EgPn-440: A Late Prehistoric Bison Pound on the Northwestern Plains. Unpublished MA, University of Calgary, Calgary.

Trigger, Bruce G.
1968 The Determinants of Settlement Patterns. In *Settlement Archaeology*. Edited by K.C. Chang. National Press Books. California: Palo Alto.

Turner, Jack C.
1977 Cemental Annulations as an Age Criterion in North American Sheep. *Journal of Wildlife Management* 41(2)211-217.

Uhlenbeck, C.C.
1912 A New Series of Blackfoot Texts From The Southern Peigans Blackfoot Reservation Teton County Montana. Amsterdam, *Koninklijke Akademie van Wetenschappen, Afdeeling Letterkunde, Verhandelingen*, new series 13(1).

Unfreed, Wendy
1993 Final Report: Archaeological Investigations at the Highway 2/3 Junction Site (DkPi-2) 1991-1992 (Permit Number 91-050 and 92-35). Report on file. Archaeological Survey of Alberta, Alberta Community Development, Edmonton.

Van Dyke, Stanley, Sharon Hanna, Wendy Unfreed, and Barbara Neal
1991 That Dam Archaeology: Campsites Archaeology in the Oldman River Reservoir. In *Archaeology in Alberta 1988 and 1989*. Occasional Paper No. 33, edited by Martin Magne, pp. 25-66. Archaeological Survey, Provincial Museum of Alberta, Edmonton.

Verbicky-Todd, Eleanor
1984 *Communal Buffalo Hunting among the Plains Indians*. Occasional Paper No. 24, Archaeological Survey of Alberta, Edmonton.

Vickers, J. Roderick
1983 An Introduction to Alberta Radiocarbon Dates. In *Archaeology in Alberta 1982*. Edited by David Burley, pp. 142-160, Occasional Paper No. 21, Archaeological Survey of Alberta, Edmonton.

1986 *Alberta Plains Prehistory: A Review*. Occasional Paper 27. Archaeological Survey of Alberta. Edmonton.

1987 Winter Campsite Selection: A Critical Resource Model. Paper presented at the 20th Annual Meeting of the Canadian Archaeological Association, Calgary.

1991 Seasonal Round Problems on the Alberta Plains. *Canadian Journal of Archaeology* 15:55-72.

1994 *Cultures of the Northwestern Plains: From the Boreal Forest Edge to Milk River. In Plains Indians, AD 500-1500, The Archaeological Past of Historic Groups*. Edited by Karl H. Schlesier, pp.3-33. University of Oklahoma Press, Norman.

Vickers, Rod, and Trevor Peck

2001 Aspects of Winter Settlement on the Northwestern Plains. Paper presented at the 34th Annual Meeting of the Canadian Archaeological Association, Banff.

Vogt, Evon Z.

1968 Some Aspects of Zinacantan Settlement Patterns and Ceremonial Organization. In *Settlement Archaeology*. Edited by K.C. Chang. National Press Books. California: Palo Alto.

Walde, Dale

1993 A Descriptive Assessment of Pottery at DkPi-2. In Final Report; Archaeological Investigations at the Highway2/3 Junction Site (DkPi-2) 1991-1992 (Permit Number 91-050 and 92-35). Edited by Wendy Unfreed. Report on file. Archaeological Survey of Alberta, Alberta Community Development, Edmonton.

1994 The Mortlach Phase. Unpublished Ph.D. Dissertation, Department of Archaeology, University of Calgary. Calgary.

Walde, Dale Allen, Dale Boland, and Michelle Schatz

2001 The Fish Creek Archaeological Project: A Progress Report on Work Conducted Under Permits 98-042, 99-054, and 00-083. Report on file, Archaeological Survey of Alberta and the Alberta Historical Resources Foundation, Alberta Community Development, Edmonton.

Walde, Dale Allen, David Meyer, and Wendy Unfreed

1995 The Late Period on the Canadian and Adjacent Plains. *Journal of American Archaeology* 9:7-66.

Walker, Ernest

1974 The Seasonal Nature of Post-Altithermal Communal Bison Procurement on the Northwestern Plains. *Na'Pao* 4(2):1-6.

1979 Vertebrate Faunal Remains from the Tschetter Site (FbNr-1). *Na'pao* 9 (1 and 2):51-60.

Warkentin, John
1994 *The Kelsey Papers*. Canadian Plains Research Center, University of Regina, Regina.

Wedel, Waldo
1961 *Prehistoric Man on the Great Plains*. University of Oklahoma Press: Norman.

White, Leslie
1949 *The Science of Culture: A Study of Man and Civilization*. Farrar, Strass, New York.

1959 *The Evolution of Culture*. McGraw-Hill, Washington D.C.

Wildschut, William
1928 Blackfoot Pipe Bundles. *Indian Notes* 5(4):419-433.

Wiessner, Polly
1982 Beyond Willow Smoke and Dog's Tails: A Comment on Binford's Analysis of Hunter-gatherer Settlement Systems. *American Antiquity* 47(1):171-177.

Willey, Gordon R.
1953 *Prehistoric Settlement Patterns in the Virú Valley, Perú*. Bureau of American Ethnology, Bulletin 155.

1999 The Virú Valley Project and Settlement Archaeology: Some Reminiscences and Contemporary Comments. In *Settlement Pattern studies in the Americas: Fifty Years Since Virú*. Edited by Brian R. Billman and Gary M. Feinman, pp. 9-11, Smithsonian Institution Press, Washington, D.C.

Willey, Gordon R., and Jeremy A Sabloff
1980 *A History of American Archaeology*. W.H. Freeman and Company, New York.

Willey, Gordon C., and P. Phillips
1958 *An Introduction to American Anthropology*, Volume One, North and Middle America. University of Chicago Press. Chicago.

Wilson, Michael
1974 The Casper Local Fauna and Its Fossil Bison. In *The Casper Site: A Hell Gap Bison Kill on the High Plains.* Edited by George C. Frison, pp. 125-1172. Academic Press, Inc., New York.

Winterhalder, Bruce
1981 Optimal Foraging Strategies and Hunter-gatherer Research in Anthropology: Theory and Models. In *Hunter-gatherer Foraging Strategies: Ethnographic and*

Archaeological Analyses. Edited by Bruce Winterhalder and Eric Alden Smith, pp. 13-35. University of Chicago Press, Chicago.

Winterhalder, Bruce, and Eric Alden Smith (eds.)
1981 *Hunter-gatherer Foraging Strategies: Ethnographic and Archaeological Analyses*. University of Chicago Press, Chicago.

Wissler, Clark
1910 *Material Culture of the Blackfoot Indians*. American Museum of Natural History, Anthropological Papers Vol. V, Part I.

1911 *The Social Life of the Blackfoot Indians*. American Museum of Natural History, Anthropological Papers Vol. VII, Part I.

1912 *Ceremonial Bundles of the Blackfoot Indians*. American Museum of Natural History, Anthropological Papers Vol. VII, Part II.

1918 *The Sundance of the Blackfoot Indians*. American Museum of Natural History, Anthropological Papers Vol. XVI(III).

Wissler, Clark, and D.C. Duvall
1908 *Mythology of the Blackfoot Indians*. American Museum of Natural History, Anthropological Papers 2, Part 1.

Wolfe, Michael
1969 Age Determination in Moose from Cementum Layers of Molar Teeth. *Journal of Wildlife Management* 33(2):428-431.

Wormington, H.M., and R.G. Forbis
1965 *An Introduction to the Archaeology of Alberta, Canada*. Proceedings, Denver Museum of Natural History Proceedings 11, Denver.

TABLES

Table 1. The distribution of the control sample specimens through the calendar year.

Number of Specimens	*Date of Death*
5	February 22
3	March 2
5	March 26
5	March 30
5	June 15
5	August 31
5	October 28
5	December 15

Table 2 - The interpretation of the modern control sample [The numbers in parentheses ( ) indicate the Dental Cementum Increment Stage, see Table 3, below].

Spec. No.	*Date of Death*							
	Feb. 22	*Mar. 2*	*Mar. 26*	*Mar. 30*	*Jun. 15*	*Aug. 31*	*Oct. 28*	*Dec. 15*
1	*Slow-growth (4)*							
2	*Slow-growth (4)*							
3	*Slow-growth (4)*							
4	*Slow-growth (4)*							
5	*Unidentified*							
6		*Slow-growth (4)*						
7		*Slow-growth (4)*						
8		*Rapid-growth (2)*						
34			*Unidentified*					
35			*Incipient rapid-growth*					
36			*Slow-growth (4)*					
37			*Slow-growth (4)*					
38			*Slow-growth (4)*					
9				*Rapid-growth (2)*				
10				*Unidentified*				
11				*Unidentified*				
12				*Slow-growth (4)*				
13				*Unidentified*				
14					*Rapid-growth (2)*			
15					*Rapid-growth (2)*			
16					*Rapid-growth (2)*			
17					*Rapid-growth (2)*			
18					*Rapid-growth (2)*			
19						*Rapid-growth (2)*		
20						*Slow-growth (4)*		
21						*Rapid-growth (2)*		
22						*Unidentified*		
23						*Unidentified*		
24							*Incipient slow-growth*	
25							*Rapid-growth (2)*	
26							*Rapid-growth (2)*	
27							*Incipient slow-growth*	
28							*Incipient slow-growth*	
29								*Slow-growth (4)*
30								*Slow-growth (4)*
31								*Unidentified*
32								*Slow-growth (4)*
33								*Unidentified*

Table 3 - The seasonal deposition of cementum increments inferred from the analysis of the control sample.

Dental Cementum Increment Stage	Description	Inferred Time Interval
1	An incipient rapid-growth zone is apparent in some specimens by the end of March. This process is complete some time before mid June.	late March to mid June
2	Rapid-growth zone layers are deposited as early as mid June until as late as late October.	mid June to late October
3	Incipient slow-growth zone deposition begins as early as late October and before the end of December.	late October to late December
4	Development of the slow-growth zone occurs between late December until as late as late March.	late December to late March

Table 4. The analysis of dental cementum increments for each archaeological site in the study.

Specimen Designation			Element	Side	Season of Death	Cultural Affiliation
Site	Cult. Unit	Cat. No.				
DjPm-80	CU-2	2373	M_1	L	2	Protohistoric
DjPm-80	CU-2	11136	M_1	L	4	Protohistoric
DjPm-80	CU-2	9865	M_1	L	2	Protohistoric
DjPm-80	CU-2	3876	M_1	L	Indet.	Protohistoric
DjPm-80	CU-2	2266	M_1	L	Indet.	Protohistoric
DjPm-80	CU-2	2247	M_1	L	2	Protohistoric
DjPm-80	CU-2	1463	M_1	L	2	Protohistoric
DjPm-80	CU-2	807	M_1	L	2	Protohistoric
DjPm-80	CU-2	9248	M_1	L	Indet.	Protohistoric
DjPm-80	CU-2	5663	M_1	L	Indet.	Protohistoric
DjPm-100	CU-16	18594	M_1/M_2	R	4	Protohistoric
DjPm-100	CU-17	10081	M_2	R	Indet.	Protohistoric
DjPm-114	CU-1	3576	M_2	R	2	Prairie/Plains Undif.
DjPm-115	CU-24	54950	M_1/M_2	L	Indet.	Prairie/Plains Undif.
DjPm-115	CU-48	83319	M_1/M_2	L	4	Protohistoric Pr/Pl Undif.
DjPm-115	CU-24	54922	M_1	L	Indet.	Prairie/Plains Undif.
DjPm-115	CU-24	83024	M_2	L	Indet.	Prairie/Plains Undif.
DjPm-115	CU-29	54916	M_1	L	4	Prairie/Plains Undif.
DjPm-115	CU-18	54928	M_1	R	Indet.	Prairie/Plains Undif.
DjPm-115	CU-25	54934	M_1/M_2	L	Indet.	Prairie/Plains Undif.
DjPm-115	CU-18	83031	M_1	L	Indet.	Prairie/Plains Undif.
DjPm-115	CU-22	54933	M_1/M_2	L	Indet.	Prairie/Plains Undif.
DjPm-115	CU-5	2290	M_2	R	4	Prairie/Plains Undif.
DjPm-115	CU-18	54937	M_1	R	4	Prairie/Plains Undif.
DjPm-115	CU-47	54961	M_1	R	Indet.	Protohistoric
DjPm-115	CU-21	54919	M_2	L	Indet.	Prairie/Plains Undif.
DjPm-115	CU-74	83202	M_1	R	4	Protohistoric Pr/Pl Undif.
DjPm-115	CU-22	54923	M_1	L	1	Prairie/Plains Undif.
DjPm-115	CU-10	2179	M_1	R	4	Prairie/Plains Undif.
DjPm-115	CU-5	24544	M_1/M_2	R	Indet.	Prairie/Plains Undif.
DjPm-115	CU-30	54942	M_3	L	Indet.	Prairie/Plains Undif.
DjPm-115	CU-18	54917	M_1	L	Indet.	Prairie/Plains Undif.
DjPm-126	CU-1	10876	M_2	R	Indet.	Protohistoric
DjPm-126	CU-1	22476	M_1	R	Indet.	Protohistoric
DjPm-126	CU-2	22000	M_1	L	4	Unassigned
DjPm-126	CU-1	7978	M_1	R	Indet.	Protohistoric
DjPm-126	CU-1	7481b	M_1	R	Indet.	Protohistoric
DjPm-126	CU-1	7877	M_2	R	Indet.	Protohistoric
DjPm-126	CU-1	19768	M_1	R	Indet.	Protohistoric
DjPm-126	CU-1	7481a	M_1	R	4	Protohistoric
DjPm-126	CU-1	21277	M_1	R	4	Protohistoric
DjPm-126	CU-1	6641	M_2	R	Indet.	Protohistoric
DjPm-126	CU-1	10170	M_2	R	Indet.	Protohistoric
DjPm-126	CU-1	8624	M_2	R	Indet.	Protohistoric

DjPm-126	CU-1	16055	M_3	R	Indet.	Protohistoric
DjPm-126	CU-1	22128	M_2	R	Indet.	Protohistoric
DjOu-62	SC-11	2956	M_1/M_2	L	1/early 2	Protohistoric
DjOu-62	SC-14	2445	M_3	R	Indet.	Protohistoric
DjOu-62	SC-14	2458	M_3	L	Indet.	Protohistoric
DkPi-2		68387	M_1	R	4	Old Women's
DkPi-2		70175	M_1	R	4	Old Women's
DkPi-2		65496	M_1	R	Indet.	Old Women's
DkPi-2		49183	M_1	R	4	Old Women's
DkPi-2		59633	M_1	R	4	Old Women's
DkPi-2		24006	M_1	R	4	Old Women's
DkPi-2		51375	M_1	R	Indet.	Old Women's
DkPi-2		49175	M_1	R	4	Old Women's
DkPi-2		31338	M_1	R	4	Old Women's
DkPi-2		24954	M_1	R	4	Old Women's
DkPj-1	L2 Sp2a	4565	M_1	R	4	Old Women's
DkPj-1	L3 Sp3	80892	M_1	L	4?	Old Women's
DkPj-1	L2	4584	M_1	R	4	Old Women's
DkPj-1	L2	2513	M_1	R	3	Old Women's
DkPj-1	L3 Sp3	80887	M_1	L	Indet.	Old Women's
DkPj-1	L3 Sp3	80899	M_1	L	Indet.	Old Women's
DkPj-1	L3 Sp1.2	80852	M_1	L	2	Old Women's
DkPj-1	L3 Sp1.2	80864	M_1	L	4	Old Women's
EcOr-35		503.14	M_1	L	Indet.	Avonlea/Old Women's
EcOr-35		518.04	M_2	L	4	Avonlea/Old Women's
EcOr-35		529.11	M_2	L	Indet.	Avonlea/Old Women's
EcOr-35		640.61	M_1	L	2	Avonlea/Old Women's
EcOr-35		870.04	M_1	L	1	Avonlea/Old Women's
EcOr-35		1513	M_2	L	1	Avonlea/Old Women's
EcOr-35		1518.4	M_2	R	1/early 2	Avonlea/Old Women's
EcOr-35		1519.3	M_1	L	Indet.	Avonlea/Old Women's
EcOr-35		1534	M_1	R	Indet.	Avonlea/Old Women's
EcOr-35		1567	M_2	L	2	Avonlea/Old Women's
EcOr-35		1656	M_2	L	2	Avonlea/Old Women's
EfOk-16		3-E-10	M_1	R	2	Old Women's
EfOk-16		58-E_1-87	M_1	L	4/early 1	Old Women's
EfOk-16		14-E-17	M_1	R	4	Old Women's
EfOk-16		57-E-67	M_1	L	4	Old Women's
EfOk-16		23-E-9	M_1	L	Indet.	Old Women's
EfOk-16		11-E-11	M_1	L	4	Old Women's
EfOk-16		15-E_1-20	M_1	R	4	Old Women's
EfOk-16		42-E_1-63	M_1	R	4	Old Women's
EfPm-27	L6A	1	M_1	L	4	Old Women's
EfPm-27	L7	2	M_1	L	4	Old Women's
EfPm-27	L7	3	M_1	L	4	Old Women's
EfPm-27	L5	4	M_1	R	4	Old Women's
EfPm-27	L6	5	M_1	L	Indet.	Old Women's
EgPn-440		4620	M_1	L	4	Old Women's
EgPn-440		7576	M_1	L	4	Old Women's
EgPn-440		7593	M_1	R	4?	Old Women's

EgPn-440		2324	M_1	R	2	Old Women's
EgPn-440		5235	M_1	L	4	Old Women's
EcNj-6		1991	M_1	R	Indet.	Old Women's
EcNj-6		2146	M_1	L	4	Old Women's
EcNj-6		1967	M_1	R	Indet.	Old Women's
FaOm-1		10-32-5-2-2 SE1	M_1	R	4	Old Women's
FaOm-1		10-32-5-1-2 SE3	M_1	L	3/early 4	Old Women's
FaOm-1		10-32-5-1-2 SE1	M_1	R	4	Old Women's
FaOm-1		10-32-5-1-2 SE2	M_1	R	4	Old Women's
FaOm-1		10-32-5-2-2 NE1	M_1	R	4	Old Women's
FbNr-1		57-21	M_1	R	4	Old Women's
FbNr-1		50-61	M_1	R	4	Old Women's
FbNr-1		70-63	M_1	R	4	Old Women's
FbNr-1		37-99	M_1	R	4	Old Women's
FbNr-1		59-48	M_1	R	4	Old Women's
FbNr-1		25-215	M_1	R	4	Old Women's
FbNr-1		69-26	M_1	R	4	Old Women's
FbNr-1		43-39	M_1	R	Indet.	Old Women's
FbNr-1		68-146	M_1	R	Indet.	Old Women's
FbNr-1		50-99a	M_1	R	4	Old Women's
24GL302		514-96	M_1	L	4	Old Women's
24GL302		560-33	M_1	L	4	Old Women's
24GL302		515-30	M_1	L	4	Old Women's
24GL302		348	M_1	L	4	Old Women's
24GL302		193	M_1	L	4	Old Women's
24GL302		565-29	M_1	L	4	Old Women's
24GL302		364 b	M_1	L	4	Old Women's
24GL302		606-1	M_1	L	4	Old Women's
24GL302		70	M_1	L	4	Old Women's
24GL302		a/5	M_1	L	Indet.	Old Women's
24GL302		519-26	M_1	L	4	Old Women's
24GL302		193	M_1	L	2	Old Women's
24GL302		642-32	M_1	L	4	Old Women's
24GL302		600-28	M_1	L	Indet.	Old Women's
24GL302		565-28	M_1	L	4	Old Women's
24HL101	CU-12	178.1	M_1	R	3	Saddle Butte
24HL101	CU-12	178.11	M_1	R	Indet.	Saddle Butte
24HL101	CU-11	187.02	M_1/M_2	R	2	Saddle Butte
24HL101	CU-12	1913.04	M_1/M_2	R	4	Saddle Butte
24HL101	CU-12	1947.01	M_1/M_2	R	4	Saddle Butte
24HL101	CU-11	1996.01	M_1	R	4	Saddle Butte
24HL101	CU-11	1996.02	M_2	R	Indet.	Saddle Butte
24HL101	CU-11	2021.01	M_1	R	Indet.	Saddle Butte
24HL101	CU-21	2023.13	M_1/M_2	R	1	Saddle Butte
24HL101	CU-11	2062.06	M_1/M_2	R	3	Saddle Butte
24HL101	CU-14	2064.02	M_1/M_2	L	1	Saddle Butte
24HL101	CU-11	2070.17	M_1/M_2	R	3	Saddle Butte
24HL101	CU-11	2073.03	M_1	R	3	Saddle Butte
24HL101	CU-14	2115.02	M_1/M_2	L	3	Saddle Butte
24HL101	CU-14	2133.01	M_1	L	4	Saddle Butte
24HL101	CU-14	2133.02	M_2	L	Indet.	Saddle Butte

24HL101	CU-14	2133.03	M_2	R	Indet.	Saddle Butte
24HL101	CU-11	2138.1	M_1	R	2	Saddle Butte
24HL101	CU-16	2153.02	M_1	L	4	Saddle Butte
24HL101	CU-15	2154.01	M_1	L	2	Saddle Butte
24HL101	CU-12	2155.06	M_1/M_2	R	3	Saddle Butte
24HL101	CU-12	2155.13	M_1/M_2	R	4	Saddle Butte
24HL101	CU-16	308.01	M_1	R	3	Saddle Butte
24HL101	CU-16	308.04	M_1	R	3	Saddle Butte
24HL101	CU-16	376.05	M_1	R	3	Saddle Butte
24HL101	CU-16	391.02	M_1	R	4	Saddle Butte
24HL101	CU-16	398.01	M_1	R	3	Saddle Butte
24HL101	CU-16	556.03	M_1	R	3	Saddle Butte
24HL101	CU-16	593.01	M_1	R	3	Saddle Butte
24HL411	CU-1	145	M_1	L	2	Prairie/Plains Undif.
24HL411	CU-1	146	M_1	L	2	Prairie/Plains Undif.
24HL411	CU-1	147	M_1	R	2	Prairie/Plains Undif.
24HL411	CU-1	148	M_1	R	Indet.	Prairie/Plains Undif.
24PH2886	CU-53	19346	M_2	L	2/3	Plains/Prairie Undif.
24RL246	CU-1	9	M_1	R	Indet.	Plains/Prairie Undif.
24RL246	CU-1	10	M_1	R	4	Plains/Prairie Undif.
24RL246	CU-1	28	M_2	R	Indet.	Plains/Prairie Undif.
24RL246	CU-1	30	M_2	L	Indet.	Plains/Prairie Undif.
24RL246	CU-1	31	M_1	R	1/early 2	Plains/Prairie Undif.
24RL246	CU-1	32	M_1	L	4	Plains/Prairie Undif.
24RL246	CU-1	36/37	M_1	R	2/3	Plains/Prairie Undif.
24TL1237		B/707/XI	M_1	L	4	Old Women's
24TL1237		B/859/XI	M_1	L	4	Old Women's
24TL1237		B/757/XI	M_1	L	4	Old Women's
24TL1237		no prov	M_1	L	4	Old Women's
24TL1237		D/576/xa	M_1	L	4	Old Women's
24TL1237		B 3/10	M_1	L	4	Old Women's
24TL1237		B/662/xc	M_1	L	1	Old Women's
24TL1237		B/612/XI	M_1	L	4	Old Women's
24TL1237		B/662/xa	M_1	L	4/early 1	Old Women's
24TL1237		B/909/XI	M_1	L	4	Old Women's
24TL1237		B/662/xb	M_1	L	4	Old Women's
24TL1237		D/526/III/80-6	M_1	L	4	Old Women's
24TL1237		B/910/X	M_1	L	4	Old Women's
24TL1237		B/812/xb	M_1	L	4	Old Women's

Table 5. Historic pounding events tabulated by month and period of the 'buffalo year'.

Calendrical Month	Buffalo Year	Pounding events in Chapter 4
January	Period V	5
February	Period V	4
March	Period V	4
April	Period V/I	2
May	Period I	0
June	Period I	0
July	Period II/III	1
August	Period III	1
September	Period III	1
October	Period IV	1
November	Period IV/V	2
December	Period V	5

FIGURES

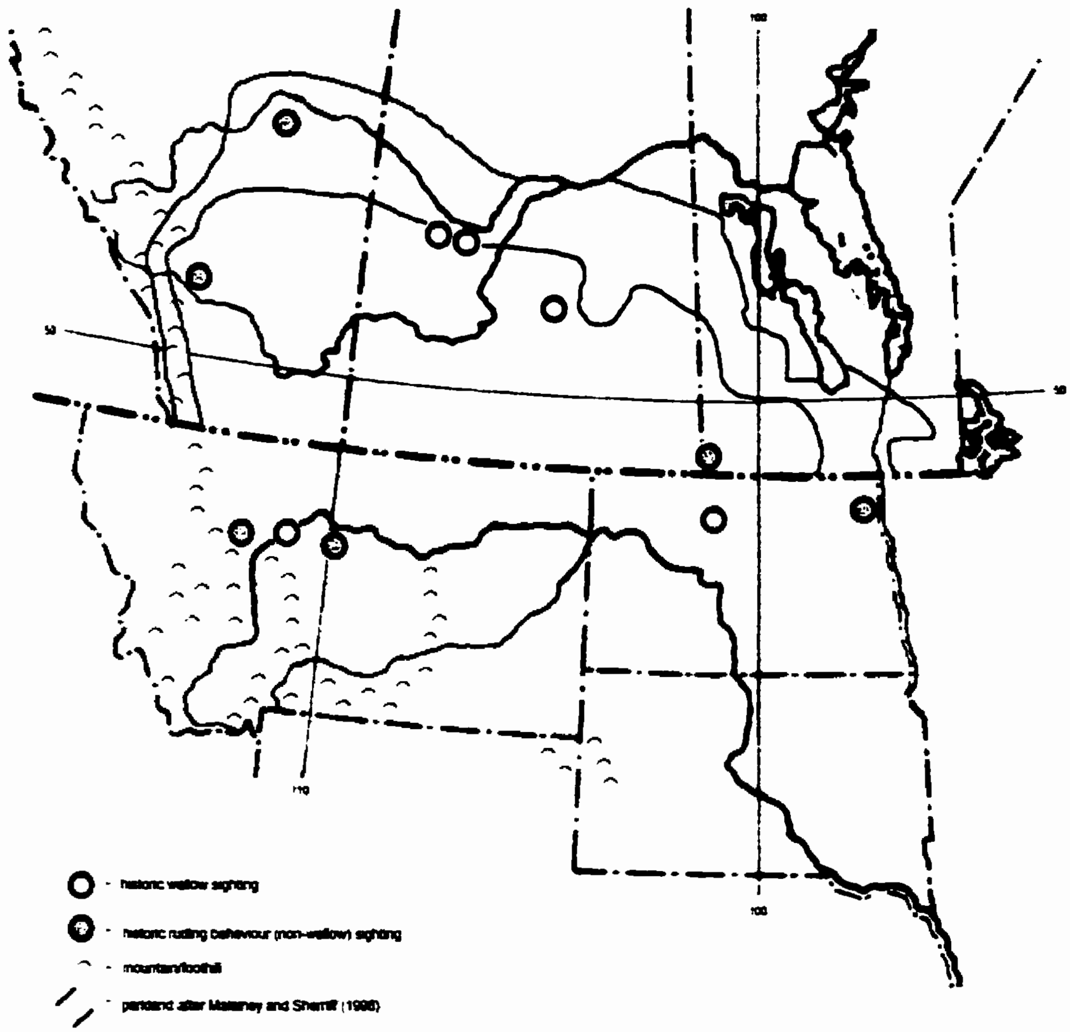

Figure 1. The geographic distribution of historic references to rutting behaviour, especially wallowing, on the northern Plains.

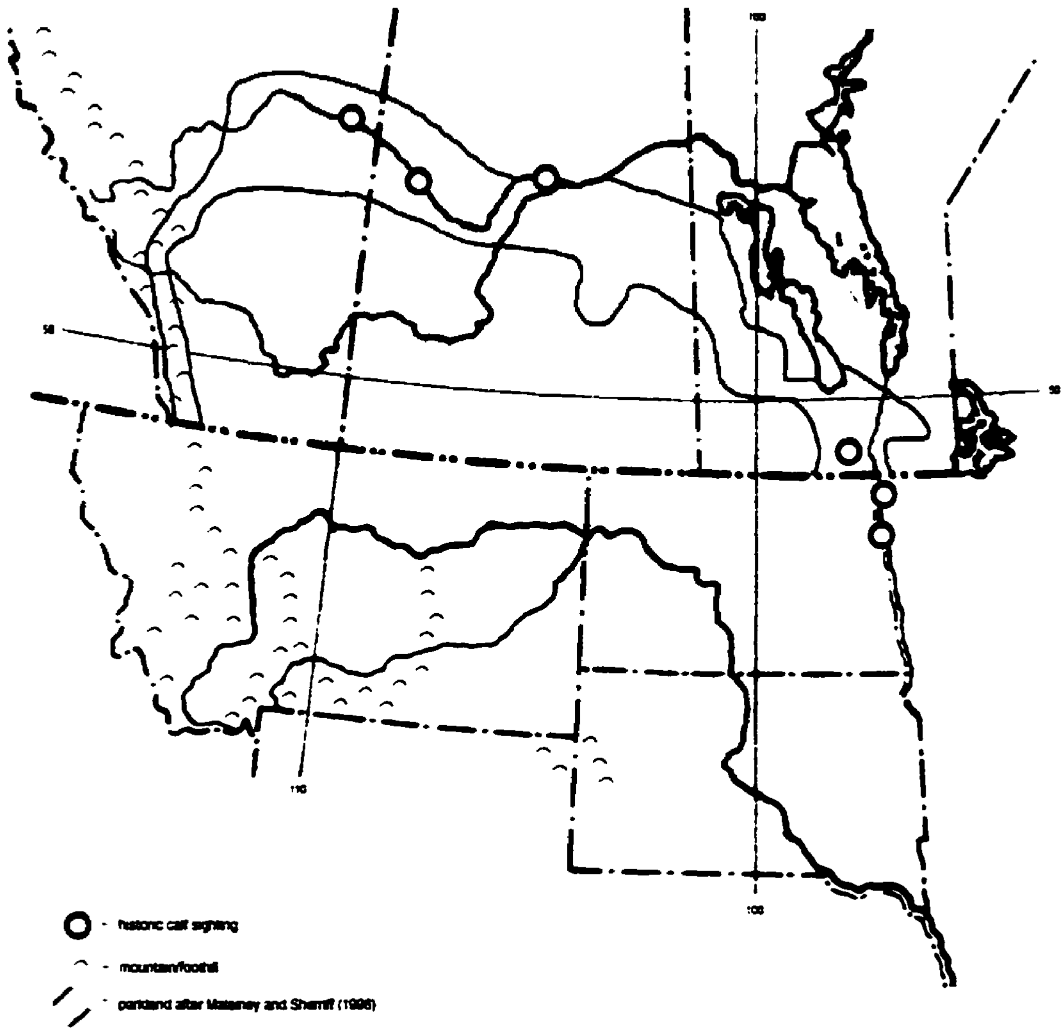

Figure 2. The geographic distribution of historic references to calving on the northern Plains.

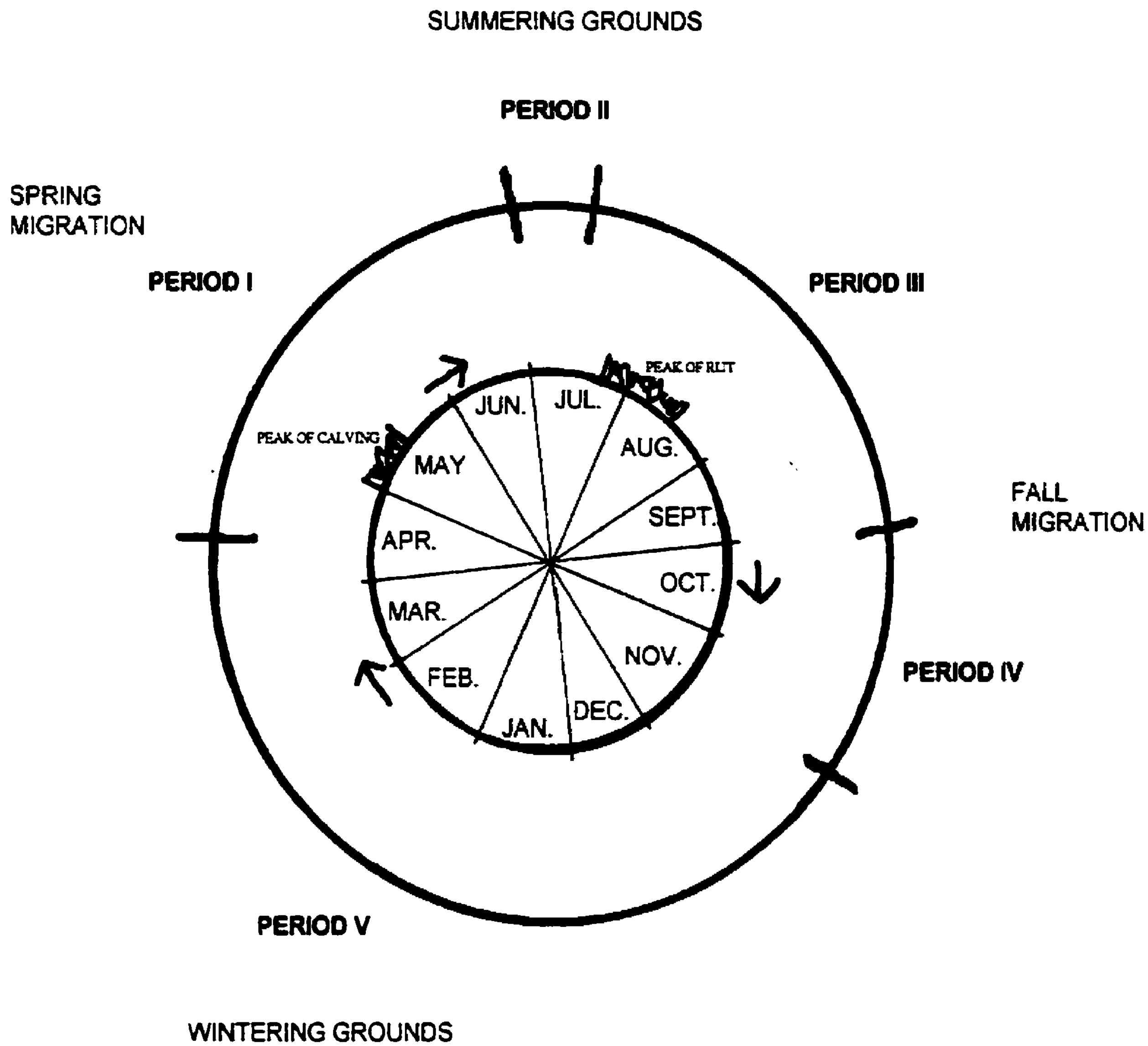

Figure 3. 'Periods' used to describe the 'buffalo year'.

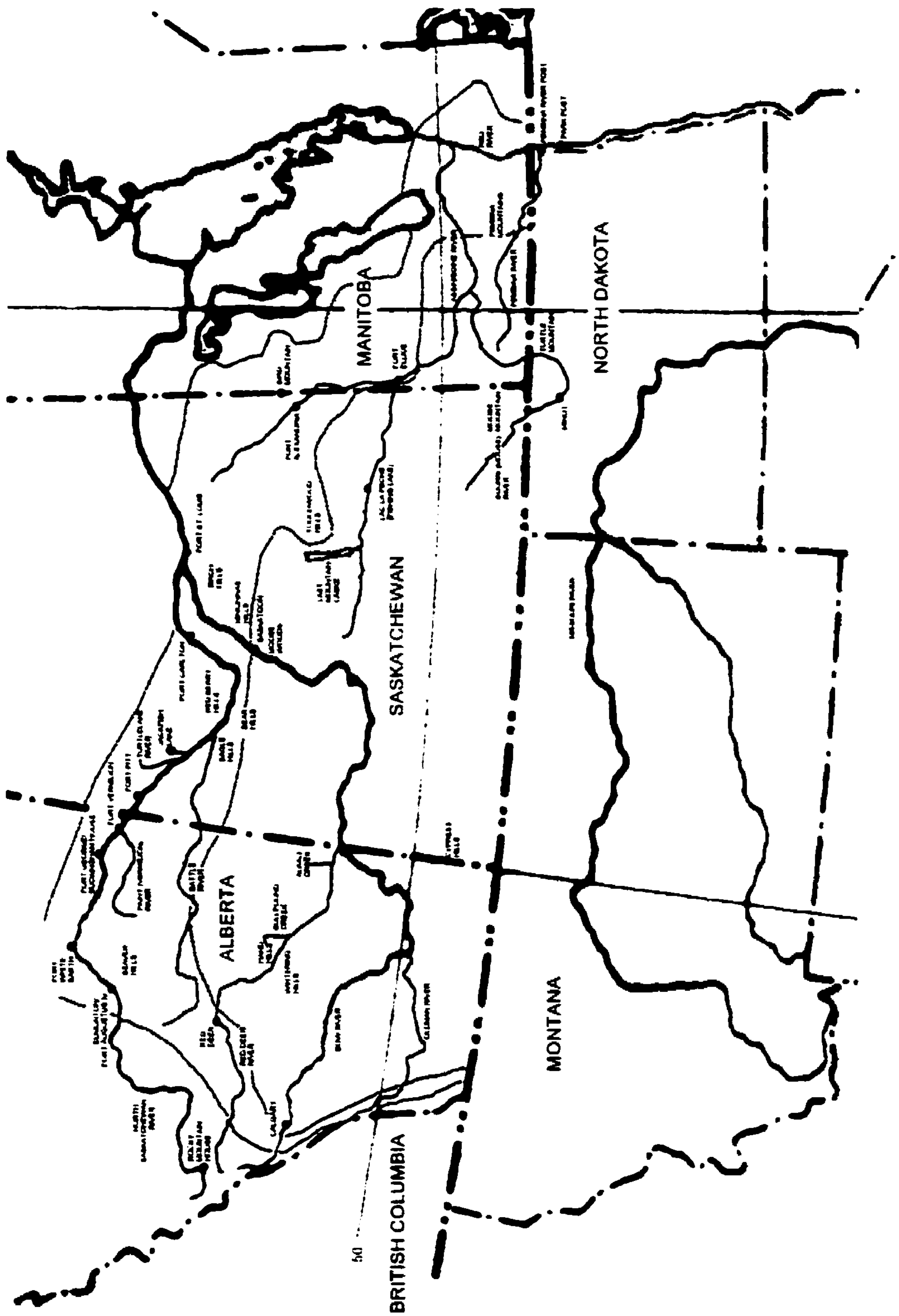

Figure 4. The geographic distribution of historic sites and modern sites used in describing bison locations from historical references.

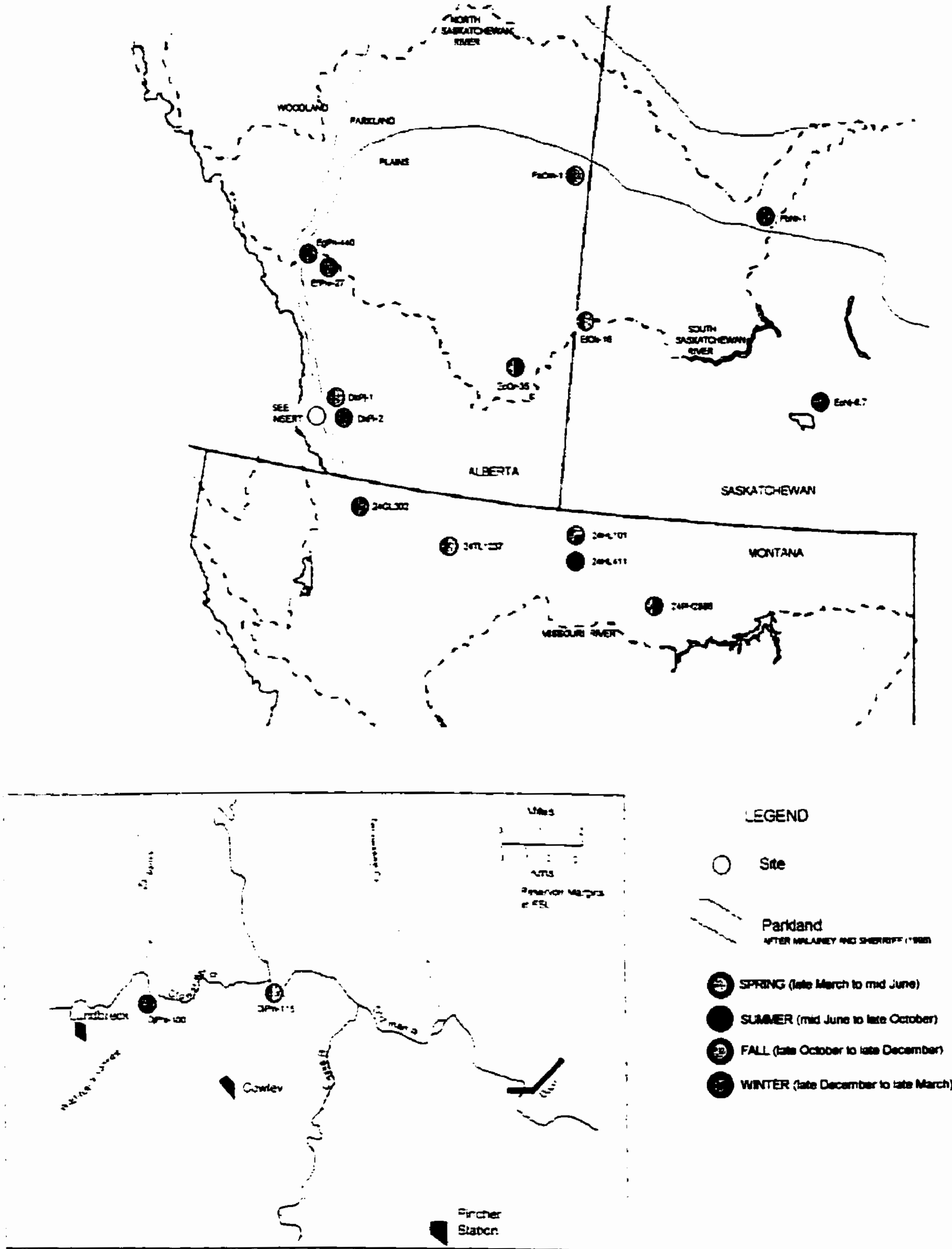

Figure 5. The geographic distribution and seasonality (established by dental cementum increments) of prehistoric sites on the northwestern Plains used in the study (adapted from Brumley and Peck (2000).

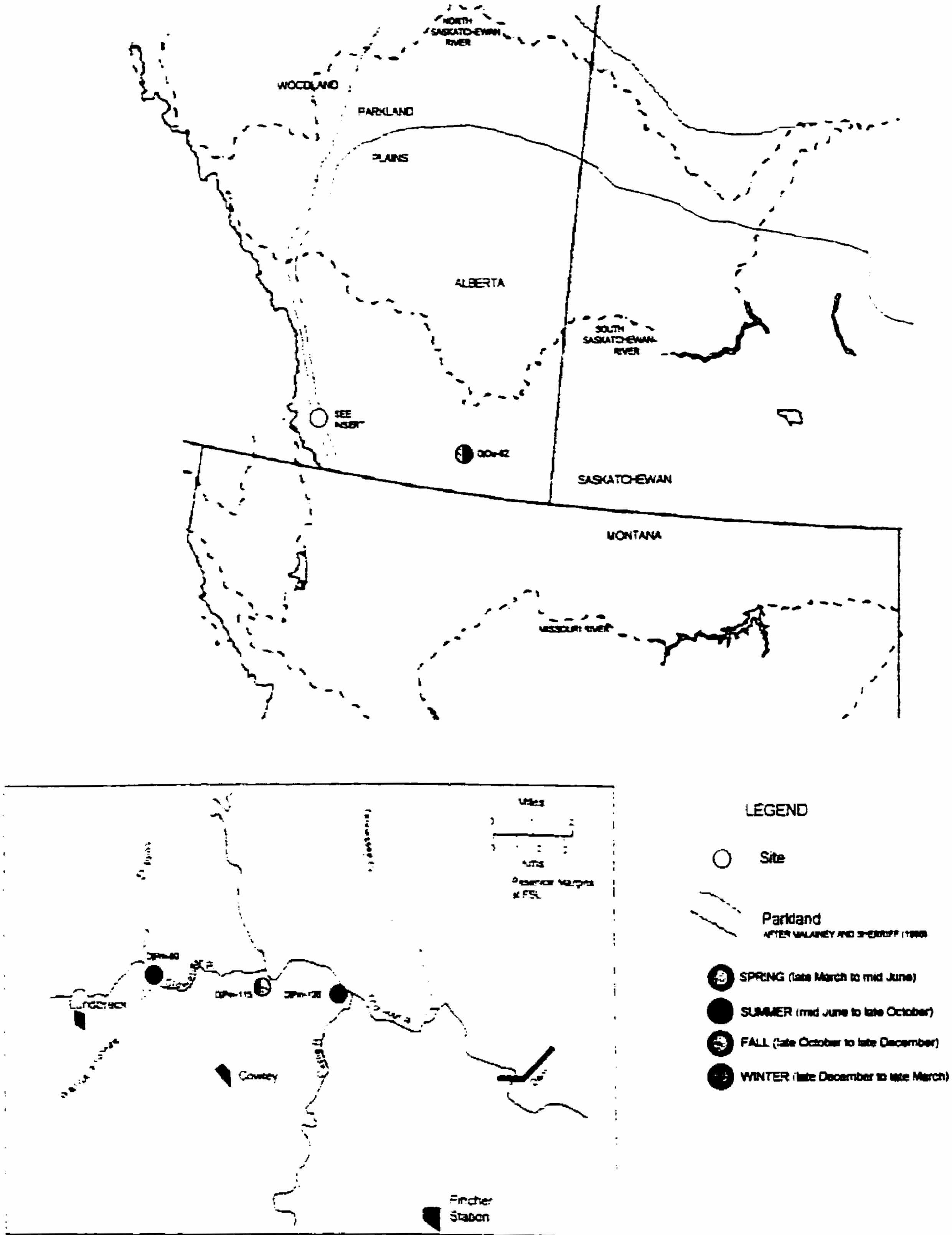

Figure 6. The geographic distribution and seasonality (established by dental cementum increments) of protohistoric sites on the northwestern Plains used in the study (adapted from Brumley and Peck (2000).

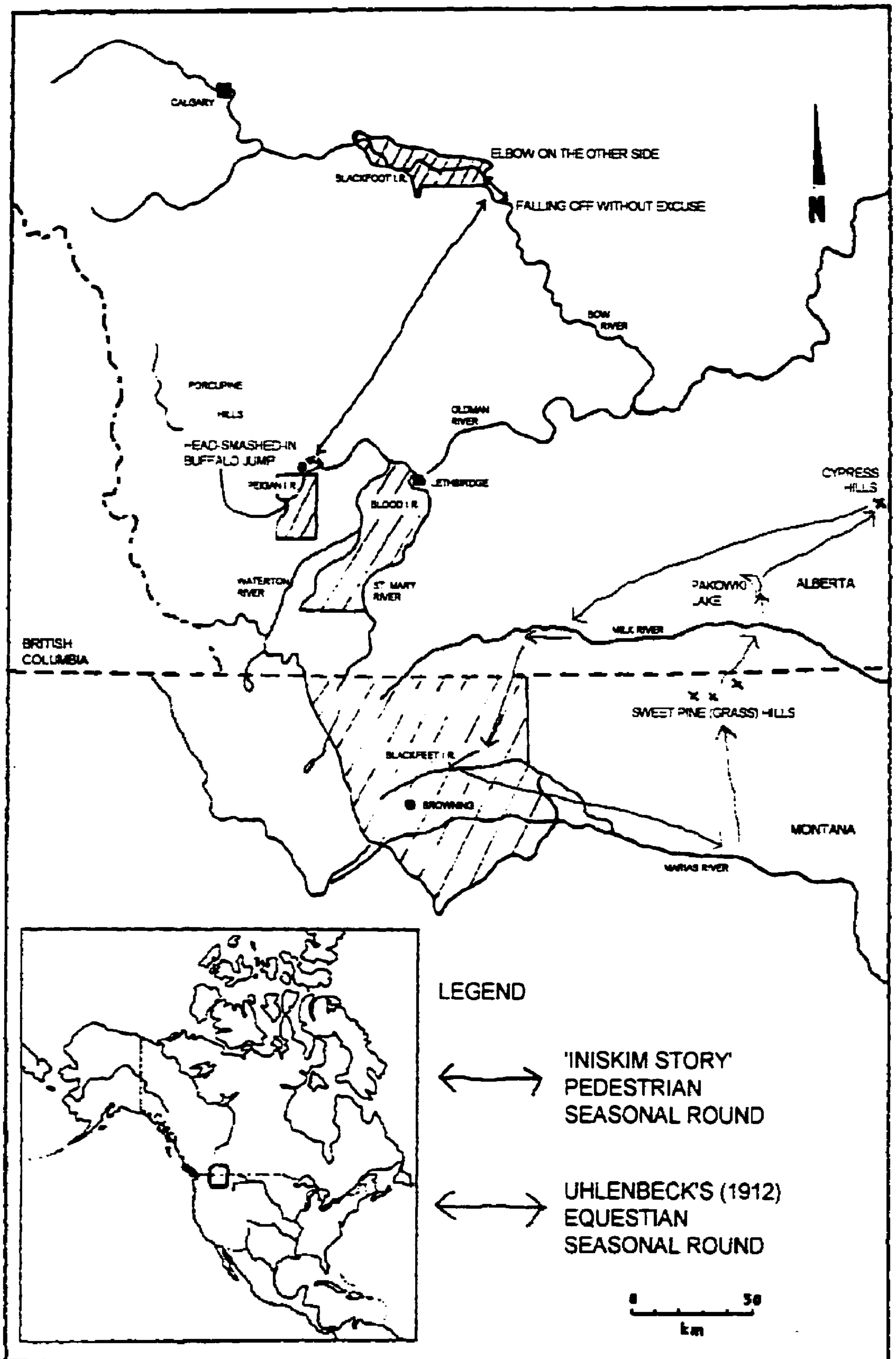

Figure 7. Hypothetical pedestrian seasonal round from the 'Iniskim Stories' and an ethnographic seasonal round from Ulhlenbeck (1912) (adapted from Reeves (1993)).

PLATES

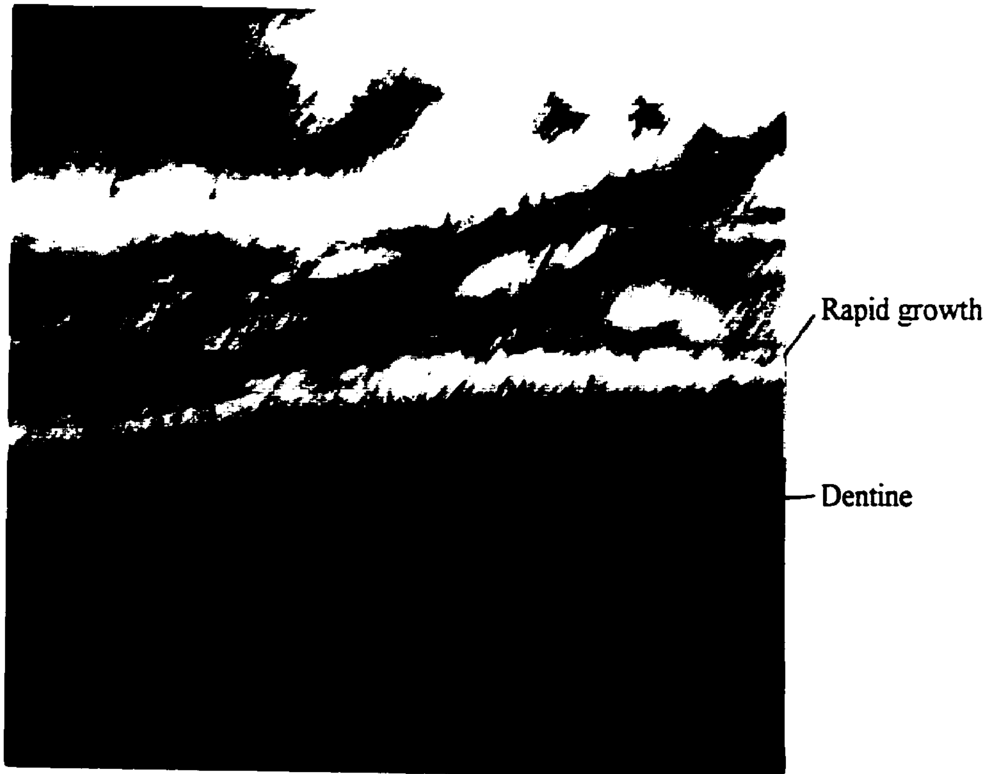

Plate 1. Rapid growth of cementum illustrated in specimen 13 of the modern control sample.

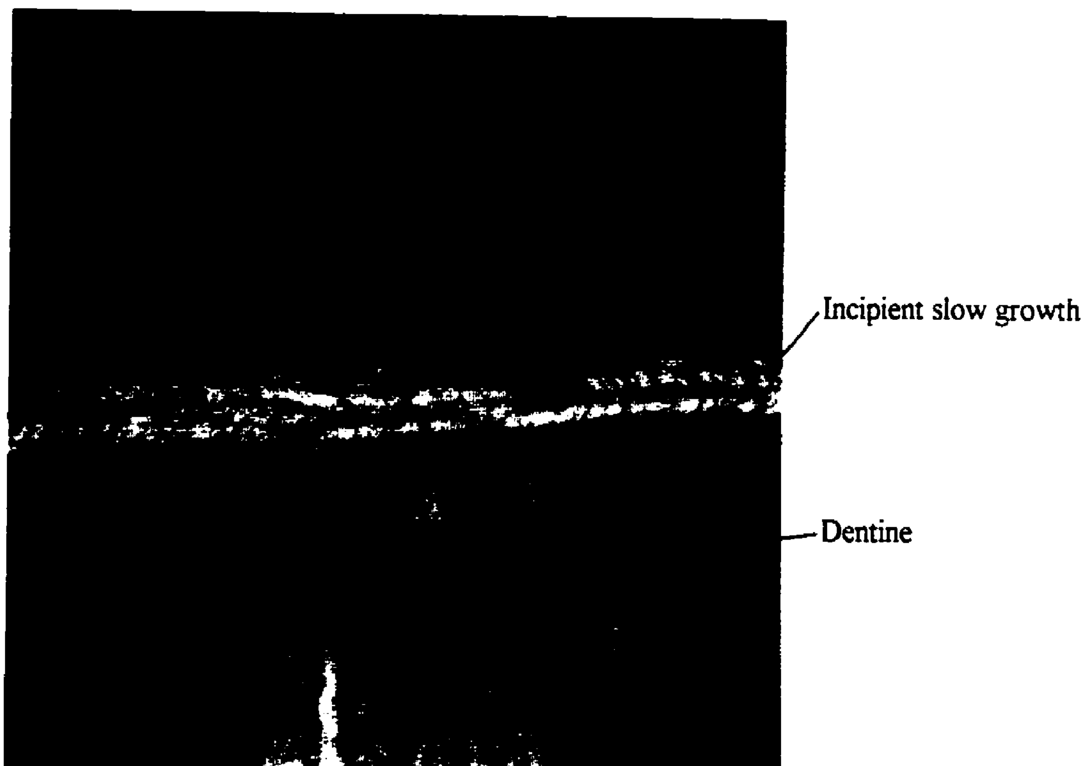

Plate 2. Incipient slow growth of cementum illustrated in specimen 24 of the modern control sample.

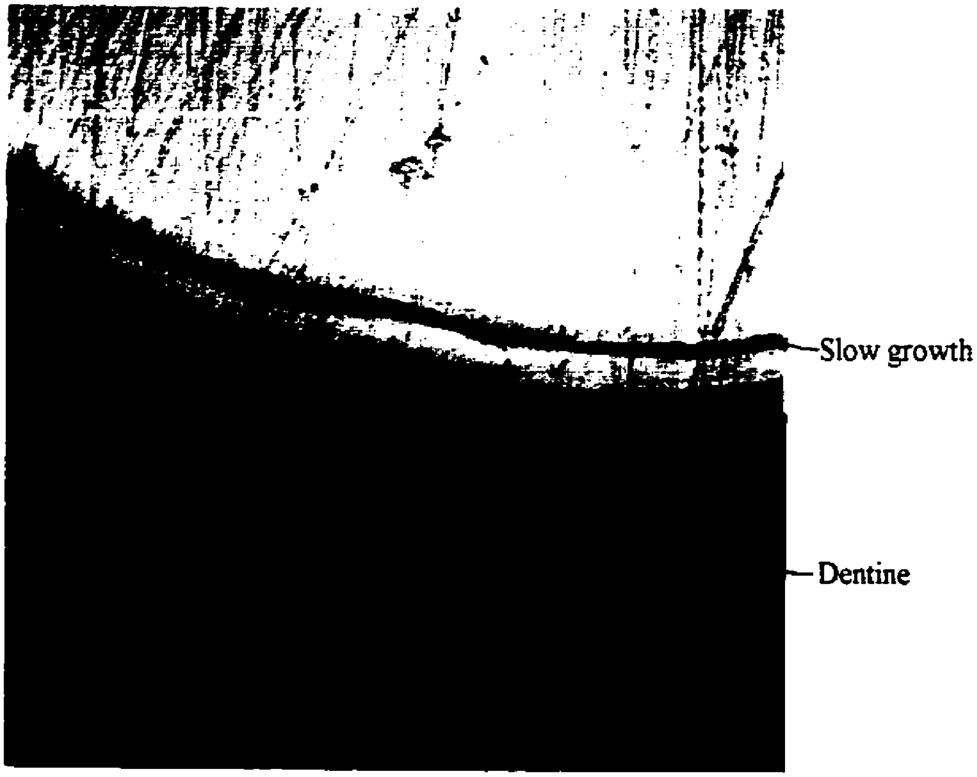

Plate 3. Slow growth of cementum illustrated in specimen 30 of the modern control sample.

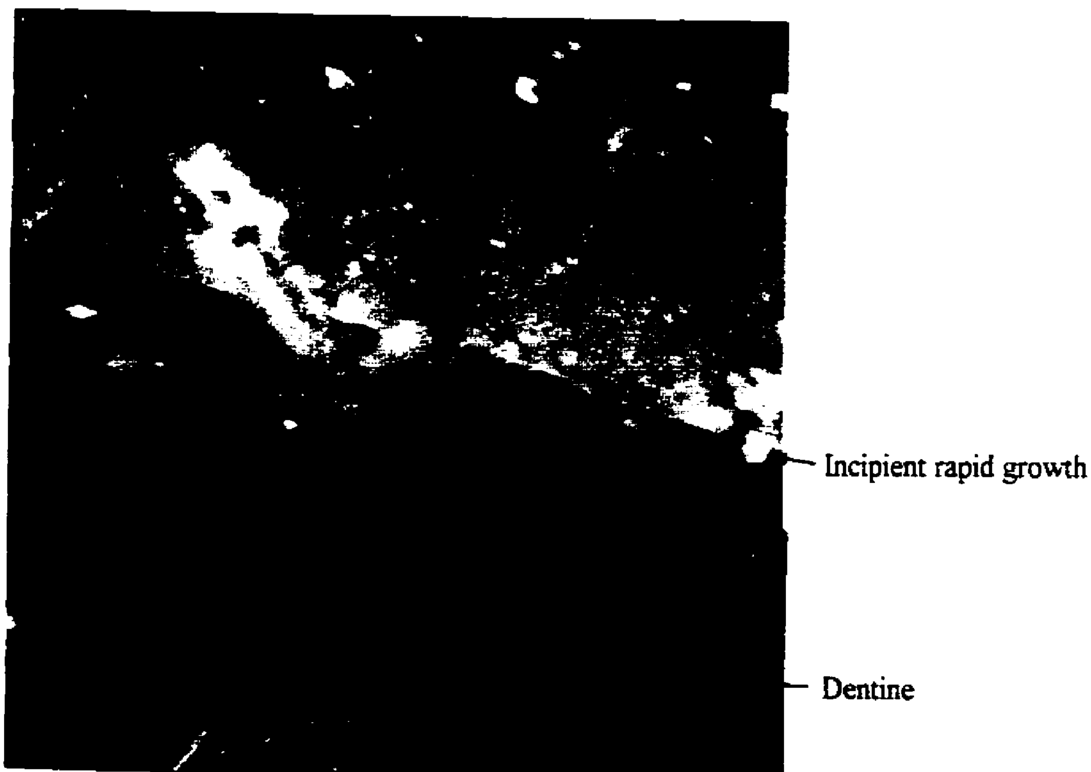

Plate 4. Incipient rapid growth of cementum illustrated in specimen 35 of the modern control sample.