FAUNAL EXPLOITATION AT THE FORKS: 3000 B.P. TO 1860 A.D.

By

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ABSTRACT

This thesis addresses the faunal remains from five archaeological assemblages spanning three thousand years of human occupation at the Forks, Winnipeg. The assemblages are from the Archaic (Hanna), Late Woodland (Blackduck), and Fur Trade (Fort Gibraltar I, Fort Garry, and Upper Fort Garry) periods.

The three goals of the thesis are 1) to analyze the five faunal assemblages from the Forks and compare them, providing information on subsistence and faunal exploitation for the various periods; 2) to compare archaeological and documentary information regarding subsistence to provide a better understanding of faunal exploitation as well as to identify areas of disagreement and potential bias; and, 3) to examine possible explanations for changes in faunal exploitation patterns as indicated by faunal recoveries through time at one locality noted for its comparatively stable environmental regime.

The faunal analysis examined variability in taxonomic composition, taxonomic richness, taxonomic diversity; butchering and processing patterns; and, seasonality of procurement. Using the combined archaeological and documentary databases, the variability was explained through recognition of the following factors: technology, length and permanence of occupation, seasonality and scheduling, site function, and the nature of the subsistence economy. The variability in the faunal assemblages reflects differences in subsistence adaptation and resource use at the Forks.

The combined use of archaeological and documentary databases provided a more complete understanding of faunal exploitation patterns and of the observed variability in the archaeological record. The primary cause of discordance between the two databases was the business orientation of the Fur Trade period documents that consistently underestimated the range of subsistence activities that were apparent in the archaeological record.

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CHAPTER 1:INTRODUCTION

This thesis addresses the faunal assemblages recovered from five spatially discrete archaeological components excavated at the Forks of the Red and Assiniboine Rivers in Winnipeg, Manitoba (DlLg-33 and DlLg-21). Archaeological investigations at the Forks have yielded evidence of human occupation dating to at least 3,000 years before present (B.P.) and possibly as early as 6,000 years B.P. The analysis of the excavated faunal assemblages provides information regarding the nature of subsistence, settlement patterns and seasonality occurring during the occupation periods at the Forks. The assemblages are also analyzed in order to identify and explain changes in these patterns over time.

Five assemblages provide data spanning three major archaeological culture periods - the Archaic, Late Woodland, and Postcontact. The earliest assemblage dates to the late Archaic period (ca. 2870 ± 80 B.P.; BGS 1316), including evidence of both Hanna and Shield Archaic cultures. This combination of point styles suggests influence from cultural groups which have been traditionally identified as utilizing Grassland and Boreal Forest biomes, respectively. The Archaic is generally characterized by a subsistence economy of increased diversification with distinct seasonal rounds and by the use of the atlatl or spearthrower. The second assemblage consists of the remains of a Late Woodland occupation identified as Blackduck and dating to ca. 1250 ± 140 B.P. (AEC 789C). Earliest evidence of Blackduck culture is found in the mixed forest environment of northern Minnesota with subsequent gradual movement west as far as the Parkland area of southwestern Manitoba, and north throughout the boreal forest of northern Ontario. The Late Woodland period is characterized by the use of ceramics and the bow and

arrow. The third assemblage consists of the remains of the Northwest Company (NWC) fur trade occupation of Fort Gibraltar I, dating to 1810-1816 A.D.. This occupation postdates Eurocanadian contact and settlement and Fort Gibraltar I is considered one of the *forts des prairies*, established with the intent of procuring subsistence items to support the expansion of the NWC fur trade into the northwest. The fourth assemblage has been identified as Fort Garry, a Hudson's Bay Company (HBC) occupation dating from 1821-1835 A.D., and representing a continuous, year-round occupation of the area with an increasing dependence on local agriculture. Upper Fort Garry, also a HBC occupation, produced the fifth assemblage. This occupation dates to 1836-1881 A.D. and is characterized by a more complete dependence on local agriculture and represents the end of the fur trade period in the area.

1.1 Goals of the Research

The aims of this thesis are: 1) to analyze the five faunal assemblages from the Forks and compare them, providing information on subsistence and faunal exploitation for the various periods; 2) to compare the archaeological and documentary information regarding subsistence to provide a better understanding of faunal exploitation as well as to identify areas of disagreement and potential bias; and, 3) to examine possible explanations for changes in faunal exploitation patterns as indicated by faunal recoveries through time at one locality noted for its comparatively stable environmental regime. The environmental stability minimizes the possibility that temporal variability in faunal exploitation might be due to cultural adaptation to changing environmental conditions and

thus permits an analytical focus on the implications of changing cultural conditions.

1.2 Theoretical Perspective

One of the main conceptual frameworks used to interpret archaeological remains is materialism (cf. Trigger 1989:291-292). This approach argues that human culture is primarily affected by the ways in which human groups organize themselves to satisfy the basic requirements of survival within specific environments, placing an emphasis on material factors as influencing cultural development. This thesis employs a general materialist perspective through its focus on the interrelationships between human cultures and their environment.

Two materialist approaches are useful in this context - Julian Steward's cultural ecology and Marvin Harris' cultural materialism. Both of these approaches focus on the interrelationship between human culture and the environment (environmental adaptation), with Steward placing a greater emphasis on ecology/environment and Harris a greater emphasis on economy. Harris' model is built upon and developed from Steward's cultural ecology model.

Steward (1963:36) states that "[c]ultural ecology... seek[s] to explain the origin of particular cultural features and patterns which characterize different areas...." He divides culture into two primary aspects, the cultural core and the secondary, peripheral features. The cultural core consists of those features which are "most closely related to subsistence activities and economic arrangements" (Steward 1963:37), including social, political, and religious patterns that are considered to be most closely connected to these

arrangements. Secondary peripheral features, on the other hand, are considered to be due to historical accident through innovation or diffusion. Cultural ecology focuses on the cultural core, on the features which are most closely connected to cultural exploitation of the environment. Steward's approach acknowledges that different aspects of culture are functionally interdependent but that the degree of interdependency varies.

Steward (1963:40-41) presents three "fundamental procedures" of cultural ecology. These are 1) the analysis of the interrelationship of exploitative or productive technology and environment; 2) the analysis of the behaviour patterns involved in the exploitation patterns of a particular area by a particular technology; and, 3) the assessment of the extent to which these behaviour patterns affect other aspects of culture.

Rather than addressing a cultural core, Harris (1979) subdivides culture into three hierarchical components, the infrastructure, structure, and superstructure. The infrastructure consists of the modes of production and reproduction and is the "principal interface" between culture and nature. The structure consists of the domestic and political economies, while the superstructure consists of the "behavioral superstructure" including elements such as religion and aesthetics. Cultural materialism focuses its priority on the infrastructure, which is viewed as providing the primary causal factors of cultural adaptation and change. The three components constitute an entire sociocultural system, and a change in one component generally results in changes in the other two. The infrastructure, however, has "causal priority" in that changes in this component are most likely to result in changes in the other two components. Innovation or deviation in any one of the components can lead to either positive (amplifying) or negative (dampening)

feedback. Innovation in the infrastructure is considered more likely to result in positive, amplifying feedback from the other components than is innovation in either of the other two components.

The theoretical model used in this thesis rests upon these concepts of culture as an adaptation to the environment, focusing on the interaction between culture and environment as mediated through technology and social organization. Technology and social organization are most basic to understanding and explaining cultural adaptation and culture change. Change in the structure and superstructure are more likely to be caused by changes in the infrastructure rather than the other way around.

The periods under study in this thesis are defined by changes in archaeologically visible technology and characterized by differences in subsistence economy. Given that the environment has remained relatively stable over the last three thousand years, the archaeologically visible variability in technology, coupled with variability in social organization, should result in changes in the ways in which human groups utilize available resources and locations. The interrelationship between culture and the environment will also be affected by changes in social organization related to subsistence. Variation in the cultural infrastructure should also be accompanied by variation in the other cultural components (structure and superstructure). Differences in the infrastructure should result in archaeologically visible differences in the ways in which the cultural groups have exploited the environment and its resources. Each cultural period should be characterized by different cultural adaptations, and these adaptations should be visible in the archaeological record through changes in the faunal record. The relative stability of

the environment means that the visible variation in resource use should stem from differences in technology, social organization, and ideology. This thesis asks the following questions, is there variability in the faunal record and does this variability indicate differences in adaptation and resource use at the Forks? Can these differences, in turn, be attributed to differences in subsistence economy, social organization, and ideology?

The analysis of the faunal remains focuses on identifying the variability in cultural adaptations and resource use by focusing on changes in taxonomic composition, richness and diversity; changes in butchering patterns; and changes in seasonality of procurement of various resources. The variability can then be evaluated using a documentary database (ethnographic, ethnohistorical, and historical), examining such factors as technology, seasonality and scheduling, catchment areas, group size, population mobility, political economy and site function.

Studying faunal exploitation provides only one part of the overall picture of subsistence and resource use. Likewise, occupation and resource utilization at the Forks represents only one part of the environmental adaptation of each culture. The Precontact assemblages provide information on only one seasonally limited portion of the entire subsistence round, while the Postcontact assemblages provide information on one location with a specific function, within a large network of locations tied into a global market economy.

1.3 Thesis Organization

The research goals will be addressed in this thesis according to the following chapter outline.

Chapter 2 provides the environmental and cultural context of the assemblages. The environmental background includes a description of the current environment, environmental changes over the three thousand year period, and a discussion of climate change. The section emphasizes the site location within the Parkland ecotone and the relative climatic/environmental stability within the given time period. The cultural background provides a summary of the relevant archaeological culture periods: Archaic, Middle and Late Woodland, and Fur Trade. Each section focuses on the specific archaeological cultures discussed in this thesis.

Chapter 3 introduces the data and methodology to be used in this thesis. The first section introduces the archaeological data by archaeological sample, including faunal sample size, excavation and curatorial methodology, and dating. The methodology section begins with information relevant to the archaeological faunal data, including taxonomic quantification, butchering/processing analysis, seasonality, and potential taphonomic factors. The chapter ends with a discussion of the integration of the archaeological and documentary databases.

Chapter 4 presents the results of the archaeological data analysis, moving from taxonomic quantification, through the analysis of butchering and processing patterns, to seasonality. Within each of these topics the presentation is subdivided by taxonomic class. This chapter provides the knowledge base for comparison with the

subsistence/resource use information from the documentary database.

Chapter 5 presents the documentary data, as extracted from ethnographic, ethnohistorical, and historical sources. The data are presented by culture period, providing details on subsistence, seasonal round, activities, and social data.

Chapter 6 provides the interpretations by period, including a summary of information from the archaeological database, results of the comparison between the archaeological and documentary databases, and a response to the research question of change through time.

Chapter 7 completes the thesis, presenting a final response to the research question, an evaluation of the results of the archaeological and documentary comparison and of the general methodology, and suggestions for future research.

CHAPTER 2: ENVIRONMENTAL AND CULTURAL CONTEXT

Archaeological data must be examined and interpreted within its context in order to improve the resulting interpretations. Both environmental and cultural contexts are described in this chapter, providing the necessary background for later interpretations.

2.1 Environmental Context

Human culture is not defined by its environmental context; however, a successful adaptation to the environment is a necessary prerequisite for cultural survival and continuity. The environment serves to limit the realm of cultural possibility, providing a range of potential within which a culture can manoeuvre. There is no direct, "one-to-one" cause and effect relationship between environment and culture. Instead there is a gradual development of workable solutions for various cultures within an environment - in other words, adaptation. To examine the archaeological remains of a culture in isolation from the broader cultural and environmental context is as invalid as to reason that each cultural characteristic has a root cause within the environment.

The existence of the relationship between culture and environment has prompted this study of cultural change at one locality. An attempt is made to control for one of the major variables - environment - by examining one location within a temporally consistent physical environment. Examination of cultural and temporal variability in faunal exploitation can thus be studied without the complications of a changing physical environment. Changes in species composition occurred following European contact due

to overhunting and habitat destruction and these factors will be considered as potentially influencing exploitation patterns. An overview of the environment is provided, with subsequent discussion regarding climatic change. The high degree of mobility in human groups necessitates a discussion not only of the immediate environment but of the surrounding areas which also may have been utilized.

2.1.i Current Environment

The Forks is located at the confluence of the Red and Assiniboine Rivers, within the Aspen Parkland ecotone (Figure 2.1) . Bird (1961:3) describes the aspen parkland as containing "two major plant communities, forest and grassland, which are intermingled in a mosaic of irregular isolated patches, and more or less solid stands, as well as numerous aquatic communities." The aspen parkland is considered to be an ecotone, or transitional area, between the grassland and boreal forest biomes. It is characterized by a "diversity of habitat and subsistence resources available in comparison to the adjacent major biomes of the xeric plains and the boreal forest" (Nicholson 1987:49-50). Diversity is further heightened by the Forks' situation in a riverine environment, providing access to specialized plant and animal resources.

The site's location within a transitional environment would have made both grassland and forest species available for human exploitation. Major mammalian species within the grassland community include bison (*Bison bison*), pronghorned antelope (*Antilocapra americana*), wapiti (*Cervus canadensis*), wolf (*Canis lupus*), coyote (*Canis latrans*), red fox (*Vulpes vulpes*), badger (*Taxidea taxus*) and other mustelids, as well as
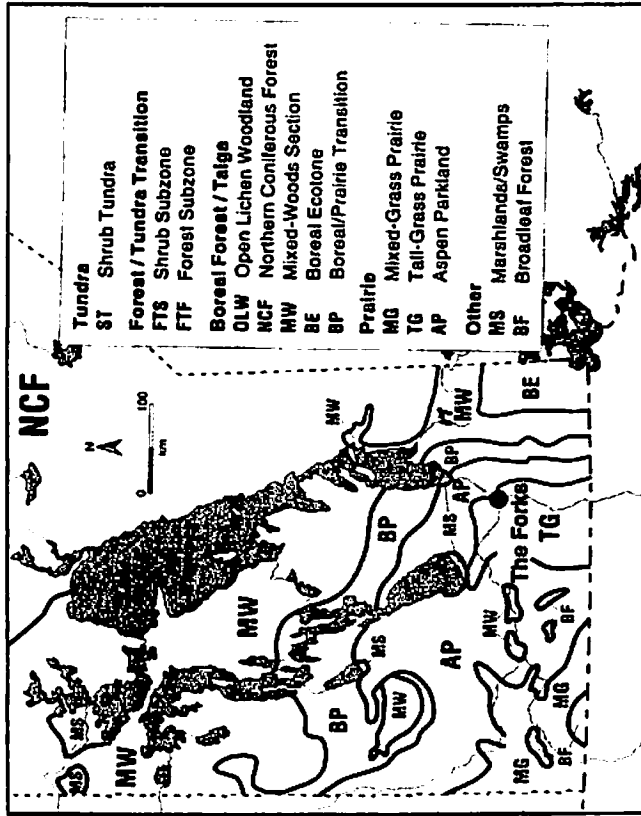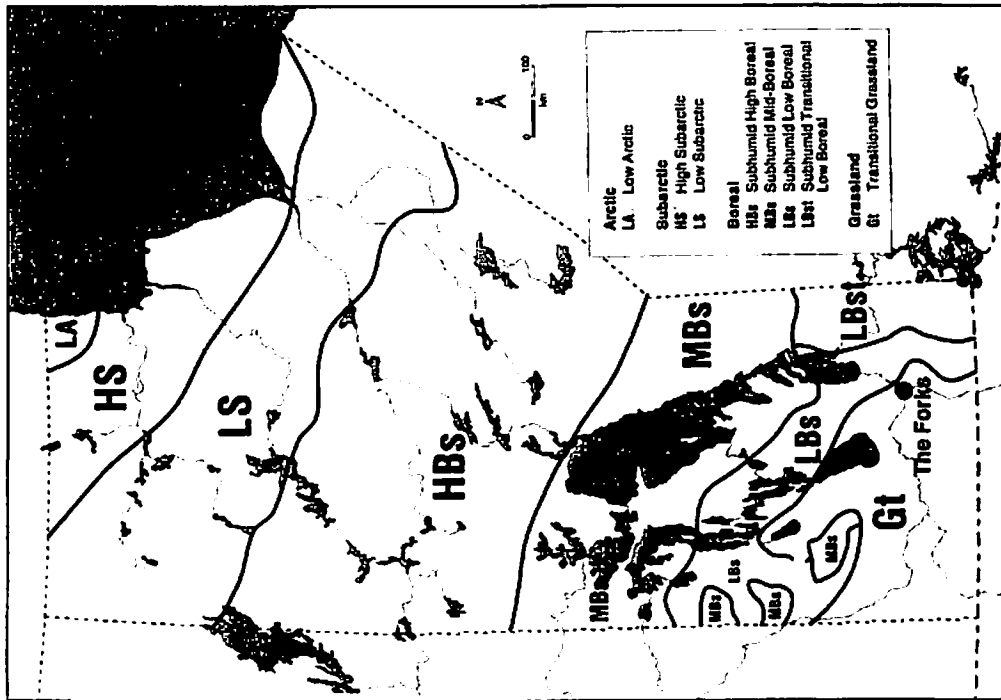
Figure 2.1 Map of Manitoba showing site location, a) ecoclimatic zones, and b) natural vegetation zones. Original from Scott, 1996.

various smaller mammals such as mice, voles, ground squirrels, and jack rabbit and a wide variety of avian species (Bird 1961:9-11).

Mammalian species of the forest community include snowshoe hare (*Lepus americanus*), mule deer (*Odocoileus hemionus*), moose (*Alces alces*), black bear (*Ursus americanus*), beaver (*Castor canadensis*), and smaller mammals (mice, chipmunks, ground and tree squirrels, mustelids) (Bird 1961:15-17). On a seasonal basis, many grassland species also ranged within the forested areas. Common riverine mammals of the area include beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), mink (*Mustela vison*), and raccoon (*Procyon lotor*). Waterfowl are seasonally available, while various fish species exist - or existed - in the Red and Assiniboine Rivers. These include pike (*Esox lucius*), catfishes (Ictaluridae), suckers (Catostomidae), sturgeon (*Acipenser fulvescens*), walleye/sauger (*Stizostedion* sp.), and minnows. Two species of turtle are also present - the western painted turtle (*Chrysemys picta*) and the snapping turtle (*Chelydra serpentina*) (Bird 1961:23-24).

Major changes have occurred in the faunal community composition of the aspen parkland, particularly since European contact. The fur trade, land clearance and settlement served not only to decimate, marginalize and extirpate a number of species but also to increase the ranges and populations of others. The most dramatic effect has been the disappearance of the bison, primarily through overhunting. The last recorded sighting of wild bison near Winnipeg was in 1819, while the last record of bison in the Souris River area to the west was in 1883 (Bird 1961:58-59). The large carnivores which preyed on these herds, such as the buffalo wolf, cougar, and plains grizzly, have also

vanished or retreated to wilder areas. Both moose and wapiti have been pushed into more marginal areas, while the mule deer has been gradually replaced by the white-tailed deer (*Odocoileus virginianus*). Jack rabbits have also increased their range with the expansion of agriculture and resultant land clearing.

The greatest change in avian species has been the disappearance of the passenger pigeon (*Ectopistes migratorius*). This bird was considered both a pest and a subsistence resource during the early settlement period and was hunted into extinction by the turn of the twentieth century. The prairie chicken (*Tympanuchus cupido*) has also become virtually extinct within the area, while various European species have been introduced (Bird 1961).

The mixture of grassland and woodland species within the aspen parkland is as characteristic of the floral species as it is of the faunal species. The following description of the floral community focuses on the riverine environment in the immediate area of the Forks. Primary forest cover in the floodplain area consists of Manitoba maple (*Acer negundo*), lance-leaved ash (*Fraxinus pennsylvanica*), American elm (*Ulmus americana*) and, to a lesser extent, cottonwood (*Populus sargentii*), basswood (*Tilia americana*), willows (*Salix* sp.), and a variety of understorey plants (Bird 1961:13-14). Scrub, or bur, oak (*Quercus macrocarpa*) is present on higher ground (Shay et al. 1990:2).

Bird's description of the floodplain forest composition is largely supported by the results of a modern vegetation survey carried out in the area by Shay et al. (1990:9), which noted the presence of Manitoba maple, ash, cottonwood, peach-leaved willow (*Salix amygdaloides*), and elm. The underbrush consists of "various shrubs and vines

along with...saplings and a variety of herbs....The shrubs present are dogwood..., gooseberry..., and snowberry..." (Shay et al. 1990:12).

The plant community composition has also been altered by European settlement, exemplified by the deforestation of the local area by the need for building materials and firewood (Shay et al. 1990:16). Nineteenth century maps and journals note the presence of extensive marshes east of the Forks and the existence of forests of oak (*Quercus macrocarpa*) and aspen (*Populus tremuloides*) on the east side of the Red River (Shay et al. 1990:19-20).

2.1.ii Changes in Environment at the Forks

Various changes have occurred in the Forks environment over the three thousand year span with which this thesis is concerned. Most of these changes have occurred within the last two centuries during which the fur trade and European settlement altered the landscape and the composition of floral and faunal communities. The environment has also been altered through natural means such as fire and the ongoing creation and destruction of oxbows and the seasonal flooding of the Red and Assiniboine Rivers.

More recently, the infilling of the Forks area by the CN Railway has covered the area "to depths varying from 0.5 m to 5.0 m ... and has moved the bank outward and increased its elevation" (Priess, cited in Shay et al. 1990:6). This inclusion of Postcontact period refuse is clearly evident in excavation profiles at the Forks.

The apparent periodic rerouting of the Assiniboine River is another important change in the physical environment of the Forks. Rannie et al. (1989) have studied the

paleochannels associated with the Assiniboine River, creating a chronology of the channels which directed Assiniboine River discharge either into Lake Manitoba to the north or into the Red River to the east. Radiocarbon dated organic remains from the various paleochannels provide a chronology which suggests that 3000 years ago (about the time of the earliest human occupation dealt with in this thesis) the Assiniboine did not discharge into the Red River at the Forks but through the La Salle River channel to the south. The establishment of the La Salle channel has been dated to 2980 ± 70 B.P. (TO-242), while the current discharge path towards the Forks was not established until 1330 ± 100 B.P. (BGS-1078).

The work of Nielsen et al. (1993) does not support the early dates for the La Salle channel although their study of sedimentation rates does suggest that the Assiniboine River did not flow into the Red River until ca. 1500 B.P. Based on stratigraphic evidence related to the Archaic horizon at the Forks, Kroker (pers. comm. 1998) disagrees with both of these discharge chronologies. Thick sand deposits are evident both above and below the dated Archaic occupation. These deposits could only have been produced through a massive water influx. Kroker believes that the Assiniboine River must have deposited these flood sands and, therefore, that the Assiniboine must have flowed into the Red during this period. He does not dispute, however, that the Assiniboine River may have flowed in different patterns at other times.

Rannie et al. (1989) do not describe what would have existed at the Forks in the absence of the Assiniboine. Kroker (pers. comm. 1998) suggests that the Assiniboine channel may have been at least seasonally utilized by either Colony Creek or Sturgeon

Creek, both of which currently flow into the Assiniboine River further upstream. To what degree the shifts in the Assiniboine River flow might have affected the availability of subsistence resources at the Forks is unknown but, as some water flow through the valley was apparently ongoing, the effects of any habitat shift were probably minimal. In addition, the consistent presence of the Red River and corresponding vegetation would have maintained a relatively stable riverine environment.

2.1.iii Climate Change

In order to track temporal and cultural changes in faunal exploitation, the number of complicating factors has been reduced by maintaining location and environment as constant. The selected faunal assemblages date to a period when vegetation and climate were generally stable and similar to the present. This avoids the potential problem of major climatic change affecting faunal exploitation patterns. This section deals with the dating of the major climatic episode which preceded the Archaic occupation (the "Altithermal") and includes a brief discussion of climatic change within the last three thousand years.

This discussion is based on pollen core studies from southern Manitoba and adjacent regions. Pollen analysis is considered to be "one of the most useful tools for studying palaeoenvironmental changes" (Shackley 1981:72). Pollen analysis provides a large scale image of vegetation changes over time. The composition of a pollen core can be affected by differential production and deposition of pollen grains, as well as by differential preservation (Pearsall 1989:442). These factors introduce bias into the

composition of the pollen core, resulting in under- or over-representations of certain taxa. Pollen analysts therefore utilize a comparative approach to interpret the pollen assemblages, in which "assemblages produced by known vegetation formations ... are compared to fossil assemblages...[and]...close correspondence permits modeling of past vegetation" (Pearsall 1989:442).

Despite the noted drawbacks of pollen core analysis, they do provide a broad spectrum representation of past vegetation zones which can be linked to major climatic episodes. Pollen cores are not available for the Forks area, specifically, but the regional cores which are available are sufficient to indicate large scale vegetation changes. The understanding of climate change at the Forks, specifically, would be enhanced by future study incorporating the analysis of local pollen cores and other means of accessing palaeoenvironmental data (e.g. dendrochronology, molluscs).

Pollen core studies from southern Manitoba reveal a broadly similar series of vegetation zone changes over time. Ritchie (1964; 1967) describes three pollen "zones". The first zone (from the last deglaciation to ca. 10 000 B.P.) is represented by a large amount of spruce, smaller amounts of poplar, larch, black ash, juniper, and *Shepherdia canadensis*, and a herb component of *Artemisia* and sedges. The second zone (ca. 10 000 to 3500 B.P.) consists of "a herb-dominated assemblage dominated by Gramineae, Cheno-Amaranths, *Artemisia*, and Ambrosieae" (Ritchie 1983:159). The third zone (ca. 3500 B.P. to present) consists of current vegetation types. The composition of the current vegetation communities varies according to area (i.e. grassland versus parkland) but generally indicates a landscape of "mixed deciduous forest dominated by oak, birch,

and ...aspen poplar" (Ritchie 1967:224). The drying effects of the Altithermal are evident within the second zone, which Ritchie (1983:168) interprets as "a warm dry climate with summer temperatures 15 to 17°C...and effective precipitation 10 to 20% less than modern values supporting a prairie zone complex of communities on all sites except hydric and cool-mesic, where shrub and deciduous tree stands prevailed." Ritchie (1983:168) provides the rough date of 2500 B.P. for the "establishment of the modern climate and vegetation."

Ashworth and Cvancara (1983) provide a similar outline of vegetation periods within the area immediately to the south (North Dakota, Minnesota, South Dakota), although dates differ slightly. From 11 500 to 10 000 B.P., a spruce parkland existed near Lake Agassiz. The following period (10 000 to 4 000 B.P.) maintained higher summer temperatures and increased aridity. Spruce forests were replaced by pine and hardwoods in the eastern region and by deciduous forest and prairie in the western region. The last period (4 000 B.P. to the present) was both wetter and cooler.

Shay's (1967) study of the southern Lake Agassiz basin area provides a third similar reconstruction. Shay's "interval III" (9 000 to 4 000 B.P.) represents the period of the Altithermal, with pollen cores dominated by oak and herbaceous pollen. This is followed by "interval IV" (4 000 B.P. to present), with pollen assemblages dominated by herbs, deciduous trees, and pine.

These vegetation reconstructions serve to point out that the effects of the Altithermal had largely passed by 3 000 B.P., by which time modern vegetation types and ranges were established.

The Altithermal (also termed the "Atlantic") was the last major climatic episode to occur prior to the Archaic occupation. The Archaic occupation postdates the end of the Altithermal, thus avoiding the effects of the drier conditions on faunal exploitation and human movement. The attempt to completely factor out the effects of climate on exploitation patterns is, of course, doomed to failure. Climate is not static and changes continually in patterns of varying duration. The most dramatic climatic occurrence since the Altithermal was the "Little Ice Age," a period of lower temperatures and of notable variability from one year to the next. Lamb (1982:202) states that "it would be reasonable to regard the whole period between about 1420, or even 1190, up to 1850 or 1900 as belonging to the Little Ice Age development."

While Lamb (1982) provides numerous examples of the effects of the Little Ice Age and its dramatically lower temperatures, Bamforth (1990) argues that the most notable characteristic of the Little Ice Age was not lower temperatures or increased precipitation, but increased climatic variability, both temporally and geographically. He suggests that climatic reconstructions should be compared to data from the specific region under study. This type of climatic data is not available for this area, until we have access to fur trade journals for the eighteenth and nineteenth centuries. The time period defined for the Little Ice Age varies and, following Lamb's estimates, it should be noted that the bulk of the Postcontact Period assemblages used within this thesis coincide with the closing decades of the Little Ice Age period. Given the variation in the dates considered for the end of the Little Ice Age, it is possible that its effects may still have been felt at this late date.

2.2 Cultural Context

As noted in the introduction, archaeological data should be viewed within the context of the physical and cultural environments. The combination of environmental and cultural context is perhaps most relevant when studying the faunal remains of a cultural occupation. These remains represent one of the most direct connections between cultural and environmental context, emphasising the adaptation of human cultures to the physical environment and its resource potential. This thesis is primarily a study of the manner in which different cultures adapted to and utilized the environment, as exemplified by the faunal remains from several occupations at the Forks.

An outline of the archaeological cultures under consideration provides the necessary context. These cultures range from the relatively little-known hunter-gatherer groups of the Precontact period to the fur traders and settlers of the eighteenth and nineteenth centuries, minor participants in an increasingly complex international economy. The former are recognized almost solely through archaeological investigation, while the latter are represented by a wealth of documentary detail.

The intent within this section is to provide a brief outline of these cultures, including time depth, distribution, and general characteristics. A more in-depth description of faunal exploitation patterns and seasonal rounds is presented in Chapter 5. A recurrent problem when studying the archaeological cultures of the Forks area is the tendency of many researchers to focus on other biomes (e.g. grassland/prairie; boreal forest). The cultural chronology of the Aspen Parkland ecotone has been inadequately studied, yet its position between the grassland and forests served as an area of cultural

contact. A broad temporal and cultural outline of occupations at the Forks is provided in Table 2.1.

2.2.i Archaic Period

The earliest human occupation so far encountered at the Forks is estimated to date to approximately 6000 years before present (B.P.) and consisted of two hearths associated with charred fish bone (Kroker and Goundry 1993:6). The estimated date places this occupation within the Altithermal and prior to, or during the initial portion of, the archaeological period known variously as the Archaic, the Middle Indian, the Meso-Indian, or Middle Precontact Period.

The earliest assemblage used in this study dates to the later Archaic. Various researchers, focusing upon different regions, provide a variety of dates for the Archaic period. Wright's (1995:298) Middle Plains Culture, for example, is dated from 8000 to 2000 B.P. and Dyck's (1983:87) Middle Plains Indian Period from 7700 to 1850 B.P., while Kroker and Goundry (1993:6) date the Archaic between 5000 and 2000 B.P.. The terminal dates (ca. 2000 B.P.) are thus fairly consistent although the initial dates vary considerably from region to region.

The Archaic period is recognized archaeologically by a distinctive projectile point style. The diagnostic points of this period are fairly large, side- to corner-notched varieties which are thought to have been used with the atlatl, or spear thrower (e.g. Dyck 1983:87). The preceding Paleo-Indian period is marked by the predominant use of lanceolate spear points. The Archaic is also marked by a greater use of local lithic

Table 2.1 Cultural outline for the Forks occupations mentioned in the text

OCCUPATION	DATES
Unknown Archaic	ca. 6000 B.P.
Hanna	2870 +/- 80 B.P. (BGS 1316) 2850 +/- 90 B.P. (BGS 1374) 2815 +/- 75 B.P. (BGS 1483)
Unknown Archaic	2160 +/- 100 B.P. (BGS 1479) 2340 +/- 90 B.P. (BGS 1480)
Blackduck	1220 +/- 130 B.P. (AEC 774C) 1250 +/- 140 B.P. (AEC 789C) 1280 +/- 100 B.P. (AEC 784C) 1560 +/- 100 B.P. (AEC 783C)
Fort Gibraltar I (NWC)	1810-1816 A.D.
Fort Gibraltar II (NWC)	1817-1821 A.D.
Fort Garry (HBC)	1821-1835 A.D.
Upper Fort Garry (HBC)	1835-1883 A.D.

materials (Wright 1995:299). The disappearance of the earlier megafauna species, the gradual decrease in bison size, and the climatic effects of the Altithermal are thought to have given rise to a more intensive use of local resources, with the development of a distinct seasonal round focused on the efficient use of local faunal and floral resources (Buchner 1980:163 ff., 206; Wright 1995: 278 -279). The shift to a more diversified subsistence round did not necessarily occur on the Plains in the manner that it did in the woodland areas. The term "Archaic" is not always applied to Plains cultures of the period. Because the Forks is situated in a transitional area and was accessible to both grassland and forest adapted people, the term "Archaic" is used only to indicate a temporal period.

Two Late Archaic occupations have been recovered and dated from the Forks. A thin deposit of materials encountered during the development of the Assiniboine Riverfront Quay (Kroker and Goundry 1993:167) as well as during the Public Archaeology Project excavations in 1992 and 1993 (Kroker 1993:209) has been radiocarbon dated to ca. 300 B.C. (ca. 2000 B.P.). A second, more extensive occupation was also encountered during the riverfront quay excavation and the Public Archaeology Project excavations and has been dated to ca. 3000 B.P..

Excavations within this more extensive Archaic horizon recovered a total of nine projectile points, eight of which were classified to a type (Kroker 1989; Kroker and Goundry 1993, 1994). Four have been classified as Hanna, two as Shield Archaic, one as possibly Pelican Lake/Larter, and one as Pelican Lake/Shield Archaic (Figure 2.2). Given the preponderance of Hanna points, the incomplete state of the Pelican Lake point,
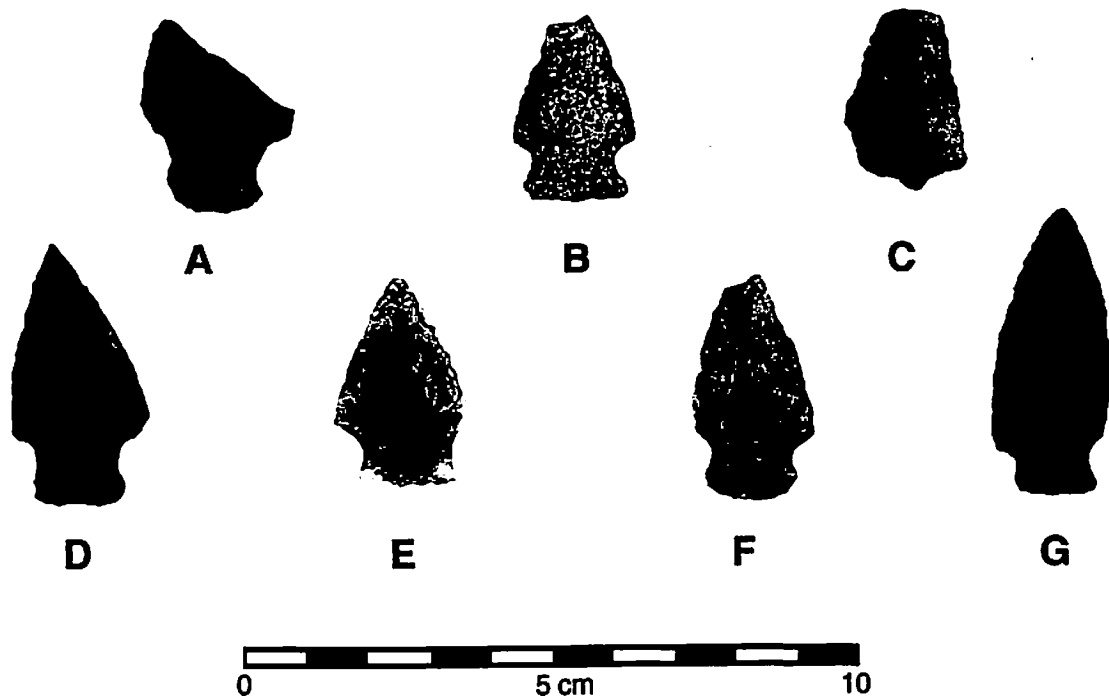
Figure 2.2 Projectile points from the Archaic occupation. A, B, D, and E have been typed as Hanna; C is a possible Pelican Lake point; F and G are considered to be Shield Archaic. Photograph by Sid Kroker.

and the uncertainty of the Pelican Lake/Shield Archaic point, the larger Archaic occupation at the Forks (Zone 3/3B of the Public Archaeology Project stratigraphy) is considered here to be a Hanna occupation.

The Hanna culture is considered as the last of a series of three temporally overlapping, related point styles, namely McKean, Duncan, and Hanna, often subsumed under the McKean complex. Wright (1995: 299) views the McKean complex points as part of an *in situ* development of the side-notched point tradition, from Oxbow through McKean to Pelican Lake/Larter. He (1995:302) dates the McKean complex to between 3000 and 2000 B.C. (5000 to 4000 B.P.), while Dyck's (1983:100) dates for Saskatchewan are somewhat later, ranging from 4150 to 3100 B.P.. Manitoba dates are slightly later again. Buchner's (1979:95) summary of McKean provides dates ranging from ca. 1240 B.C. (3190 +/- 60 B.P.; A-1469) at The Pas Reserve site to 910 B.C. ± 205 (ca. 2860 B.P.; S-1029) at Cherry Point. The Forks dates of 3000 B.P. are thus not anomalous for McKean complex dates in Manitoba.

Dyck (1983:101) provides two "lines of speculation" regarding the origins of the McKean complex. The first is that the McKean complex peoples moved from the foothills of the Rockies onto the Plains at the end of the Altithermal, while the second has the McKean complex originating in the Great Basin of the southwestern United States and moving in a generally northeasterly direction. Either of these possibilities would place McKean complex occupations on the boreal forest edge towards the end of the time range. These two possibilities, however, contradict Wright's hypothesis of an *in situ* development of McKean from Oxbow.

The Hanna culture is distinguished archaeologically by its diagnostic projectile point style, described as corner-notched, expanding-stemmed, and concave-based (HRB 1989). Dyck (1983:100) describes the point as "a mid-size to small lanceolate form with very broad side-notches that occasionally result in a tanged shoulder and always a flared, almost eared, base." It has been suggested that the Larter variant of the Pelican Lake type may have developed out of the Hanna style (Bowe 1999:63). The inclusion of Larter style points within the Forks Archaic component may represent a transitional stage in the continuum of change from Hanna to Larter styles.

The Hanna point style has been found over a broad area, indicating a distribution of Hanna groups across a huge area from northern plains and parkland, north and east into the boreal forest, and west to the mountains. Wright (1995:312) suggests that both the McKean and Oxbow culture groups were concentrated on the prairies and parkland, with the McKean groups making increased use of the major river valleys within this region. The subsistence round appears to have been focused upon the bison, following the herds onto the plains in the summer months and into the parklands during the fall and winter. The occurrence of Hanna style points from eastern Manitoba suggests that these people also made use of the southern portions of the boreal forest (Dyck 1983:100).

Faunal assemblages from McKean sites are dominated by bison throughout the northern plains, including the Whitemouth Falls site on the Winnipeg River (Buchner 1979). Subsistence species within the boreal forest are poorly known, with Syms' 1969 re-evaluation of Cemetery Point site material including only cervid and beaver as definitely associated with the McKean component. In the absence of other faunal

materials, however, Syms suggests that subsistence was derived from both hunting and fishing. As a McKean group within the Parkland zone, the Hanna people who inhabited the Forks likely utilized both plains and parkland resources. The possibility of the inclusion of Shield Archaic points within the Hanna assemblage also suggests connections with the boreal forest. Shield Archaic site components in Manitoba date from 2500 to 1000 B.C., although the culture is considered to have first developed from late Plano ca. 6000 B.C. (Wright 1995:262-263).

2.2.ii Middle and Late Woodland Periods

The Archaic period terminated by ca. 2000 B.P.. Archaeological markers for the end of the Archaic and the beginning of the Middle Woodland are considered to be the appearance of the bow and arrow and the local development of ceramics. Within Manitoba, no evidence of the Early Woodland period has been recovered. Ceramics first appear during the Middle Woodland which, within the parkland and woodland areas near the Forks, is characterized by the presence of Laurel ceramics.

Dates for Laurel ceramics also tend to vary by region. Laurel dates for the Rainy River area range from ca. 50 B.C. to A.D. 1000 (ca. 2050 to 950 B.P.). Laurel ceramics have been recovered from Wisconsin and Michigan, northwest to east-central Saskatchewan. Laurel ceramics are primarily coil-made, with smoothed surfaces. Conical to sub-conical in form, they are decorated with pseudo-scallop shell, stab-and-drag, incised, punctate or punctate and boss, and dentate stamped designs (Lenius and Olinyk 1990:82). A number of these decorative techniques were likely carried out using

the same dentate tool. While Laurel groups appear to have been primarily forest-adapted, Syms (1977:82) suggests that the presence of certain faunal species within Laurel sites indicates a seasonal use of Parkland resources.

Laurel ceramics have not yet been found at the Forks. Kroker (pers. comm. 1998) suggests two reasons for this absence. First, that the Laurel occupations have not yet been encountered, as the bulk of the Forks development (and thus, mitigative archaeology) has occurred in discrete areas; and, second, that the existence of an alternate Assiniboine River channel may have made the Forks a less attractive place to inhabit. Further excavations should clarify this issue.

Laurel was succeeded in this area by three broad ceramic types of the Late Woodland Period: Blackduck, Rainy River, and Selkirk, each recognized by a distinctive pottery style. Late Woodland ceramics were made by a paddle-and-anvil technique or, possibly, within a textile bag. The surface is textile-impressed and sherds exhibit a laminated construction. The pots themselves tend towards a globular form, with decorative techniques including cord-wrapped object impressions (CWOI), punctates, and stamps (Lenius and Olinyk 1990).

The second sample used in this thesis consists of material from six Blackduck occupation layers, excavated by Parks Canada in 1988. These excavations yielded a number of radiocarbon dates, including: 1220 ± 130 B.P. (AEC 774C), 1250 ± 140 B.P. (AEC 789C), 1280 ± 100 B.P. (AEC 784C), and 1560 ± 100 B.P. (AEC 783C).

A refined typology for Late Woodland ceramics within southern Manitoba and adjacent areas of Minnesota has Blackduck emerging "at least by A.D. 700 and possibly

as early as A.D. 500, and is ... not found much beyond A.D.1000. After this time, ceramic vessels previously included in Blackduck conform more closely to the ceramics of the Rainy River Composite" (Lenius and Olinyk 1990:82). Thus, all of the Parks Blackduck horizon dates fit within Lenius and Olinyk's Blackduck time span.

The diagnostic artifacts of the Blackduck culture are the ceramic vessels, which can be described as relatively thin-walled, globular vessels with flattened, thickened lips, grit temper and constricted necks. Decoration is usually limited to the lip and neck of the vessel, consisting of "cord-wrapped object impressions" or CWOI (horizontal or oblique), punctates (often with corresponding bosses), exterior bosses, and combing (Syms 1977; Lenius and Olinyk 1990; Anfinson 1979; Tisdale 1978). Figure 2.3 shows a portion of one of the diagnostic vessels from the Forks. Syms (1977:104) notes that other Blackduck culture traits include small triangular notched and unnotched points, end and side scrapers, awls, tubular pipes, unilateral harpoons, bone spatulate tools, fleshers, copper beads and awls, beaver incisor gouges, and burial mounds with seated primary burials. Although these traits are associated with Blackduck, they are not exclusive to that culture and cannot be considered diagnostic.

Blackduck ceramics are distributed across a large area, from northern Minnesota and Michigan, across northwestern Ontario, into the southern half of Manitoba as far west as the Stott site, with some isolated finds in the Nelson River drainage of northern Manitoba (Lenius and Olinyk 1990:79). Blackduck culture groups evidently lived within the Great Lakes mixed forest, the boreal forest, parklands, and grasslands.

It is hypothesized that a subsistence shift occurred with the development of Late
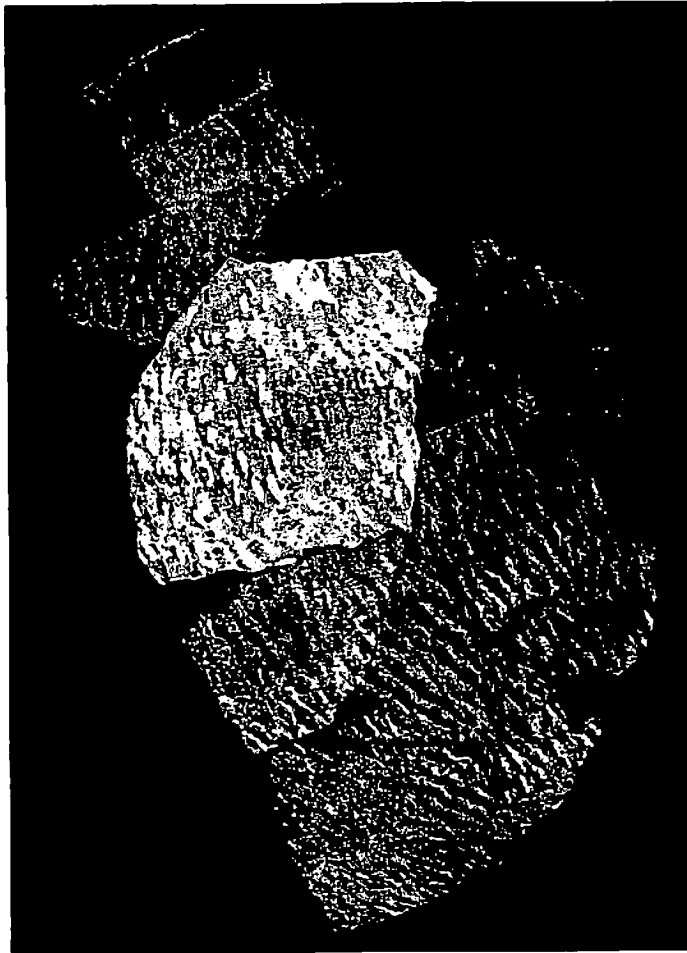
Figure 2.3 Blackduck vessel reconstruction from the Forks.
Photograph courtesy Parks Canada Agency.

Woodland cultures, incorporating an increased use of wild rice as a major food source, resulting in an increase in population. This population surge may have caused a migration into the southern Manitoba/northwestern Ontario regions (Dyck 1983:126). Meyer and Hamilton (1994:113) state that the rapid expansion of Blackduck into Ontario and Manitoba was either "at the expense of the resident population that made Laurel pottery or involved a radical, rapid change in ceramic styles by peoples who were making Laurel pottery." Buchner (1982), however, sees substantial evidence of cultural continuity from the Laurel to the Blackduck cultures and hypothesizes that Blackduck ceramics developed from Laurel ceramics beyond the borders of Manitoba, reaching southeastern Manitoba by means of diffusion.

A distinctive characteristic of the Blackduck people is the relative flexibility of their subsistence system, adapting quickly to new environments as they moved into the boreal forest, parkland, and plains. Nicholson (1987:207-208), for example, states that the "subsistence strategies of the Blackduck Horizon are characterized by an adaptive flexibility which efficiently exploited the available subsistence resources of all of the regions into which people utilizing Blackduck ceramics expanded." Buchner (1979:119) notes that both Blackduck and Laurel sites are located near good ricing areas within eastern and east-central Manitoba, while faunal assemblages from the Bjorklund site (Buchner 1982) and east-central Manitoba sites (Buchner 1979) include a large number of forest species. Syms (1977) notes both an overlap in species as well as the use of environment-specific species when comparing the boreal forest McCluskey site and the Plains/Aspen Parkland Stott site. He views the adaptations as a "gradual shift from a

diffuse Woodland economy to a transitional Woodland-Plains economy, then to a resource intensive utilization of bison" (1977:136). Given the location of the Forks as transitional between parkland and grasslands, a subsistence economy similar to that at the Stott site would have been possible.

Two other Late Woodland ceramic types, Rainy River (Bird Lake) and Selkirk (Winnipeg River), were recovered during the St. Mary's Avenue Extension excavations. Both of these are chronologically later than Blackduck and, to some extent, derived from it. The manufacture and use of Selkirk ceramics continued until the Protocontact period, when they were replaced by vessels of European manufacture.

2.2.iii Fur Trade Period

The Late Woodland Period essentially terminates with European contact. The Fur Trade Period, extending from 1737-1870, can be subdivided as follows: Early Fur Trade/Contact (1730-1780); Competitive Fur Trade (1780-1821); Hudson's Bay Company Fur Trade (1821-1860). The latter time period also encompasses the events surrounding the establishment and slow growth of the Red River Settlement. Each of these periods can be characterized by specific settlement and subsistence/economic patterns for both the European and Native populations.

Three Fur Trade period assemblages have been selected for inclusion within this study, each linked to a particular post. The earliest is the Fort Gibraltar I sample, a North West Company (NWC) post (1810 to 1816 A.D.); the second is Fort Garry, representing a Hudson's Bay Company (HBC) re-use of the NWC's Fort Gibraltar II

(1821-1835/1852); the third, Upper Fort Garry, is the last fort built at the Forks (1835-1883). Changes within fur trade structure and society, as well as the development of the Red River Settlement (RRS), cannot be seen solely as European or Eurocanadian endeavours. Throughout the fur trade, interaction between Eurocanadians and Native groups was of primary importance, affecting the historical trajectories of both of these groups as well as of a third group, the Métis or mixed blood descendants of these two groups.

The earliest documented contact occurs with La Vérendrye's exploration into northwestern Ontario and southern Manitoba during the 1730s (Guinn 1980). La Vérendrye moved through the Forks area, meeting with Native groups, during 1737 and 1738. The first post at the Forks, Fort Rouge, was not built by La Vérendrye, however, but by an independent trader, M. de Louvière. The exact location and length of occupation of Fort Rouge are still unclear.

Following the establishment and abandonment of Fort Rouge, "no long term post of any real significance ever existed at the Forks" during the period from 1730-1760 (Coutts 1988:45), although various traders wintered there.

Cree, Assiniboine, Ojibwa, and to a lesser extent the Dakota, utilized the Forks area during the early fur trade period. La Vérendrye's journals provide the first documentation of Native use of the area. At the council between the Assiniboine and La Vérendrye, the Assiniboine wished the trader to locate a post at the Forks partially due to the wealth of subsistence resources in the area, including bison, fish, and passenger pigeon (Coutts 1988:35). Ray (1974) stresses the importance of the transitional parkland

area within the subsistence round of the Cree and Assiniboine who occupied the area during the period of European contact, summarizing two basic "cycles of exploitation." The first, most common amongst the Cree, was based in the boreal forest and parkland and involved direct trade with the HBC posts on the Bay. Families fished and hunted in the boreal forest area during the summer months, at which time the men conducted trading expeditions to the Bay. In the fall, the bands moved to the forest/parkland transition zone, hunting moose and trapping beaver. During the winter, they moved further into the parkland, often living with the Assiniboine, hunting bison and trapping. The early spring months saw a return to the waterways to trap, fish, and hunt migrating waterfowl.

The Assiniboine bands, on the other hand, were primarily grassland and parkland adapted, trading with the French, rather than the HBC. With the Cree, they remained in the parklands during the winter to hunt bison and trap fur-bearers, fishing the large parkland rivers in the spring. During the summer, the bands moved onto the grasslands to hunt the bison, also incorporating periodic trading trips to the Mandan villages on the Missouri. Both of these exploitation patterns suggest that the parkland would have been particularly heavily populated during the winter and to a lesser extent during the fall and spring. This pattern, however, is dependent upon the hypothesis that bison wintered in the Parkland. Malainey (1997) disputes this hypothesis and suggests (1997:50-51), based on historical eyewitness documents, that the bison wintered on the plains. Acceptance of this new hypothesis would require a shift in the interpretation of human movements during the Precontact and Fur Trade periods.

The French fur trade ended with the fall of Québec in 1760 and from shortly after this time and until 1783, the interior fur trade was dominated by independent Montréal-based "Pedlars." The Lower Red River was one the first areas to be exploited, with the trade gradually moving to the Saskatchewan and Upper Assiniboine River valleys as the Red became trapped out (Guinn 1980:36). The Forks declined in importance, serving only as a meeting place or staging spot for brigades heading up the Assiniboine.

From the late 1760s, the business conducted by these independent traders throughout the northwest increasingly ate into the HBC profits, resulting in a move inland by the HBC beginning in 1774 (Coutts 1988:59). The Montréal Pedlars, recognizing the need for a more organized co-operative system between wintering traders and Montréal suppliers, created the North West Company (NWC) in 1783-84 (Coutts 1988:66). Competition, primarily between the HBC and the NWC, became increasingly intense and destructive, ending in an amalgamation of the two companies in 1821.

This intense competition and the trapping out of the eastern areas meant that the fur traders had to expand their operations further to the north and west. This, in turn, necessitated longer transportation routes. Food supplies were required both to feed the canoe brigades and to provide for posts in areas of fewer, or less reliable, resources. The major food supply which facilitated this was pemmican, and provisioning posts were established in the parkland and prairies for the trade, preparation and redistribution of pemmican. The Northwest Company was established in 1789 in order to consolidate the rival fur trade interests and provide a firm base for the necessary expansion into the northwest (Innis 1970; Guinn 1980; Ray 1974).

The resources of the Assiniboine River and Upper Red River areas became increasingly important in the post-1790 period. During the first decade of the nineteenth century, the Forks became a consistent location for rendezvous between the various brigades of the NWC and of the HBC, although no permanent buildings were erected until 1810 (Guinn 1980:37-38). The NWC post, Fort Gibraltar, was built by John Willis, bourgeois with the NWC, in 1810 and eventually destroyed by the Selkirk settlers and HBC in 1816. Coutts (1988:81-82) states that "the Forks assumed an increasingly critical role as a provisioning centre, rendezvous point, and an eventual transshipment depot in [the] expanding interior trade. During the years between 1809 and 1821 a total of six establishments were erected there, as each company endeavoured to gain the strategic advantage offered by control of these important inland waterways." The importance of the Forks area increased following the establishment of the Selkirk Settlement in 1812.

While the HBC shuttled back and forth from the inland posts to the factories on the Bay, the NWC was faced with a long and arduous journey from the interior to Montréal. It soon became impossible to travel from Montréal, trade for furs, and return to Montréal all within one brief navigable season as the fur trade progressed further into the interior. The NWC partnership therefore included both wintering partners, who remained in the interior, and merchant suppliers who remained in Montréal. These two groups met annually on Lake Superior, where the Montréal group exchanged supplies and trade goods for the furs of the previous season. The winterers exchanged furs for goods and returned to the interior. The fur trade seasons were scheduled around this

rendezvous. Furs and country supplies were prepared throughout the fall, winter and early spring. In the spring, these supplies and furs were shipped to Lake Superior, the men returning to the interior in the late summer/early fall to return to the posts or establish new ones. Frequently, a few men would be left at the interior posts to carry on trade during the summer (Coutts 1988; Guinn 1980; Hamilton 1990).

Native groups throughout the Northeastern Plains, specifically the Cree and Assiniboine, acted as suppliers of the pemmican, as did many of the mixed blood people. This period saw the beginning of the Red River bison hunts, which occurred in both spring and fall, supplying pemmican and meat for the posts and for the growing population of Red River. This shift in economic activity of the Cree and Assiniboine resulted in a more consistently parkland and plains economic orientation. As the Cree and Assiniboine moved further west and south, the Ojibwa moved into the vacated territory and, by 1820, occupied much of southern and central Manitoba (Ray 1974:101-102). Ray (1974:104) hypothesizes that the Ojibwa (also termed Saulteaux, Bungi, or Western Ojibwa) trapped more intensively than did the Cree, allowing them to move into an area that the Cree viewed as exhausted and continue to extract fur resources. Peers (1994:53-55) provides the following description of the seasonal round of the Ojibwa in the Red and Assiniboine River regions. Late summer and early autumn were spent at the trading posts, taking debt and trading bison meat and sturgeon. Autumn was spent in trapping small furs and hunting large mammals in the parkland, provisioned by a fall bison hunt. A bison hunt was also conducted during the winter months, while mid-winter was the time for a second visit to the post, with intense trapping in February and March.

Women produced maple sugar in early spring, followed by fishing for sturgeon during the spawning time in early spring. This permitted a large gathering of families, after which they dispersed to hunt wildfowl or bison. Summer was also the period of berry picking, while wild rice was harvested in the fall.

With the establishment of the Red River Settlement in 1812 and amalgamation of the two companies in 1821, the nature of the trade and the roles of Native and mixed blood groups began to change. From 1821 to 1870, the HBC was the sole fur trading company, holding a monopoly that was only broken during the 1840s by the mixed blood independent traders of the RRS.

The two final samples selected for this study fall within this latter period of the fur trade. The first of these has been interpreted as Fort Garry, which was initially the rebuilt NWC post of Fort Gibraltar II. With amalgamation in 1821, this post was renamed Fort Garry and was occupied by the HBC until ca. 1835. The bulk of the faunal assemblage was recovered from what appears to have been a midden located within a disused cellar. This refuse deposit has been tentatively dated to post-1830, based on recovered ceramics (Monks n.d.:5).

The final sample was recovered from Upper Fort Garry, the last HBC post to be built at the Forks. Construction on this post began in 1834, continuing until 1837 (Guinn 1980:67). The fort was expanded and changed several times in the next thirty years (Monks 1992). The HBC abandoned the fort and sold the property in 1872 and by 1885 most of the fort had been demolished (Guinn 1980:101). The faunal remains used in this study were recovered from two privy pits (Monks 1982, 1983, 1984) which have been

dated to the 1840s and after (Seyers 1988:50-52).

During this period, the Hudson's Bay Company was the dominant force in the RRS, with establishments at the Forks and at Lower Fort Garry, administering both the fur trade and the settlement (Guinn 1980). The settlement was a mixture of various ethnic groups: the Selkirk settlers in Kildonan, the French Canadian settlers in St. Boniface, the Métis of St. Boniface and White Horse Plains, the Orcadian and mixed bloods of St. Paul's and St. Andrew's, and the Native settlement at St. Peter's (Guinn 1980:81-82). Political and social problems within the Settlement were fuelled by the limited representation of the largest ethnic group - the Métis and mixed blood people (Coutts 1988:117).

In the early part of this period, the Settlement practised what Coutts (1988) terms a "hybrid" economy, combining the annual bison hunts and fishing with agricultural produce (primarily grains and domestic meats). Work was also available through the HBC on the boat brigades, while other settlers engaged in private trade. Activities and movements both within and outside of the Settlement area were largely determined by the season. Activities of the HBC labourers at Upper Fort Garry were focused on the arrival and departure of boat and cart brigades, spring and fall bison hunts, planting and harvesting of crops (Coutts 1988:139). Yearly activities of the Métis and mixed blood people included the spring and fall bison hunts, sowing and harvesting crops on river lot farms, and the whitefish catch in the fall (Coutts 1988:149).

Ray (1974: 213, 228) sees the period from 1821-1870 as one of decline for the Native groups. The depletion of wild resources and decrease in fur trade opportunities

led to economic difficulties for the Native groups, culminating in the eventual treaty agreements of the 1870s.

2.3 Conclusion

This chapter has served to provide the necessary context for the study of faunal exploitation patterns at the Forks over a period of approximately 3000 years. This context is necessarily both environmental and cultural, given the focus of the study on faunal exploitation patterns. It is evident that the cultural groups within each period utilized the Forks area in characteristic ways as part of a larger seasonal round, within a greater economic sphere. The contextual description is necessary in order to provide a firm basis for interpretation of the results of the faunal analysis to follow.

The Forks, situated within the Parkland ecotone, was an area of rich, though seasonally variable, resources. Each culture group utilized the Forks in a characteristic manner, accessing varied resources within shifting subsistence schedules.

CHAPTER 3:DATA AND METHODOLOGY

The goal of this chapter is to present the data sources and methodology for the archaeological and documentary databases. The first section, Archaeological Data, presents the five archaeological samples which have been selected from the available assemblages. The second section, Archaeological Methodology, presents the analysis that will be applied to these samples, focusing on taxonomic quantification, butchering and processing, and seasonality of procurement as well as a brief discussion on potential taphonomic effects. The third section, Documentary Methodology, discusses the ethnographic and historic databases and their integration with the archaeological data.

ARCHAEOLOGICAL DATA

3.1 Archaeological Data

As stated above, five archaeological samples are used within this research. Four of the five samples were recovered from the Forks site, DlLg-33. The fifth sample, Upper Fort Garry (DlLg-21), lies slightly upstream on the Assiniboine River. Each assemblage represents a different temporal and cultural period, ranging from Archaic to Late Fur Trade. The samples have been collected by different agencies for different purposes and collection and curation methodologies vary. Each sample is presented below, providing an assessment of strengths and potential sources of bias. Tables 3.1 and 3.2 present a summary of the samples and of the excavation methods employed.

Table 3.1 Summary of archaeological samples

sample #	cultural association	project designation	excavation year(s)	agency	total sample size	catalogue format
1	Archaic	DlLg-33:92A	1992	FPAA	109, 095	CHIN
	Archaic	DlLg-33:93C	1993	FPAA		CHIN
2	Blackduck	21K3	1988	Parks Canada	8, 225	ZAP
3	NWC	21K4, 21K6	1989	FPAA	17, 631	DOSSIER
	NWC		1990	FPAA		DOSSIER
	NWC		1991	FPAA		DOSSIER
4	HBC	DlLg-33:88C	1988	U. of Manitoba	8, 859	MAC CHIN
5	HBC	DlLg-21	1981–1983	U. of Manitoba	3, 462	University Mainframe

Table 3.2 Summary of excavation methodologies

sample #	year	procedure	unit size	screening	excavators	area excavated
1	1992 1993	natural levels	1m x 1m	1.5mm, water	supervised public	42 m^2 28m^2
2	1988	natural levels	1m x 1m	4mm/6mm	professional	94m^2
3	1989 1990 1991	natural levels	0.5m x 1m	1.5mm, water	supervised public	30m^2 7.5m^2 12m^2
4	1988	natural levels	1m x 1m	6mm	supervised field school students	39m^2
5	1981-1983	natural levels	1m x 1m	6mm, water	supervised field school students	97m^2

Most of the agencies involved have adopted a consistent means of identifying their projects, due to the potential confusion created by multiple projects occurring each year at the same site. The Borden number, DlLg-33, is followed by a colon and the last two digits of the project year, followed in turn by a letter designating the project itself. DlLg-33:88C is thus the third project undertaken at the Forks during 1988.

3.1.i The Archaic Period Sample

This sample was collected as part of a public archaeology program under the aegis of the Forks Public Archaeology Association (FPAA). The excavations were carried out primarily during the summers of 1992 and 1993 within an area of the Forks which has been set aside as an Archaeological Preserve by the Forks Renewal Corporation (Figure 3.1). The stated goals of the excavations (Kroker 1993:ii) were to investigate the 3000-year-old Native occupation horizon located during a 1988 impact assessment and to educate the public regarding archaeology, the Forks' and Native history.

The Archaic sample, from Zone 3 of the excavation, is the earliest of the range explored within this thesis. The majority of the projectile points recovered from the two years of excavation have been classified as Hanna (Kroker and Goundry 1994:51ff). The horizon has also been radiocarbon dated, with the following tight cluster of dates: 2870 +/- 80 B.P. (BGS 1316), 2850 +/- 90 B.P. (BGS 1374), and 2815 +/- 75 B.P.(BGS 1483) (Kroker 1997: 14).

The Archaic sample is also the largest sample used within this research, providing a total of 118, 556 faunal specimens (Kroker and Goundry 1993, 1994). This figure

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b) Map of the Forks showing the locations of archaeological samples:
1 - Archaic; 2 - Blackduck; 3- Fort Gibraltar I; 4 - Fort Garry.

a) General area of the Forks including
archaeological sample 5 - Upper Fort Garry,
and B - general area of other four samples.

Figure 3.1 Maps of the Forks

discounts those remains which are considered to have been naturally deposited - small mammals, small perching birds, reptiles, amphibians, and mollusc shell. The 1992 field season recovered a total of 2,951 mammal specimens and 67,083 fish specimens, while 2,530 mammal specimens and 45, 992 fish specimens were recovered from the 1993 excavations. Within the 1992 excavated sample, 319 (10.8 %) mammal bones were identified to family, genus, or species (Kroker and Goundry 1993:95-96). Simonds (in Kroker and Goundry 1993:151) states that 22.3 % of the fish sample was identified to genus or species, while 46.8 % was identified to skeletal element. In the 1993 sample, a total of 316 (12.5 %) mammal specimens were identified to genus or species level (Burns, in Kroker and Goundry 1994:94). Approximately 12.6 % of the fish sample was identified to a further taxonomic level (i.e. family, genus, species), while 56.0 % of the sample was identified to skeletal element. Both the 1992 and 1993 samples were identified and catalogued by QCL personnel. Published results and the original computer catalogue have been used as sources of data for the current research.

It is important to note the excavation methodology and subsequent curation for each project, in order to factor in potential sources of bias which may produce spurious patterns during the analytical stage of this research. The Archaic occupation (Kroker and Goundry 1993: 19-21; 1994:21-23) was excavated by natural levels, with each recovery recorded by site designation (DlLg-33:92A; DlLg-33:93C), excavation unit, level and, where necessary, by feature. The excavation was tied in to the City of Winnipeg bench mark located on the north end of the Low Line Bridge. The excavated matrix was waterscreened through a 1/8" (1.5 mm) mesh, resulting in good recovery of the smaller

size range of faunal remains and artifacts.

Once excavated, artifacts and fauna were brought into the lab where most fauna was washed (dependent upon state of preservation), rough-sorted, and weighed. The information was then entered into the CHIN (Canadian Heritage Inventory Network) microcomputer program, which printed relevant information on a file card to be stored with the specimen. The faunal remains were identified, analysed, and quantified by individuals under contract to QCL. The computerized data were then uploaded onto the Manitoba Museum of Man and Nature (MMMN) mainframe, with the recoveries themselves also stored at the Museum.

3.1.ii The Blackduck Period Sample

The Blackduck period sample was collected by Parks Canada during 1988 as part of the development of the North Point Interpretive Node of the Forks National Historic Site (Figure 3.1). The excavations encountered a number of occupations/horizons, from the Blackduck to the Railway Periods. The Blackduck layers have been designated as 134, 137, 141, 144, and 147.

Three carbon samples were submitted for radiocarbon dating from the 1984 excavations. Each of the samples were associated with Blackduck ceramics and yielded the following three dates: 1105 ± 160 years B.P. (S-2565) or 845 A.D., 1440 ± 165 years B.P. (S-2564) or A.D. 510, and 1225 ± 160 years B.P. (S-2563) or A.D. 725 (Priess et al. 1986:41). Dates from the 1988 excavations also yielded a number of Blackduck occupation dates. Blackduck 1 was dated to 1220 +/- 130 B.P. (AEC 774C),

Blackduck 2 to 1250 +/- 140 B.P. (AEC 789C), Blackduck 3 to 1280 +/- 100 B.P. (AEC 784C), and Blackduck 5 to 1560 +/- 100 B.P. (AEC 783C) (Tisdale and Priess n.d.). All of these dates fit reasonably within the accepted date range for the Blackduck archaeological culture. Lenius and Olinyk (1990:79-82) suggest, based on available dates for Blackduck horizons, that Blackduck "emerges at least by A.D. 700 and possibly as early as A.D. 500, and is not found much beyond A.D. 1000."

It should be noted that these individual occupations have been grouped in order to provide a sufficient sample size for the purposes of this analysis. The total count of faunal specimens from the 1988 Blackduck sample used in this thesis is 8 225. All of the excavated soil matrix was screened through 4 or 6 mm screening. Excavation proceeded by natural level, using Parks Canada's lot, operation, and suboperation system. The Forks site is designated 21K by Parks Canada. The artifacts and remains were then catalogued using this system [e.g. 21K3L5-4]. The artifact information was then entered into the Dossier computer cataloguing program at Parks Canada. The faunal material, in this case, was identified and analyzed by Kathlyn Stewart and Leslie Still of the Canadian Museum of Nature and the information entered into an ACCESS program file. Production of a summary report by Kathlyn Stewart completed contract obligations to Parks Canada. The material was then returned to the Parks Canada office in Winnipeg.

3.1.iii The North West Company Fur Trade Sample (Fort Gibraltar I)

The third sample represents the results of the partial excavation of the North West Company post of Fort Gibraltar I (1810-1816). The fort (Figure 3.1) was excavated

during the summers of 1989, 1990, and 1991 as part of the Forks Public Archaeology Program, jointly funded by the federal (Canadian Parks Service), provincial (Historic Resources Branch), and city (Forks Renewal Corporation) governments. Quaternary Consultants Ltd. (QCL) ran two of the three years, but, as the site area is located on the National Historic Site (i.e. federal) portion of the Forks, methodology followed Parks protocol. The goals of the project were both research-oriented and educational.

The excavations encountered a number of cultural horizons, from Precontact to the Railway Period. Only those remains considered to be from the NWC occupation of Fort Gibraltar I (layers 14 to 38) are used within this research. Fort Gibraltar I was built in 1810, burnt and demolished in 1816. The fort was rebuilt in 1817, named Fort Gibraltar II and located further to the south.

The faunal recoveries from the 1989 Fur Trade Period excavations (Kroker et al. 1990: 126-127) totalled 4454 pieces. After removing probable natural deposits, molluscs, amphibians, reptiles, the sample size shrinks slightly to 4182. Of these, 102 pieces (2.4 %) have been taxonomically identified further than the class level.

Faunal recoveries from the 1990 Fur Trade Period excavations (Kroker et al. 1991: 133) totalled 4,061 pieces which was reduced to 3,685 following the removal of the probable naturally deposited specimens (small rodents, molluscs, and amphibians). Of these, 211 pieces (5.7 %) have been identified past the class level.

Total faunal recoveries from the Fur Trade Period excavations during 1991 (Kroker et al. 1992:118) are 14, 166 pieces. Exclusion of the naturally deposited remains results in a total of 13, 752. Of this total, 912 pieces (6.6 %) have been identified past

the class level. The combined assemblages provide a total usable sample of 22, 033 pieces, of which 1225 (5.6 %) have been identified past the class level.

Excavation was carried out using natural levels and all soil matrix was water screened through a 1.5 mm mesh. Excavation used the Parks proveniencing system, while remains were catalogued and data computerized using Parks methodology and programs. Computerized data and artifacts are stored by Parks Canada.

3.1.iv The Hudson's Bay Company Sample (Fort Garry)

This period is represented by the 1988 excavations of Fort Garry (the renamed Fort Gibraltar II), carried out by the Universities of Manitoba and Winnipeg (Figure 3.1). The purposes of the Manitoba Universities Archaeological Field School and subsequent East Yards Archaeological Project (University of Manitoba) were both research-oriented and educational.

Fort Gibraltar II, the rebuilt NWC post, was renamed Fort Garry following the amalgamation of the NWC with the Hudson's Bay Company (HBC) in 1821. End dates for this occupation overlap with occupation dates of Upper Fort Garry and the HBC Experimental Farm. Construction began on the former in 1835 and on the latter in 1838. Fort Garry was finally abandoned following the flood of 1852.

The bulk of the faunal remains below the railway fill (Stratum A) were recovered from Trench 5 where a midden deposit, located within an unused cellar feature (Feature 1), produced datable transfer-printed ceramics. One of these, a Minton "Swiss Cottage" pattern bowl, has a legible maker's mark on the base which dates the bowl to the 1822

to 1836 period (Sussman 1978: 16 in Monks, n.d.). The second pattern with a fairly limited production period is a "Bamboo and Flower" patterned sherd, dated to 1820 - 1830 (Sussman 1978:6). These sherds suggest that the excavated occupational debris had been deposited following amalgamation and may stem from the subsequent HBC fur trade or from the Experimental Farm period. The "Swiss Cottage" patterned sherd was recovered near the base of the cellar fill deposits, suggesting that subsequent deposition dates to ca.1830 A.D. (Monks n.d.:5, 14). The total faunal sample size from this period is 8, 859 pieces.

The excavations were begun as a joint universities field school and were continued into July and August as part of a University of Manitoba research project. Trenches were subdivided into 1x1m units. The bench mark on the railway bridge was used as site datum. The site was excavated by natural levels in combination with an arbitrary level proveniencing system. Matrix was dry screened through a 1/4" (6mm) mesh. Remains were catalogued using a combination of stratum and level designated respectively by letters and numbers (e.g. B76).

The remains were briefly examined in the field and the data entered into an Excel spreadsheet using CHIN artifact fields and categories. Artifact cards were then produced using a Hypercard program. The computerized data as well as the archaeological remains will eventually be turned over to the MMMN.

3.1.v The Late HBC Fur Trade Sample (Upper Fort Garry)

Excavations of Upper Fort Garry (DlLg-21) produced the last sample to be

discussed. These excavations were also carried out by the University of Manitoba, during the summers of 1981, 1982, and 1983 (Monks 1984). The 1982 faunal data, identified and analysed by Linda Seyers (1988), will be used within this thesis. The purposes of the excavation were both educational and research-oriented.

The bulk of the archaeological materials were recovered from two privy/refuse pits. Use periods of these pits were estimated using ceramic, glass, newspaper, and textile remains, resulting in the following dates: Privy 1 to the late 1840s, Privy 2 following the military occupation (post-1848) (Seyers 1988:48-51). The faunal remains total 4 842 pieces (Seyers 1988:57), some of which will not be included in this research (e.g. small mammals, molluscs, amphibians).

The site was excavated in 1x1m units using natural levels. Excavated matrix was water screened using a 1/4" (6mm) mesh. Data was coded using the Parks Canada coding manual (1982) and stored on a computer file (Seyers 1988:53). This data has been uploaded from the mainframe and translated into an Excel spreadsheet. The data and materials are stored at the MMMN.

ARCHAEOLOGICAL METHODOLOGY

3.2 Quantification of the Archaeological Data

Quantification of the faunal assemblages by taxon is an important and basic step towards the recognition and explanation of the changing faunal exploitation patterns at the Forks. Variation over time is expected in the range of taxa represented and their relative

frequencies. Such variability may be due to, for example, changes in cultural preferences, seasonal site occupation affecting species availability, local extirpation of some taxa, nature of the local environment, catchment area or various taphonomic factors.

These potential shifts in taxon frequencies, or "relative taxonomic abundance," should be apparent in the quantified archaeological samples recovered from the Forks. As much of the subsequent analysis and interpretation depends upon the quantification of taxonomic abundance, it is vitally important that an appropriate means of measurement be selected.

3.2.i Measures of Taxonomic Abundance

The two most commonly used measures of taxonomic abundance are the "minimum number of individuals" (MNI) and the "number of identified specimens present" (NISP). Many additional quantification methods have been presented in the literature - 112 terms by Lyman's (1994a:38) count - with resultant terminological confusion as one method may be referred to in different ways or various methods referred to by similar terms.

While acknowledging the existence of these various methods (for instance, the "wiegemethode" or "weight method," Binford's "improvements" on MNI counts, and the recent plethora of complex statistical and computer simulation techniques), only the MNI and NISP methods will be dealt with in detail here. It has often been said that the selection of a quantification method should be appropriate for the research questions

asked. The MNI and NISP measures are two which "suit" the questions and the data sets to be used in this thesis. While they have acknowledged faults, as discussed in more detail below, these faults have been recognized and can at least be taken into consideration during further analysis and interpretation. These two measures each exhibit strengths and weaknesses for the accurate representation of species abundance.

Minimum Number of Individuals (MNI)

The MNI provides a calculation of the smallest number of individuals per taxon required to account for the elements present within the archaeological sample. The introduction of the MNI measure into North American archaeology is generally attributed to White (1953), although Casteel (1977:125) points out that the "MNI concept was being presented explicitly in the early 1880's and applied to faunal remains from archaeological sites in Russia ...[and] ...was in use in paleontology for at least two decades prior to its introduction into American archaeology."

Chaplin (1971:69, 70) states that the MNI method is "purely factual", is a "direct measure ...and is an abstraction...only within fixed limits", and that "sites treated on the basis of the minimum number of animals are directly comparable." However, the way in which the MNI is actually calculated varies enormously from researcher to researcher and these variations are seldom explicitly stated. White's (1953) method is to count the numbers of elements, left and right, and to use the maximum number as the MNI for that taxon. Age, sex, and size may, however, also be included in the calculation, generally increasing MNI values (Bökönyi 1970; Chaplin 1971:70-71; Klein and Cruz-Uribe

1984:26; Lyman 1994a: 38). Additionally, there are various means of dealing with the paired elements (e.g. Casteel 1977). The MNI cannot therefore be considered as directly comparable between researchers as Chaplin assumes. In addition to the incomparability of MNI counts, this measure exhibits a number of additional flaws (Binford 1984: 49; Brewer 1992:216; Casteel 1977; Grayson 1984; Klein and Cruz-Uribe 1984:26-28; Ringrose 1993:127), as described briefly below.

The problem of interanalyst variation in the way in which MNIs are calculated has already been noted. This problem is often accentuated by a lack of detailed description accompanying the presentation of MNI results. Concerns with the actual calculation of the MNI includes the time-consuming and tedious nature of the technique, a concern which increases exponentially with sample size and can lead to increases in computational errors.

The MNI count is not additive in nature. If the sample size increases with additional excavation, the MNI must be completely recalculated. One of the most serious concerns with the MNI count is that it is severely affected by the nature of the collection units. An MNI count for an entire site is usually very different from the MNI count of a stratum, for example, or of an individual excavation unit. As the degree of aggregation decreases, the MNI count is dramatically exaggerated and, as taxa are not distributed equally within the site, this exaggeration will affect taxa differentially. As Grayson (1984:39-40) points out, the "altered absolute abundances caused by the effects of differing aggregation methods on minimum numbers may greatly alter the outcome of any significance test applied to minimum number data."

Casteel (1977) and Grayson (1984), among others, also discuss the effects of sample size, which can lead to the over-representation of taxa with lower bone counts and conversely of the underrepresentation of taxa with higher bone counts. Grayson (1984:116 ff) explains at length how the results of comparisons of MNI counts are often actually results of comparisons of sample size.

MNI counts also fail to take into consideration the existence of butchering units, as animals may have been transported into the site as portions rather than whole animals. MNI counts can thus potentially overexaggerate the relative importance of certain taxa. MNI counts also fail to recognize variability in fragmentation.

Number of Identified Specimens Present (NISP)

The NISP is a count of the identified fragments of bone for each taxon. The strengths of the NISP are generally presented as the weaknesses of the MNI and vice versa, as described below (Brewer 1992; Chaplin 1971; Grayson 1984; Klein and Cruz-Uribe 1984; Ringrose 1993).

The NISP is easily calculated following the identification of the bone fragments, consisting merely of the sum of identified specimens to each taxon. An expansion of sample size is easily incorporated, as new NISP counts can be added directly to the existing ones. The NISP is not affected by the problem of aggregation. It may also provide a better count of taxonomic abundance when dealing with the presence of butchering units in a site, rather than the whole carcass. The MNI count, in this instance, would exaggerate the resources by assuming the completeness of the carcass

represented by a minimal number of elements.

The major criticism is that the NISP is not a count of independent units - the same individual animal may be counted many times as it is represented by numerous bone fragments, which is problematic as statistical tests require the independence of the items counted.

The NISP count also does not take into consideration the taxonomic variation in the number of identifiable elements. Those taxa with more elements or more distinctive or diagnostic elements may be over-represented. Similarly, those taxa which have been deposited within the site as whole carcasses are over-represented compared to those which may reach the site in prepared portions or with "low utility" parts missing, thus ignoring the "schlepp" effect.

Additionally, the NISP count can be severely effected by fragmentation of the remains. Highly fragmented remains, due either to butchery or post-depositional effects, will produce artificially high counts for certain taxa, an effect which may occur differentially across taxa. NISP counts are also more sensitive than MNI counts to the effects of collection techniques such as screen size. Smaller animals may be represented by few elements in the final sample due to loss during screening.

NISP counts can also be criticized as they do not directly correspond to the relative dietary contributions of various taxa. For example, 40 bison fragments = 40 vole fragments, although the relative dietary contributions represented by these fragments are obviously quite different. The NISP counts may also be affected by sample size, as noted above in the discussion concerning MNI counts.

3.2.ii Selection of Taxonomic Abundance Measure

A perusal of the current literature concerning faunal quantification leaves one with the general impression that there is little point in quantifying the faunal assemblage at all, given the number of unknown variables which affect the assemblage between death of the animal and archaeological recovery. Gautier (1984:240) estimates that the chance of an animal of a certain death assemblage being represented by one fragment in an assemblage under study is 0.5. "Chances that an animal will be represented by n bones would be less than 0.5 to the nth degree, i.e. 0.25 for two bones, 0.125 for three bones...." While this sort of discussion is rather depressing when considering the attempted reconstruction of *actual* abundances, it is of less concern when dealing with *relative* taxonomic abundances of different archaeological samples.   The problem of unknown, and currently unknowable, taphonomic effects transforming the original death assemblage into the recovered assemblage still exists, but the effect is less than might be the case if attempting to reconstruct, for instance, the absolute dietary contribution of each taxon. While the numbers of the original death assemblage may have been deflated by intervening taphonomic processes, the relative abundances of the various taxa are more likely to be similar. The variable degree of fragmentation will still be one of the major potential causes of interassemblage variability.

The quantification method selected for this analysis is the NISP count. This selection was made after taking into account both methodological concerns and the specific characteristics of the data. The disadvantages of the MNI count outweigh those of the NISP count, particularly given Grayson's (1984:62 ff) argument that the rank order

of MNI values can generally be predicted from the rank order of NISP counts. "The information on relative abundance that resides in MNI counts generally resides as well in NISP counts, and if relative abundance is the target of the analysis, there would seem little reason to spend the time and effort to calculate the minimum numbers." The NISP counts can therefore be ranked, with the resulting ranks compared using Spearman's rank order correlation coefficient (Grayson 1984; Hays 1963).

The specific characteristics of the data sets under study also contribute towards the selection of NISP. Firstly, the aggregation problem of MNI counts places a great importance on the choice of measurement unit. Given that the Forks samples were excavated by various individuals and agencies with differing stratigraphic interpretations, it would be difficult and dangerous to select a unit within which to count the MNI.

Secondly, the actual faunal remains are in some cases difficult to access for re-examination, which would be necessary in order to produce the MNI counts. NISP counts, on the other hand, utilize computerized data.

Thirdly, in some cases the sample sizes are enormous. Calculating MNIs would necessarily involve re-examining hundreds of thousands of fragments.

Fourthly, while the MNI counts have been calculated for most of the samples, there is no detailed description of how this was done, rendering these counts unusable for interassemblage comparisons.

The combination of methodological and logistical concerns suggests that the use of MNI counts is unnecessary, inadvisable, and needlessly time-consuming.

3.2.iii Discussion of the NISP Method within the Context of the Forks Data

A number of topics of concern are readily apparent: site taphonomy, sample sizes, aggregation units, quantification across taxonomic classes, quantification problems of certain classes, and varying screen sizes.

The comparison of various samples from within the same site or site area would appear to be an advantage when examining taphonomic effects in the destruction of bone. Post-depositional taphonomic effects are likely to be more similar within the one site area. However, it must be remembered that various taphonomic effects are cultural in nature, such as butchering patterns, the presence of scavengers, or disposal activities. Certain taphonomic effects are also bound to affect taxonomic classes differentially. Flooding, for example, is a perennial occurrence at the Forks. The possibility of removal and redeposition of bone elements is perfectly plausible and may affect smaller, flatter bones more than others.

Any comparison of samples must address the problem of different sample sizes and the potential affects of sample size on quantification. Table 3.3 presents the sizes of each sample used. Grayson's (1984) method is used to assess the effects of sample size on relative taxonomic abundance. This involves the rank ordering of the assemblages by sample size and by relative abundance then testing for significant correlation. The results of this exercise can be considered during further interpretation and may provide evidence regarding the taphonomic processes at work at the site. The sample sizes cannot be increased but awareness of the affects of sample size can be useful during the interpretive stage.

Table 3.3 Sample size and screen size for each archaeological sample

sample #	culture period/site name	sample size	screen size/method
1	Archaic	109, 095	1.5 mm/water
2	Blackduck	8, 225	4-6 mm
3	NWC/Fort Gibraltar I	17, 631	1.5 mm/water
4	HBC/Fort Garry	8, 859	6 mm
5	HBC/Upper Fort Garry	3, 462	6 mm/water

The amount of area excavated, as well as the selected locations of excavation within the site, must also be considered as a potential source of bias. Without a complete excavation of the site, it is impossible to determine how representative the excavated samples are of the entire site. Selection of certain site areas for excavation may also produce a false emphasis on certain activity areas. The aggregation unit used is the actual cultural occupation, corresponding with the focus of the thesis in large-scale, long-term changes over time.

One of the concerns with the use of NISP counts is the means of dealing with fragmentation of the specimens. The Fort Garry sample was processed for the purposes of this thesis. Within this collection, recent breaks (those which occurred during or after collection) were noted but were not included in the specimen quantity. Those specimens which exhibited earlier breakage were included in the count, regardless of the possibility of reconstruction with other specimens (although this possibility was noted in the data base). To provide an example, a distal tibia broken by the backhoe into four fragments would be considered as a count of one and, generally, repaired. A distal tibia butchered into four fragments would be considered as a count of four, while the relationship between the four fragments was noted in the database. The remaining samples were identified and catalogued by a variety of researchers, none of whom note the way in which they dealt with this issue.

Much of the literature concerned with faunal quantification does not consider comparisons across faunal classes. In fact, much of it deals implicitly with mammalian - often large mammalian - species. Given the abundance of the various classes within the

samples here (particularly fish), this concern must be addressed. It may be superficially apparent that the use of NISP will exaggerate the relative abundance of fish species due to their numerous bones. However, the fragility of many of these bones argues against their over-representation due to the increased likelihood of postdepositional destruction, the increased likelihood of consumption/destruction by humans/scavengers, the decreased likelihood of recovery due to larger screen sizes, and the difficulty in identifying many of these bones to species (Colley 1990:208-209, 215; Shackley 1981:181-182). The potential overexaggeration of fish bones in NISP counts is probably more than offset by various taphonomic variables, the precise effects of which are currently unknown. Additionally, many of the comparisons between the assemblages are concerned with changing representations in one class or taxon over time. This type of comparison thus reduces the potential effects of differential class/taxon representation within each assemblage.

Quantification by NISP for bird and fish remains must deal with the problem of scales and eggshell. Both of these can enormously exaggerate the relative abundance of these classes. As neither scale nor eggshell has been identified to further taxonomic levels (beyond class), it should not affect relative taxonomic abundances within class. The problem of eggshell varies with age as it is preserved only within the Postcontact period samples. Fish scale, on the other hand, is represented within all of the samples used, although the percentage preserved may vary with the age of the sample. In order to produce more accurate comparisons between classes, the number of scales and scale fragments as well as eggshell fragments will be presented beside the basic NISP counts

per taxon, but will not be included within the NISP counts. In this way, their presence will be recorded but will not affect the comparison between classes.

The last concern to be discussed is that of variable screen size. Table 3.3 includes the screen sizes used in the excavation of each sample. An awareness of the variability in screen size will be taken into consideration during the interpretive stage of the analysis. Larger screen size will obviously create a bias against smaller elements, smaller fragments, and smaller taxa.

3.3 Butchering and Processing

Butchering studies are an important part of any faunal analysis, providing information on how carcasses were dismembered, transported, and processed for consumption and raw materials. The interpretation of this information is useful in the study of such areas as subsistence, site use, site activity areas, ethnicity, economic position and seasonality. Two classes of data are generally used in butchery studies: 1) the observation of butchering marks and recreation of a butchering pattern, and 2) the relative frequencies of elements represented, particularly in relation to their naturally occurring frequencies. Taphonomic variables must be considered in the observation and interpretation of butchering data.

The primary goals of butchering analysis in this thesis are to determine if butchering and processing patterns for the various taxa change over time; to describe the nature of that change; and to present possible explanations for these changes.

3.3.i Butchering Evidence

The two major lines of evidence used in this thesis are the observation of butchering marks and the relative frequencies of elements.

Butchering Marks and Butchering Patterns

The study of butchering marks and the resultant "butchering pattern" permits the reconstruction of past butchering behaviour - how the carcass was skinned, gutted and dismembered, and processed for further use.

Guilday et al. (1962, cited in Lyman 1987:260) suggest that two criteria should be met for qualification as a butchering mark. The first is the "repetition in specimen after specimen at precisely the same location on the bone". The second is that "there must be some anatomically dictated reason why a particular mark should occur at any given spot." Lyman (1987:260) terms these criteria "patterning" or "redundancy" and "purposiveness". Using these two criteria, a butchering pattern can be reconstructed, determining the manner in which faunal resources were processed, from the living animal to the final consumption as food or raw material.

It should be noted, however, that negative evidence - the absence of a cut mark on a bone - does not necessarily indicate an absence of butchering activity at that location. Wheeler and Jones (1989:65), for instance, note that "[k]nife contact with bone blunts the blade and ... fishmongers try to avoid such contact." Butchers may have avoided such "negative impact" with the bone surfaces when possible in order to preserve butchering tools for further use. Flesh and periosteum surrounding the bone also serves

to protect the bone surface from damage, potentially preventing the creation of butchering marks. Marks may also have been "erased" by subsequent degradation of the bone surface (e.g. weathering, exfoliation) or overlain by secondary effects (e.g. carnivore chewing). Dawson (1992:36) also notes that small mammals, such as lagomorphs, could have been pulled apart rather than formally butchered, resulting in subdivision of the carcass without the creation of cut marks. The presence of butchering marks is thus a reduced representation of the initial butchering activity.

Crabtree (1989:97) suggests that the ideal manner of recording butchering marks would be to draw or photograph every mark. This would be far too time consuming given the large size of many faunal assemblages. Instead, Crabtree describes the location (e.g. proximal, distal), direction or orientation (axial, medio-lateral), and nature (knife-cut, chop) of each mark. This information is then entered into a computer. A similar method is used in this thesis, where possible. Directional terms "transverse" and "longitudinal" replace "medio-lateral" and "axial" and the marks are recorded as cut, chopped, and sawn. The variation in data quality and completeness varies from sample to sample.

Presence of butchering marks and their frequency of occurrence are noted for each taxon and element, and described via text and figures. The original purpose of the butchering marks can then be determined and butchering patterns reconstructed as completely as the data permits. Incorporation of the second line of evidence - the relative frequency of elements - will assist in this reconstruction.

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Relative Frequency of Elements

Interpretation of the relative frequency of elements per taxon is a second body of data that can be used in butchery studies. Klein and Cruz-Uribe (1984:63) state that the shifts in skeletal part abundance "must...have originated when the death assemblage was transformed into the deposited assemblage, when the deposited assemblage was transformed into the fossil assemblage, or when the fossil assemblage was sampled during excavation." The first transformation is of primary interest in the study of butchering patterns, as the relative frequency of elements may vary due to destruction of certain parts during butchering or consumption of the carcass, or to the transportation (import or export) of various body parts. The latter two transformations must also be considered as most interpretations will be inaccurate if only cultural factors have been considered. The changes in the relative frequency of elements may be due to the destruction of certain parts during butchering or consumption of the carcass, or to the transportation (import or export) of various body parts.

The relative frequency of elements has been variously calculated and presented. Klein and Cruz-Uribe (1984: 63), Kehoe (1973), Speth (1983) and others work from MNI counts. "Expected frequencies" are based on MNI counts and are presented with the "observed frequencies" for each element, often expressed as a percentage. Binford developed MGUI (modified general utility index) calculations for sheep and caribou elements, based on the perceived "utility" of the bone for consumption of meat, marrow, and grease. Other researchers have followed his lead, either producing similar utility indices for other species or applying Binford's indices regardless of taxon. Crabtree

(1989), on the other hand, presents "body part distribution" data using NISP counts. Until recently, butchering studies have generally focused on large mammals, particularly artiodactyls. Few studies have been concerned with small- and medium-sized mammals, birds, or fish.

The data in this thesis are presented using NISP counts of elements per taxon, grouped into body areas. Fish remains, for instance, can be grouped into cranial, axial, and appendicular areas. NISP counts per element are then ranked and the ranks compared within each taxon or taxonomic group (e.g. bovids, leporids, etc). Sample specific patterning can then be recognized and explained.

3.3.ii Interpretation of Butchering Evidence

Observable variation in the butchering patterns between the samples is expected. Such variation may be present as changes in butchering mark location and butchering patterns, and in skeletal part frequencies. Potential taphonomic effects - such as selective destruction by scavengers, patterned environmental attrition, and screen size - must first be considered. Potential factors influencing the changes are grouped, and discussed, as follows:

1. Who is processing and who is consuming the remains? (social and cultural factors)

2. What is the intent of the processing? (economic factors)

3. Where is the carcass processed and where is it consumed? (logistical factors)

4. What is being processed? (individual/taxonomic factors)

5. How is it being processed? (technological factors)

Social and Cultural Factors

Social and cultural factors affecting butchering patterns include archaeological culture, ethnicity and social position. Archaeological culture and ethnicity are similar factors, expressed differently during the Precontact and Postcontact period studies. Social position, while extant and observable to some extent in the Precontact archaeological record, is primarily a focus of Postcontact period studies (historic archaeology). During the Fur Trade period, social position tends to correlate with ethnicity. Ethnicity, however, may also play a role in determining how social position is displayed. In her comparison of ranking based on archaeological assemblages and documented economic position, Brenner (1998:236) found that ambiguities which occurred in the rankings may have been due to factors other than economic position which might influence social position. These additional factors include prestige, ethnicity, religion, consumer choice, family life cycle and sampling. Spencer-Wood (1987:324) uses the term "socioeconomic status" to indicate the "relationship between economic and social position associated with economic role, particularly occupation." It is evident from Brenner's (1998:52) research, however, that there is no one-to-one correlation between wealth (or economic position) and social position. Additionally, it cannot be assumed that the resource processors and resource consumers are of the same ethnic group or social position. This may be a safe assumption during the Precontact period, but not during the Fur Trade period. Evidence

of ethnic patterns of butchery, for instance, does not necessarily imply consumption of these items by the same ethnic group.

In the consideration of cultural distinctions, butchering patterns have been viewed as "artifactual." Johnson (1978), for example, studied a group of sites in order to determine whether a standard pattern of butchering existed for the entire Palaeo-Indian period. Gilbert (1969:277) states that there has been "some variability in butchering techniques between the various subcultures of Indians....Such data, coupled with other archaeologically-derived information...which yield data on cultural change through time, serve as additional support in interpretations." Keyser and Murray (1979:173) suggest that communal bison kills "present an optimum situation for the study of stylized butchering practices....the butchering process would...have been refined and stylized to produce the maximum amount of meat in the minimum amount of time." Thus (1979:174), individual variations would be "masked by the requirements of speed in processing ... and significant differences between sites would probably represent cultural rather than individual differences."

Alternatively, Speer (1978:233) is of the view that the "procedures adopted depended upon a number of factors, including season of year, size of kill, topography of site, and size and preferences of the hunting party". It can be argued that the factors affecting the butchering pattern are so many and so variable that cultural patterns of butchery may not exist or may not be readily recognizable within the archaeological record. Lyman (1987:288-289), for instance, suggests that the likelihood is that "animals are butchered according to a set of rules that differs from culture to culture and from

natural setting to natural setting, but with constraints dictated by the anatomy of the animal."

Animal resource processing during the early Fur Trade period was often carried out by women associated with the various forts or by Native groups in their own camps, to be later traded to fort personnel. Because the women associated with the forts were either Native or Métis, early Fur Trade period faunal remains may exhibit a Native or Métis style of animal processing. Processing within the later posts was carried out by Eurocanadian men, potentially introducing yet another "style" of butchery. The question is whether these cultural styles exist and whether they can be recognized within the archaeological record. Crabtree (1990:178) suggests that ethnic distinctions in butchery patterns may be due as much to the use of different tools - technology - as to the ethnic affiliation of the butcher, while Jolley (1983:73) states that "historic butchering practices...are known to vary with ethnicity and nationality." Within the Canadian fur trade experience, both Klimko (1989:33) and Pyszcyk (1978:34) state that similarities of fur trade butchering practices are probably due to the use of Native and Métis hunters as well as to the involvement of "country wives." Pyszcyk (1978:34) also points out the existence of complicating factors such as the size of game populations, distance from the kill to the habitation site, as well as the intended uses of the meat.

The question of ethnic butchering patterns includes the consideration of ethnic preferences for various body portions, which may be reflected through the presence of certain elements or the location of butchering marks. The confusion may be compounded by the acceptance of ethnic preferences by members of a different ethnic group.

Eurocanadian fur traders, for example, often developed a taste for the body parts considered as delicacies by the Native groups. This acculturation or cultural sharing, although brief, may serve to mask the ethnic identity of the consumers.

Within historic archaeology, the question of social position is often approached through the study of butchering patterns as exemplified through the consumption of different meat cuts. Social position may also be reflected in the selection of certain taxa, particularly when considering fish remains. Schulz and Gust (1983) studied the faunal remains of four deposits of varying social "rank" in nineteenth century Sacramento, based on the rank ordering of cuts of meat by contemporary prices. Ewen (1986) studied the faunal remains of neighbouring NWC and XY Company posts in the Great Lakes area, using the amount of meat consumed per capita, the amount of delicacy items, and the proportions of preferred portions of deer in order to examine the relative rank/social position of the two posts. Singer (1985) examined cuts of fish and the fish taxa represented in order to examine the social position of New England consumers, again based on contemporary prices. While determination of social position is not the primary goal of this thesis, its effect must be considered in the interpretation of observed shifts in butchering patterns.

Economic Factors

The economic factors considered here are those linked to the intent of the animal butchering and processing - the nature of the finished product and the economic intent of the finished product (subsistence or economic).

Within the Precontact and Fur Trade periods, the range of possibility for "finished products" could include fresh, dried, smoked, and frozen meat, marrow, grease, pemmican, raw material for bone tool production, and skins. Some of these products were for immediate consumption, but many were means of storage for future consumption. The production of dog food must also be considered, particularly during the Fur Trade period.

Indications of these products should be visible within the archaeological record either through butchering marks or relative element frequencies. Some products, such as dried meat, may have been bought or traded from Native and Métis groups with processing occurring elsewhere. Pyszczyk (1978:6), for instance, notes that "factors such as off-site butchering, and the provisioning of posts with dried meat and pemmican may not be reflected in the faunal record." The large Red River bison hunts which provided so much meat and meat products for the fur trade involved the processing of much of the meat near the kill site, in order to lighten the load and reduce the amount of spoilage. Bison hunted during the winter, particularly by post employees, may have been returned to the post with only rudimentary butchering having been carried out, due to the preservation of the meat by the cold. Often bison meat was placed in the ice house with very little butchering. Kane (1925:256-257), for instance, describes the preparation of bison carcasses as merely the removal of the head and feet and the quartering of the carcass. The animals are not skinned prior to being placed in the ice house.

Extraction of marrow and bone grease may leave distinctive patterns in the archaeological record. The extraction of marrow from moose and deer has been

described by Zierhut (1967) for the Calling Lake Cree. He notes which elements contain sufficient marrow to warrant processing of the bone, accomplished by heating the bones and breaking them into two halves with an axe. The proximal and distal ends of the bones and the remains of the shaft are then further smashed and collected for the extraction of bone grease by boiling (Zierhut 1967:34). Leechman (1951) also describes the process of making bone grease through smashing the bones and boiling them slowly. Fish was also used in pemmican, incorporating the crushed bones.

Hamilton *et al.* (1981) interpreted the extensive and intensive smashing of bison bone, as well as the lower than expected recovery of high marrow cavity bone fragments, as the by-products of the manufacture of bone grease at the Stott site (DlMa-1).

Fish processing also produces distinct patterns of element representation. Butler (1993) used the relative frequencies of body parts within a number of Oregon sites in order to determine the natural or cultural origin of accumulations of salmon remains. Because salmon heads and trunks were processed independently, sites with low frequencies of cranial remains suggested cultural processing, while equal frequencies of cranial and post-cranial remains suggested natural accumulation. Stewart and Gifford-Gonzalez (1994) discovered similar patterning in a comparison of modern Kenyan fishing sites and natural accumulations. Natural accumulations were again recognized through similar frequencies of cranial and post-cranial remains, while cultural processing was indicated by unequal frequencies of cranial and post-cranial remains.

Limited use has been made of butchering mark evidence on fish. Singer (1985) describes the cut marks on historically processed marine fish of New England, while

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Wheeler and Jones (1989) describe expected cut marks as by-products of spine removal, decapitation, filleting, splitting, and other procedures.

Observation of butchering marks and element frequencies may assist in determining whether the fish were caught, processed, and/or consumed at the site, in a fresh, dried, or smoked state.

Animal products may have been produced as a subsistence item for the group or individual processing the carcasses. Alternatively, they may be prepared for trade or sale. This difference may be reflected in the processing patterns. Quartering of large carcasses, for instance, or the filleting and sectioning of fish, may indicate primary butchery and processing for transportation and subsequent sale or trade. Documentary evidence may be used to determine what products were produced for immediate consumption, for trade, or were purchased from other producers.

Logistics

Where the animal was killed, where it was processed, and where it was consumed can affect the manner in which carcasses were processed, varying in relation to the distance between kill site and consumption site. Butchering patterns and frequencies of body parts can be used to distinguish kill, processing, or consumption sites.

This type of study was pioneered by White (1953), who suggested that heavy "low utility" parts (e.g. skulls, lower legs, pelves) would be more likely to be left at the kill site rather than carried home. A high frequency of low utility elements is used to identify a kill site, while a high frequency of high utility parts is considered a consumption (or

camp) site.

Despite taphonomic variables, this type of patterning and interpretation continues in the literature and has been termed the "schlepp" (or drag) effect as coined by Perkins and Daly in 1968. Wheat (1978) distinguishes four types of Palaeo-Indian sites based primarily on butchering patterns and relative frequencies of elements. Gilbert (1969) discusses "light" versus "heavy" butchering dependent upon the distance between kill and camp. "Light" butchering indicates that the load was lightened by the discard of bones at the kill site, indicating that the kill site was far from the camp site. "Heavy" butchering thus indicates a kill near the camp, with a greater variety of elements returned to the camp for processing. Binford's MGUI calculations are based on the qualities of a bone which would determine its usefulness and thus whether or not an element would be transported from the kill.

Stewart and Gifford-Gonzalez' (1994) examination of fishing sites in Kenya permits the distinction of fishing sites versus camp sites by the relative frequencies of axial and cranial elements. Fishing sites are characterized by high frequencies of cranial elements and low frequencies of axial elements, as heads are removed and discarded at the fishing site, while axial elements are removed with the meat and returned to the campsite for consumption.

The butchering pattern, particularly the relative skeletal part frequencies, can thus be used to interpret the site type, whether the animals were procured on site, or carried in from elsewhere.

Individual and Taxonomic Characteristics

Factors such as the sex, age, size, or nutritional status of the animal can affect the manner in which it was processed. These factors, of course, may correlate with one another. For instance, bison cows and bulls are in top condition at different times of the year, revolving around the annual reproductive cycle of rut and calving, linking sex with nutritional status. Speth (1983) identified different butchering patterns for cows and bulls at the Garnsey site. He attributed this variation to the spring season of the kill, when cows were in poor condition due to the nutritional demands of pregnancy, birth, and lactation and were therefore less intensely processed.

Size of the animal often affects the degree of processing. Large animals are more intensely processed, particularly when the distance from kill to camp is considered. Small animals may be minimally butchered, or cooked "whole". Stewart and Gifford-Gonzalez (1994:247) point out the variability in fish size and processing, where fish less than 30 cm in length were left intact, while those larger were processed in three separate units (head, body, tail). The number of cut marks would therefore be much lower in smaller animals and the relative frequencies of elements would tend to be less variable. These factors should be considered during the interpretation of butchering patterns/relative abundance of skeletal elements.

Technological Factors

Variation in technology can, of course, affect the butchering pattern and the relative frequencies of elements. The use of metal rather than stone or bone tools permits

a different method of butchery and dismemberment. The use of saws and axes also changes butchering patterns. Earlier methods of quartering and disarticulation focused on smashing through the bones or focusing on the joints. It has been suggested that meat removal was primarily through muscle stripping (Frison 1970:10-16). Saws and axes can be used to cut straight through dense bone, producing modern meat cuts. More efficient transportation permits the retrieval of heavier loads from further distances, which could result in a reduction of the "schlepp" effect.

3.4 Forks Taphonomy

Taphonomy is the study of the processes which act upon organic remains after death, of "the transition in all its details of animal remains from the biosphere into the lithosphere" (Noe-Nygaard 1987:7). Hesse and Wapnish (1985) have ordered the taphonomic factors from the living assemblage to the sample assemblage, as follows: biotic, thanatic, perthotaxic, taphic, anataxic, sullegic, and trephic processes. Those taphonomic factors that are considered to have potentially altered or biased the faunal assemblages from the Forks are described briefly in this section.

Noncultural taphonomic processes can mimic or obscure the effects of the cultural factors which are the research focus, such as species preferences, butchering and processing patterns or population structure. The one truth of taphonomy is that "the total amount of information declines over time" (Hesse and Wapnish 1985:19). The differential action of taphonomic processes will produce a sample assemblage which is qualitatively, as well as quantitatively, different from the original deposit.

The following are those taphonomic factors which are of most concern within the samples collected and used for this thesis: site catchment and seasonality (biotic); changing technology and river flooding (thanatic); selective transport of elements, butchering, processing, cooking and consumption, and carnivore gnawing (perthotaxic); fluvial erosion and subsequent human site use (anataxic); location and extent of excavations, screen size, limited experience of excavators (sullegic); and, variability in identification (trephic). These factors are discussed briefly below.

Species availability through environmental and seasonal variability limit the possibilities of inclusion of various taxa within the archaeological assemblage. The range of possibility is further narrowed by cultural food preferences.

Thanatic factors remove animals from the living assemblage, producing the initial death assemblage. These factors include natural death and death by non-human agencies (e.g. carnivores, raptors), as well as human predation. Clarification of human predation can be established through archaeological context (e.g. presence within a midden), absence of evidence of carnivore chewing, and relative element frequencies. Natural death can generally be ascertained through completeness of the skeleton, as well as the lack of evidence of human butchery or consumption (Lyman 1994b:218-219).

"Superior" technology increases prey vulnerability (Hesse and Wapnish 1985:22), as in the case of the slaughter of bison by effective firearm use in the nineteenth century. Technology can also affect prey selection, particularly for fish species, where the use of harpoon, spear, fishhook, weirs, or nets can produce distinctive predation patterns of species, age, size, and sex (Wheeler and Jones 1989; Lyman 1994b:437).

Seasonal flooding is a thanatic factor of particular relevance to a prairie riverine environment such as the Forks. Fur Trade period documents (cf. Henry 1988:113, Wood 1985:136) attest to the large numbers of bison which were regularly drowned during the spring floods on the Assiniboine and Red Rivers. The carcasses were used as a subsistence resource by Native groups during the Fur Trade period. The drownings would have occurred during and shortly after the calving period and should be identifiable in the archaeological record as catastrophic accumulations of mature and very young bison.

Annual spring flooding may also have trapped fish in flood ponds. Archaeological evidence of this form of natural death may be recognizable through the recovery of entire, unbutchered fish in discrete areas of the Forks, lacking associated artifacts or other cultural evidence (Lyman 1994b:438), could be a possible result.

Perthotaxic factors intervene between the death assemblage and the deposited assemblage by moving or destroying items before they are buried (Klein and Cruz-Uribe 1984; Hesse and Wapnish 1985; Lyman 1994b). Potential natural agents of disarticulation at the Forks include fluvial action and scavengers. At the Forks, fluvial action would probably have served either to redeposit or remove, rather than disarticulate, faunal remains. Carnivore gnawing is readily identifiable and noted within the samples at hand. Carnivores leave indications of their action on bones, both through diagnostic marks (pitting, punctures, scoring) and the means by which they access marrow, creating scooped or hollowed out areas (Lyman 1994b:210). Binford and Bertram (1977:81-82) point out that canid destruction "may not only reduce the quantitative characteristics of

a surviving faunal assemblage but may also change the structure, or the relative frequencies of the surviving parts." This destruction is differential, dependent on bone density which, in turn, is a function of age of the individual at death (Binford and Bertram 1977:112). This potential effect must be considered during an examination of relative element frequencies and taxonomic frequencies.

Hesse and Wapnish (1985:26) also point out the role of selective deposition in the likelihood of burial of bone. This may include the role of natural topography (e.g. slopes, hollows) and cultural topography (e.g. buildings, middens). While the former is unlikely to have influenced bone survival at the Forks, the cultural topography is undoubtedly a factor in the Postcontact samples. Much of the Fort Garry sample, for instance, was recovered within what appears to have been a cellar midden, while the Upper Fort Garry sample was recovered from two privy refuse pits. The use of these middens, particularly the privy pits, likely improved the survivorship of the bone materials, due to rapid burial of the remains.

Processing of flesh, marrow, and bone grease, as well as garbage disposal, can affect bone through thermal alteration, ranging from charring to calcination and including extended bone boiling and smoking, which can all differentially affect bone survival. Burned bone is generally viewed as fragile and more easily destroyed (Noe-Nygaard 1987:32).

Extended boiling of bone for the extraction of bone grease may also result in bone degradation. The process involves simmering the bones very slowly in order to extract the fat (Zierhut 1967:34; Leechman 1951:355). The creation of bone grease results in

both the smashing of bone into unidentifiable fragments, as well as the increased

likelihood of postdepositional destruction due to weakening of the bone by long boiling.

As certain elements were preferred for the extraction of bone grease, this process may

be visible in the archaeological record through diagnostic patterns of element frequency

(Lyman 1994b:217).

The consumption of bone is also a potential source of loss or damage of bone

prior to deposition and burial. An experiment in the destruction of fish bone through

ingestion and digestion indicated that "only a small number of recognizable bones were

recovered" (Wheeler and Jones 1989:72). The percentages of survival varied according

to the consumer (dog, rat, pig, or human), although for small and medium-sized fish,

"probably less than 10%" of the bones survived in a recognizable form. While large

scale consumption of bone of the various taxonomic classes is unlikely for the human

population, the presence of canids as both companions and scavengers is a potential threat

to bone survival.

Anataxic processes such as erosion and subsequent site use remove bone from

buried horizons and expose them again to previous taphonomic processes, such as

weathering. The major agent of erosion at the Forks is fluvial action, which may have

removed portions of the site and exposed the remaining portions to further perthotaxic

processes. Subsequent human use of the Forks area has caused some damage to

underlying horizons. This is particularly evident within the Archaic horizon, where a

total of nine building pilings were exposed during excavation, having intruded into the

Archaic horizon and distorted the original sediments in the adjacent areas downwards

(Greco 1994:29). These oak pilings have been dated through tree ring analysis (Nielsen 1994:37) to the 1870s-1890s and are thought to have been used in the building of the H.B.C. flour mill complex

The major effect of subsequent human occupation, however, has been to preserve the underlying horizons despite the numerous developments during the nineteenth century. This preservation has been created by the deep deposits of fill which were brought in during the railway period in order to raise the level of the land and protect it from flooding. The depth of fill ranges from from 0.5 to 5 m (Adams *et al.*1990:5).

Sullegic processes bias the sample assemblage through excavation methodology, including completeness of site excavation, selection of site area to be excavated, screen size and type of screening process, training and experience of excavators.

Incomplete excavation of the sites, coupled with the selection of the excavation areas, may result in representation of a limited range of activity areas. All excavations are limited not only by construction schedules, limited access to archaeological horizons, and other needs, but also by budget. None of the excavations were randomly sampled, but focused instead on the recovery and recording of cultural features and material. These limitations mean that not only are sites incompletely excavated but that the full range of activity areas within the sites may not have been encountered.

The effects of screen size are generally well-known, biasing against the recovery of small fragments, small elements, and smaller species. The recovery of fish species is particularly at risk, given the large number of small bones in most fish species. Comparisons of hand-picked excavated soil versus 1 mm mesh and flotation methods at

Great Yarmouth (Wheeler and Jones 1976:209,212-213) showed the limitations of handpicking, with two species identified in the handpicked material and fifteen in the flotation sample. Shaffer (1992) and Shaffer and Sanchez (1994) have studied the effects of screen size on mammal skeletons, concluding that 1/4"-mesh screen misses most elements of animals in the <140 g class. The smaller size 1/8"-mesh screen recovers most easily identifiable elements of taxa ≥42 g and some elements of those taxa <20 g, in addition to improving complete recovery of elements from much larger animals such as jack rabbit and red fox. Clearly, any study of relative frequencies of taxa or elements must consider the effects of screen size. Water screening also yields better results in removing items from the dense clay at the Forks. Screen size varies between the samples used in this thesis, as noted in Table 3.3.

The last sullegic factor considered here is the training and experience of excavators. This is a subjective factor, the effects of which would be difficult to quantify. In screening the matrix, the material must be correctly identified as of some value if it is to be picked out. The care and concentration, as well as the training and expertise, of the worker is impossible to factor in. All of the excavations included here involved trained professionals as excavators and/or supervisors.

Threphic processes occur after field recovery and include curatorial factors relating to the sorting, recording, packaging/shipping, identification, and reporting of field recoveries (Hesse and Wapnish 1985:30). It is impossible to quantify these potential sources of bias although it is evident that all of these play havoc with the recovered samples on all projects.

Crabtree (1990:186) suggests that "it is important that we choose faunal samples from similar archaeological contexts that have been subjected to similar taphonomic and depositional histories." To a certain extent, variability between the Forks samples is mitigated by the use of one location. Natural taphonomic effects should be fairly similar, while the elucidation of the cultural effects is the goal of the study. It is hoped that the relatively large sample sizes as well as the analysis of occupations rather than small provenience blocks will render some of the less severe taphonomic effects of little importance.

3.5 Seasonality

The study of seasonality can be a vital part of faunal analysis, providing an estimation of the time of year of resource procurement, site activities and occupation. The interaction between human culture and the environment is patterned, in part, by the temporal and spatial availability of subsistence resources. Seasonality can affect subsistence extraction through, for instance, temporally limited availability of resources (e.g. migratory birds), seasonal increase of resources present year-round (e.g. spawning fish), increased desirability of resources during certain seasons (e.g. bison cows in fall), as well as in the complementary manner in which temporally and spatially variable resources are exploited to maximize human use (i.e. scheduling).

The concepts of seasonality and scheduling were first introduced by Flannery (1968), as two regulatory mechanisms in an ecosystems model of culture change. Seasonality, in his sense, is imposed on people by the "nature of the wild resources

themselves" - i.e. seasonal availability. Scheduling, on the other hand, is a cultural activity which serves to resolve conflict between procurement systems, as decisions are made regarding the relative importance of various resources in case of conflict. One of the ways to resolve the conflict is through the subdivision of labour, with different groups exploiting conflicting resources at the same time.

Human social organization is affected by the variable nature of resources, as groups aggregate to exploit seasonally abundant resources and break up into smaller groups during periods of scattered resources. For instance, Ojibwa groups (Peers 1994:22-24) in the early Fur Trade period gathered during the spring to process maple sugar, hunt muskrat, and fish spawning sturgeon. In the fall, they gathered to harvest wild rice and hunt large animals for winter food. Summer and winter were periods of "disaggregation," during which smaller family groups supported themselves through hunting and gathering. Temporal variability in subsistence resources also affects the timing of ceremonial events. For instance, the spring gathering was also marked by the Midéwiwin ceremonies, made possible by seasonally abundant food resources. The affects of seasonality availability of resources and corresponding scheduling decisions are evidently entwined with other aspects of culture.

Seasonality studies have been increasingly incorporated into archaeological analysis. Bowen (1988:161), however, states that archaeologists have not adequately dealt with seasonality of resources as a factor in historical subsistence systems, due to methodological biases as well as to a typical correlation of the theoretical framework of seasonality with prehistoric settlement patterns. She points out that the sedentary

agricultural framework of the historical period was also tied to the environment, while agricultural practices, meat preservation techniques, and socio-economic organization all affected the timing of harvesting of meat resources. The time period examined within this thesis provides an opportunity to examine the changing patterns of seasonal procurement at the Forks, moving from nomadic hunter-gatherer, through a mixed Fur Trade period, to a more or less sedentary agricultural community.

It should be noted at the outset that a complete seasonality study should include the use of floral subsistence resources while the exploitation of faunal resources should not be viewed as limited to subsistence purposes. Seasonal factors also affected the selection of animals for food, furs, hides, and raw materials.

A number of techniques have been selected for use within this thesis, making use of all three major taxonomic classes of remains (bird, mammal, fish). The combination of information produced by the application of a number of separate techniques should provide a more complete view of the seasonality of faunal resource procurement. Used in conjunction with the results of quantification, processing, and documentary evidence, with an awareness of potentially biasing taphonomic agents, this broader range of seasonality estimates can produce a more complete picture of seasonal resource use at the Forks. The following techniques have been selected for use and will be presented below in turn: presence/absence, avian medullary bone, incremental growth structures of fish, epiphyseal fusion and tooth eruption of mammals.

3.5.i Presence/Absence Data

This technique rests on the fact that certain species are either only seasonally available or seasonally abundant. This is one of the least technical methods, requiring only a list of recovered, identified species and a knowledge of their seasonal availability and/or abundance. This technique will be applied in two ways: 1) presence/absence of migratory birds; and 2) increased availability of fish species during the spawning period.

This technique assumes that the timing of migration or spawning of past populations was similar to modern populations. Climatic changes may affect the calendrical timing of these events but the events themselves are triggered by consistent environmental factors (e.g. temperature, length of day/night) which consistently occur at specific seasons.

Monks (1981:182-183) presents some cautionary notes regarding the application of this technique. First, "presence-absence data masks quantitative variation among seasonal indicators." Second, the technique is sensitive to sample size. Third, the storage/transportation of food resources can complicate interpretation. This latter problem can be mitigated to some extent through the butchering/processing analysis, which may clarify site activities and transportation or storage of food items. An awareness of the first two problems during interpretation (both of presence-absence data alone and when viewed complementarily with other seasonal indicators) must suffice. It should also be noted that the absence of data does not necessarily indicate the absence of occupation during any season, as the relevant species may not have been exploited or sampling error may have failed to provide representation of the species. Additionally,

the use of these seasonally available species generally indicates only a spring, summer, or fall presence.

The main source of information that will be used in determining the seasons of presence/absence of bird species is Gardner (1981). Information regarding fish spawning periods will be taken from Scott and Crossman (1973). These sources will provide a seasonal estimation of the potential presence of migratory birds and the abundance of spawning fishes.

3.5.ii Avian Medullary Bone

Medullary bone is a compositionally and structurally unique type of bone which occurs in the skeleton of laying female birds. The presence of medullary bone within the skeleton can provide a seasonal estimate due to the temporally limited nature of the laying periods of birds. Medullary bone provides the laying bird with a particularly labile source of calcium for the formation of the eggshell (Simkiss 1967). The deposition of medullary bone in pullets starts about 10-14 days before a bird "comes into lay," triggered by the secretion of increasing quantities of oestrogens and androgens (Simkiss 1967:163). The bone may exist for only about three or four weeks in a wild bird (Simkiss 1967:170). The seasonality of medullary bone in modern chickens is virtually non-existent, given the artificial manner in which these birds are maintained and bred. This does not negate the applicability of the technique to domestic fowl, however. Rick (1975:187) suggests that pre-twentieth-century chickens had shorter reproductive periods than modern birds, while other domestic birds (goose, duck, turkey) are more restricted

breeders than chickens.

Medullary bone grows out from the inner cortical bone and has been described as "a granular powdery bony substance which is deposited in the marrow cavity," either as a "thin coating on the inner surface of cortical bone,...[or as] protuberances reaching into the marrow...." (Rick 1975:184-184). The amount of medullary bone varies by element. Taylor and Moore (1953:504) note highest percentages within the ribs, femur, ilium, ischium, pubis, scapula, sternum, and tibia, with little in the ulna or phalanges. Simkiss (1961:334) states that it is most clearly seen in the shaft of the femur, while Rick (1975:184) suggests that is easily visible within the femur, tibiotarsus, and ulna.

The presence of medullary bone has been noted in a range of species, including domestic and wild turkey, chicken, sage grouse, passenger pigeon, and goose (Rick 1975:188); Canada goose, canary, domestic fowl, domestic duck, mallard Pekin duck, house sparrow, pigeon, and bobwhite (Simkiss 1961:334). Its presence in such a wide variety of species suggests that it is likely present in most, if not all, bird species.

Medullary bone is preserved in archaeological sites. Rick (1975:188) notes its recovery from sites "widely separated both spatially and temporally," while Simkiss (1967:172) describes it as "better mineralized than cortical bone...," which argues a high potential of preservation. Rick (1975) views medullary bone within broken limb bones, but points out that radiography can be used to determine its presence within unbroken elements.

Within this thesis, the technique will be used only on broken elements. Observation will be limited to the femur, tibiotarsus, and ulna. The nesting times of

relevant bird species will be noted (Gardner 1981), producing a seasonality estimate. Additional research on a variety of species could produce a finer estimate, as the stage of deposition (build-up or decline) may be recognizable. It is unknown whether or not migratory birds produce medullary bone prior to arrival at the breeding grounds. More research could improve the utility of this technique. At this point, its presence, coupled with the known breeding periods of relevant species, must suffice to produce a broad estimate.

3.5.iii Incremental Growth Structures

Growth histories are recorded within the bony structures of various fish species, as well as in the structures of other classes. Fish grow continuously throughout their lives, producing annual layers of growth within various elements, similar to tree rings. These elements "carry a permanent record of age, rate of growth in each year, and...season of death" (Monks 1981:199). Not all elements of all species are suitable for seasonality or ageing studies, however. Modern comparative specimens must be used in order to assess the utility of various elements and species. This work has begun for both freshwater and marine species.

Growth increments have been used for decades within fisheries research, for the purposes of ageing, reconstruction of rates of growth, and production of biochronologies. Archaeological applications include seasonality determination and estimation of fish size. The underlying rationale for seasonality studies is that the comparison of the amount of the last year's growth with previous years' growth can produce an estimate of the season

of death, using a knowledge of when annual growth occurs based on studies of modern specimens.

Although a variety of elements and species can be used, only one has been selected for use within this thesis, namely the pectoral spine of the channel catfish (*Ictalurus punctatus*). In some instances, the pectoral spines of the bullhead (*Ictalurus nebulosus*) have also been used. This element has been selected based on the existence of previous work suggesting utility of this element and species; availability of modern comparative specimens of known date of death within the region; occurrence, frequency, and preservation of archaeological specimens.

The pectoral spines of channel catfish (*Ictalurus punctatus*) have been used within fisheries and archaeological studies as indicators of individual age and seasonality. Sneed (1951) initially sectioned channel catfish spines in order to calculate growth rate. He found that the best point of sectioning the spines, in order to view all increments, was at the distal point of the articulating area. This point has been used by subsequent archaeological researchers. Morey (1983) developed the technique using channel catfish (*Ictalurus punctatus*) in Nebraska, west-central Illinois, and the Nebraska-South Dakota border area while, later, Brewer (1987) used the technique to determine seasonality using the spines of the Nile catfish (*Clarias* sp.).

It has been clearly established that catfish pectoral spines produce annular growth rings which can be used to determine age, rate of growth, and season of death. Pectoral spines are particularly suitable elements due to their ease of identification and paired nature, which avoids the potential pitfall of sampling the same individual more than once.

The use of vertebrae or scales, for instance, can result in a number of seasonality estimates based on one individual (Brinkhuizen 1997:4). Pectoral spines can be selected using one side consistently or can be matched in order to establish independence of specimens.

The use of pectoral spines in this thesis follows Morey (1982; 1983) and Brewer (1987), using the methods set forth by Monks and Johnston (1993). The modern comparative sample of channel catfish spines of known date of death have been provided by Walt Lysack of the Manitoba Department of Natural Resources. The spines are from Red River catfish, have been sectioned (24μ), mounted, and aged by Natural Resources personnel. The archaeological sample consists of spines which have been selected based on state of preservation and portion. Archaeological specimens are embedded in epoxy resin, sectioned using the Buehler Isomet saw, and subsequently polished. Sneed (1951) does not specify the width of his sections beyond "very thin," while Morey's (1983) sections varied between 200 and 400 microns and Brewer's (1987) were 500 microns. Neither Morey nor Brewer polished their sections. The archaeological specimens within this thesis are sectioned to approximately 50 microns and polished. This thickness produced the best visibility of the growth increments, while avoiding the possibility of removing the increments altogether through cutting too thin a section.

The viewing of the sections also varies from researcher to researcher. Sneed (1951) used reflected light and measured the growth rings with a micrometer; Morey (1983) viewed the sections with polarized transmitted light, also measured using a micrometer; while Brewer's sections were viewed through cross-polarized light, with

measurements taken from photographs of the sections. In viewing otolith annuli, Brothers (1987:324) suggests experimenting with various lighting methods, including reflected, transmitted, oblique, and polarized.

It must also be expected that some sections will be rejected due to irregular growth patterns. Morey (1983) found it necessary to reject 15-20% of his modern specimens, with a similar rate for archaeological specimens, due to the presence of "false annuli" and/or indistinct annuli. The knowledge of what specimens to read and which to reject appears to be a vital point.

Following Monks and Johnston (1993:27), a growth ratio based on a ratio of current year's growth to the last full year's growth will be produced for modern specimens. The growth ratio is then plotted against known date of death. Sample size determines the placement of the prediction band around the regression line (Monks and Johnston 1993:29), thus providing an estimation of the accuracy of the method. This is used to predict the date of death of archaeological samples, by determining the growth ratio, fitting this into the plot/regression line developed for the modern specimens, and estimating the season of death. The sample size of the archaeological sample determines the width of the prediction band and the accuracy of the estimate.

The selection of the area to section on pectoral spines has basically been determined by fisheries researchers, who require a complete record of growth encompassing the entire life of the fish. It may be possible to determine seasonality estimates using the last two or three years of growth, validating the potential use of distal portions of the pectoral spines. This would serve to substantially enlarge the sample size,

resulting in a greater accuracy of estimate. The possibility of this form of sample size enlargement should be considered in the future.

3.5.iv Epiphyseal Fusion

This technique is based on the knowledge of the ages at which bones fuse as well as the calendrical range of dates of birth for the relevant species. An examination of the fusion of bone epiphyses coupled with this knowledge provides a rough estimate of the season of death. The age at which fusion occurs varies between elements, between epiphyses of the same element, and among species. The ages at which epiphyses fuse are known for most large mammal species and are available in the literature. Nutritional state as well as castration can alter the ages at which bones fuse (Monks 1981:186).

This technique will be used for wild and domestic artiodactyl species within the samples, including *Ovis aries*, *Sus scrofa*, *Bos taurus*, *Bison bison*, *Alces alces*, *Cervus canadensis*, and *Odocoileus* sp.. Table 3.4 lists of potential resources of epiphyseal fusion schedules and tooth eruption sequences. The state of epiphyseal fusion is generally stated within the catalogue as unfused, partially fused, or fused. As an animal approaches osteological maturity, the utility of this technique declines.

3.5.v Tooth Eruption

The basis of this technique is similar to the foregoing. Tooth eruption schedules of most artiodactyls are known and accessible in the literature (Table 3.4). A knowledge of the age at which specific teeth erupt, coupled with a knowledge of the birthing period

Table 3.4 List of epiphyseal fusion and tooth eruption schedules

1. Silver (1969) - fusion and tooth eruption schedules for horse, ox, sheep, pig, and dog.

2. Grigson (1982) - fusion and tooth eruption schedules of cattle.

3. Bull and Payne (1982) - fusion and tooth eruption schedules of pig.

4. Andrews (1982) - tooth eruption schedules in young cattle.

5. Gilbert (1980) - fusion and tooth eruption schedules for deer, wapiti, and bison; tooth eruption schedules for moose.

6. Frison (1978, 1982), Frison and Reher (1970), Reher (1974), and Fuller (1959) - bison tooth eruption schedules.

7. Quimby and Gaab (1957) - tooth eruption schedule and wear for wapiti.

8. Hale (1949) and Lechleitner (1959) - epiphyseal fusion schedules for cottontail and jack rabbit.

of the animal, are combined to produce a seasonality estimate for the date of death of the individual in question.

Some variation in tooth eruption schedules may occur due to nutritional and health status of the animal (Monks 1981:187). It should also be noted that the birthing period for any species is generally an average, representing the birthing time of most individuals. Some aberrations will occur and a larger sample size is encouraged in order to ensure that the seasonality estimate is correct. A larger sample size will ensure that the chance of sampling an aberrant individual is balanced by the inclusion of the average individuals.

The sample size to which this technique is applied may also be small, given that a more or less complete tooth row is desirable, rather than the use of isolated teeth. This technique also becomes unusable as the individual ages and all teeth have erupted. The use of tooth wear as a method of ageing and seasonal indication is not being used, due to the potentially extreme variability due to diet, population differences, etc.

One potential source of confusion is the identification of *Bos taurus* versus *Bison bison* teeth. The eruption schedules are different for each taxon but the teeth themselves are difficult to identify beyond the "large bovid" category. Precontact samples (Archaic and Blackduck) are exclusively bison; Upper Fort Garry and Fort Garry samples are almost exclusively cow. The confusion exists within the Fort Gibraltar I sample. Based on proximity to *Bos* or *Bison* remains, tooth rows will be tentatively assigned to those taxa.

The examination of tooth eruption will be carried out on the large artiodactyls noted above, using published eruption schedules for each species (Table 3.4).

3.5.vi Conclusion

Methods of seasonality estimation using all three taxonomic classes in a number of ways should improve the validity of the overall estimate. A more balanced and complete perspective should be made possible through the application of a variety of techniques based on a number of different species. A determination of seasonality of catfish procurement, for instance, may have little relevance to the seasonality of bison procurement. Using a variety of methods should ensure a more accurate estimation of the season of occupation through a combination of seasonality estimates for the procurement of different taxa.

DOCUMENTARY METHODOLOGY

3.6 Integration of Archaeological, Ethnographic, and Documentary Databases

One aim of this thesis is to examine the patterns of faunal exploitation over time through the use of archaeological, ethnographic, and documentary databases. The archaeological database provides a discontinuous record over the entire three-thousand year time span. The ethnographic record provides a rough analogy for the Precontact period and the documentary database for the Postcontact period in order to produce more complete and accurate interpretations. Each of the three databases under consideration is biased in unique ways. The question of how to effectively integrate archaeological with ethnographic and documentary information has been the source of ongoing discussion within prehistoric and historic archaeology. This section of Chapter 3 deals

with how best to integrate these dissimilar databases, their nature and biases.

3.6.i The Ethnographic Database

Combining the ethnographic and Precontact period archaeological databases should enhance our understanding of the Precontact cultures and, possibly, of the ethnographic record itself. This combination should provide information on changes between the Precontact periods themselves, as well as providing a backdrop for the interpretation of the Postcontact remains. Lightfoot (1995:200) has pointed out that archaeology is "[i]deally suited for studying long-term change that transcends the boundary between prehistory and history, ...[and]...provides a common baseline for comparing the recent past to the deep past." Without a contextual "baseline" in the Precontact period, interpretations of change within the Postcontact period are likely to be flawed.

There are longstanding concerns, however, with the use of the ethnographic record as a source of analogy for the interpretation of the archaeological remains of past cultures. Lange (1980:134) defines analogy in a general sense as "interpreting nonobserved behavior through the medium of observed behavior that is considered comparable." The use of ethnographic analogy is one way in which archaeologists, faced with material culture remains, can attempt to reconstruct and interpret the behaviour of past peoples. The initial rejection of the use of ethnographic analogy stemmed from uncritical applications of the method by earlier (i.e. nineteenth century and prior) researchers, while more recent concerns have arisen from the philosophical perspective of the New Archaeology, as outlined by Wylie (1985).

Responses to the uncritical use of analogy have been provided by Ascher (1961) and Lange (1980), who stress the importance of ecological similarity between the archaeological and ethnographic cultures. Lange (1980:135) further suggests the use of the "diachronic approach" whereby "a historically known group from a cultural continuum is utilized to interpret earlier manifestations of that same culture." Ascher (1961:322-324) provides three "suggestions...to aid in placing analogy on a firmer foundation." These are the selection of a "best solution" from a finite range of possible analogs, the development of ethnoarchaeology, and the study of the transformation from the living culture to the archaeological record. Wylie (1985:80) proceeds from Ascher's first point and suggests that "archaeologists should give up the paralyzing demand for certainty and make fuller, more systematic use of the means available for assessing the relative strength and cogency of analogical arguments." Wylie (1985) points out that the investigation of the dissimilarities *as well as* the similarities between ethnographic and archaeological cultures provides more information than the similarities alone.

Binford (1977a; 1977b) suggests that archaeologists should not use ethnographic analogy merely to interpret "archaeologically observed phenomena", but rather use it as a way of encouraging and provoking new angles of investigation. Ethnographic analogy is thus applied deductively to provide basic subject matter which can be used to engender hypotheses to test but, whether the ethnographic and archaeological data sets agree or not, something has still been learned regarding the ranges of order in the archaeological data.

Hodder (1986) criticizes Binford's "objective" use of analogy, calling for an "inside, participatory ethnoarchaeology" (1986:104). He suggests that there can be no

"universal cultural relationship" due to the historical context of each situation. By removing cultural data from its historical context, the meaning is lost.

Beyond these theoretical concerns, the potential biases within the ethnographic record itself need to be considered. The documentary and ethnographic records are often perceived as being more complete than the archaeological record and are often accepted at face value as superior sources of information. The ethnographic (and ethnohistoric) records, however, should be viewed as documents, with a variety of inherent biases.

One of these is the purpose of the document, noted above in Ascher's second point. Ethnographic studies have not usually been carried out with the needs of archaeologists in mind. This has resulted in the extraction of information from a record which was not designed for archaeological interpretation. The development of ethnoarchaeology has, to a certain extent, solved this problem by producing ethnographic data tailored to respond to archaeological research concerns.

A second source of bias is the sociocultural "situation" of the researcher - a type of "observer bias." An ethnographer, or ethnohistorian, brings their own biases into the field as a part of how they define themselves. This may include concerns of gender, culture/ethnicity, etc. Peers (1988), for example, has critiqued Harold Hickerson's (1970) work on the Chippewa, *The Chippewa and Their Neighbours*, in light of a gender bias, pointing out that this bias has coloured both Hickerson's interpretation of the data as well as his selection of what data are considered "relevant."

A third source of potential bias relates to the timing of ethnographic or ethnohistorical studies. Ethnographic studies often tend to be short term, producing an

incomplete picture or one which is skewed by the season of the year or reactions to specific short term environmental conditions. In earlier studies in this region, it can be argued that Native groups were in a period of rapid change, considering the effects of acculturation, cultural breakdown, epidemic disease, and environmental degradation. Cleland (1992) has addressed this concern as it relates to the Ottawa and Ojibwa bands of the Northern Great Lakes. He argues (1992:97) that the "profound cultural changes" caused by European contact have been overstated, due to a theoretical overemphasis on the impact of technology. As a result of this assumed degree of change, "historical texts concerning such societies are assumed to have little relevance for the interpretation of archaeological data from prehistoric contexts." Cleland suggests, in contrast, that the Ottawa and Ojibwa had "not undergone substantive culture change by the end of the first third of the 19th century," and that studies of 19th-century Ojibwa/Ottawa could be safely used to interpret Precontact Woodland cultures. This argument appears to be based on unsubstantiated assumptions itself, however, suggesting a reconsideration of his argument.

Cleland's argument does, however, serve to indicate another source of bias: that of theoretical perspective. Cleland has pointed out that the theoretical stance of the primacy of technology has skewed interpretation of the data. Hamilton (1985) provides a second example, critiquing Hickerson's Chippewa study for its functionalist perspective, with an extreme emphasis on environmental variables. Theoretical perspectives may not only colour one's interpretations, but also blind the researcher to potentially relevant data.

Wobst (1978) also deals with some of these problems, criticizing the tendency for archaeologists to use ethnographic data without question. In so doing, "there is a great

danger that they merely reproduce the form and structure of ethnographically perceived reality in the archaeological record" (1978:303), thus creating a circular, self-fulfilling argument.

This brief discussion of the potential pitfalls of the use of ethnographic analogy as well as the integrity of the ethnographic and ethnohistorical record serves to introduce the ethnographic studies which have been used in this thesis, as well as the criteria of their selection. Table 3.5 provides a listing of the studies used.

Lange's (1980:135) suggestion that a "historically known group" be selected to interpret "earlier manifestations of that same culture" is an ideal which can seldom be met. This ideal situation is not possible in this area due to the current impossibility of assigning modern cultural identities to past archaeological cultures as well as the use of one ecotone (i.e. the parkland) by multiple cultural groups as part of differing seasonal rounds. Selected ethnographies, therefore, are of those cultures known to have used this area within the historical period, including cultures with distinctly different subsistence patterns. In other words, "Plains adapted" and "Woodland adapted" cultures are both considered, including the Ojibwa, Saulteaux, Assiniboine, and Plains Cree. While these cultures may not have occupied the area into the remote past, similar adaptations may have existed, thus fulfilling Ascher's (1961:319) requirement of using analogies "in cultures which manipulate similar environments in similar ways." The relative stability of the environment over the period of study, as presented in Chapter 2, suggests that not only are similar environments manipulated, but the *same* environment is manipulated.

The incorporation of the ethnographic database should provide information

Table 3.5 List of ethnographic/ethnohistoric sources

TITLE	AUTHOR
The Plains Ojibwa or Bungi	James H. Howard
The Ojibwa of Western Canada, 1780-1870	Laura Peers
Notes on the Eastern Cree and Northern Saulteaux	Alanson Skinner
The Plains Cree	David G. Mandelbaum
The Fort Belknap Assiniboine of Montana	David Rodnick
The Dakota or Sioux in Minnesota As They Were in 1834	Samuel Pond
The Assiniboine	Robert H. Lowie
The Canadian Dakota	Wilson D. Wallis

regarding social organization concerned with faunal exploitation, as well as a separate line of evidence for the reconstruction of faunal exploitation patterns to be compared with that drawn from the archaeological evidence. Given the inclusion of supposedly "Plains adapted" Precontact groups in the Archaic and Woodland/Parkland adapted groups in the Blackduck period, perhaps the by-play of ethnographic and archaeological evidence can provide some clue as to the potential adaptation of the archaeological groups. Were they Plains adapted people using fish occasionally, or Woodland adapted groups using traditional fish resources in the Parkland, or members of a group with a specifically Parkland adapted subsistence pattern?

3.6.ii The Documentary Database

The historic documentary record is coupled with the Postcontact/Fur Trade archaeological record as the ethnographic record is with the Precontact. The successful integration of documentary and archaeological records has been the subject of ongoing debate within historical archaeology over the last thirty years. The documentary record is often considered to be more complete than the archaeological record, rather than viewed as a source of information that is, itself, incomplete and biased.

The discussion of data integration originated with the ambivalence regarding the role of historical archaeology - "handmaiden to history," based in anthropology, or a separate discipline of its own (Schuyler 1978; *Historical Archaeology* 22). More recently, the debate has also been concerned with the development of a unique historical archaeological methodology. Discussions in the literature abound with criticisms of past,

ineffective uses and the lack of a productive integration of records. Hamilton (1990-91:4), concerned with the uncritical use of documents, states that "we have considerable ill-founded faith in the accuracy, completeness and reliability of documents." Beaudry's (1988:1) criticisms of past usages stem from the fact that historical archaeologists answer questions of "little interest," focusing instead on the concerns of prehistorians or cross-checking documentary and archaeological records. Deagan (1988:8) laments that "historical archaeology has failed for the most part to effectively integrate independent documentary and archaeological data to produce otherwise unobtainable results," focusing instead on the use of the two records to either "reinforce or refute the conclusions arrived at through the other source."

This wealth of criticism has also produced suggestions as to how to rectify the situation. The call for a unique historical archaeological methodology is consistently a call for a more complete and effective use of all sources available, particularly historical documents. Two approaches are of interest here, one which considers documentary and archaeological records as complementary data sets, and one in which they are independent and, potentially, contradictory. As Little (1992:4) writes, "[o]ddly enough, both of these views are viable."

The former approach recognizes that each record has its own strengths and weaknesses, focusing on different areas of past culture. Using both records, simultaneously focused on one area of research, a more complete perspective on the past can be attained. Each record provides certain types of information relating to the subject under concern, each "fills in the gaps" of the other.

The latter approach is based in Binford's (1987) middle-range theory as applied to the isolation of ambiguity in the comparison of the ethnographic and archaeological records, each viewed independently. Binford plays the two independent sources off against one another, discovering the areas where they do not agree. This lack of agreement he terms "ambiguity" and rather than viewing this as a failure of the study or explaining it away, Binford (1987:465) instead focuses on this ambiguity, stating that "through the recognition of ambiguity ...we identify problem areas in our alleged knowledge and, hence, areas in need of investigation."

Leone and Crosby (1987) and Leone and Potter (1988) have adapted this approach to historical archaeology. The archaeological record is set against the documentary record "in order to tease new meaning from each" (Potter 1992:9). Leone and Crosby (1987:399) emphasize that the "two sources of data ... are generated by two very different sets of formation processes and dynamics, and therefore two very different sorts of facts are generated," reinforcing the concept of independence. Leone and Potter (1988:14) also point out that the two records "were usually produced in different contexts, by people who usually had no direct connections with one another; those who created the documentary record were only infrequently the people who made, used, and discarded the material culture we recover archaeologically." The two independent sources are thus played off against each other, the researcher identifying where the sources agree and where they do not. The "ambiguity" identifies potentially fruitful areas of future research, with "the result of understanding ... the illumination of both records, not just the archaeology" (Leone and Potter 1988:18).

Hamilton (1990-91) has applied this approach to subsistence data from the Fur Trade period in western Canada. Two data sources are played off against one another, potentially leading to "new interpretations of meaning...and the identification of research problems not explicitly visible in either independent data set." This enables Hamilton to access information regarding a social group which cannot be accessed using either data source alone, namely the Native women involved in fur trade subsistence within the forts.

The documentary record also contains its own set of biases which must be considered prior to application. As Wood (1990:83) points out, "only a small part of what takes place is observed; much less is recorded; and what has survived is surely not always the most important...." Many of the biases are similar to those of the ethnographic record, such as the sociocultural perspective of the recorder, the time period involved, and the purpose of the documents. Hamilton (1990-1991:4) provides a brief summary of the biases inherent in Fur Trade documents. He notes that most of these documents were written by men of high rank and status, are business-oriented, with a strong "ego orientation," concerned with extraordinary events rather than the day-to-day, with little note of lower status members of the community (i.e. women, labourers), and tended to gloss over failure. These biases have resulted in the documentary "invisibility" of large numbers and classes of people, particularly women and low-status ethnic groups. The potential lack of understanding of these male writers for other cultural groups, other genders, and the environment itself should also be considered when attempting to use these documents.

Table 3.6 lists the documentary evidence used within this thesis, including both

Table 3.6 List of historic documentary sources

TITLE	AUTHOR
The Falcon: a Narrative of the Captivity & Adventures of John Tanner	John Tanner
The Journal of Alexander Henry the Younger 1799-1814	Alexander Henry
Red River Daily Journal 1814/1815 (HBC B235/a/3)	Peter Fidler
Forks Journal Book 1820-1821 (HBC B235/a/4)	Thos. Williams
Journal of Occurrences at Fort Garry 1822-1823 (HBC B235/a/5)	J. Hargrave
Fort Garry Journal 1824/25 (HBC B235/a/6)	J. Hargrave ?
The Hargrave Correspondence 1821-1843	various
The Substance of a Journal during a Residence at the Red River Colony	John West
Extracts from Mr Black's private journal, Outfit 1851	Mr. Black
Upper Fort Garry Journal 1852/53	A.W. Buchanan
Narrative of the Canadian Red River Exploring Expedition of 1857 and of the Assiniboine and Saskatchewan Exploring Expedition of 1858	Henry Youle Hind
Fort Garry Journal 1858/59	anon.
Wanderings of an Artist among the Indians of North America	Paul Kane
The Red River Settlement: Its Rise, Progress, and Present State	Alexander Ross
The Nor'Wester	various 1859-1861

published and unpublished texts. Texts have been selected which concerned the immediate area under study (the Forks and the Red River), the general region (encompassing Plains, Parkland, and Woodland areas), or similar areas slightly further afield (the Great Lakes region, for instance). Several other texts were rejected due to their general lack of detail regarding faunal exploitation. The texts listed should provide the basis for some understanding of all three Fur Trade periods dealt with in this thesis.

3.6.iii Approach to Integration of Different Data Sets

The approach taken here to the integration of the three data sets (archaeological, ethnographic, and documentary) is, to a certain extent, a combination of those perspectives discussed above. Given the biases of each of the data sets, it is imperative that each be used effectively against the others. It makes sense to use these databases in complementary fashion, using each to "fill the gaps" of the other. Ethnographic and documentary records, for instance, can provide information regarding social organization, while archaeology is useful for accessing information regarding the less well documented groups. Additionally, Leone's approach of playing each record off against the other produces an understanding of the limitations of each record and future directions for research.

Lightfoot (1995:205) supports this type of "comparative approach," in which "independently constituted lines of evidence drawn from archaeology, ethnohistory, ethnography, and linguistics may be employed to evaluate interpretations generated from particular historical contexts. The convergence of these different lines of evidence may

either strongly support, refute, or modify one's proposed interpretations." Lightfoot proposes a more integrated approach to prehistory and history in order to study long-term change, stating (1995:208) that "[d]irect comparisons of archaeological remains recovered from different aged contexts are critical to evaluate the full effects of culture change over time." The documentary records serve the historical archaeologist in a similar way as ethnography serves the prehistoric archaeologist, with the division between history and archaeology, or even historical archaeology and prehistoric archaeology, producing artificial and potentially limiting barriers.

In this thesis, then, ethnographic and documentary data will 1) provide information inaccessible to the archaeological record (e.g. social data); and, 2) provide independent lines of evidence which can be played off against the archaeological evidence in order to view the "fits" as well as the "ambiguities."

CHAPTER 4:RESULTS OF FAUNAL ANALYSIS

4.1 Taxonomic Quantification

The examination of taxonomic frequencies was carried out at two taxonomic levels: class and family/subfamily. The class level was examined in order to provide a general picture of the composition of the samples, supplying information regarding the exploitation of different animal classes and potentially biasing taphonomic effects.

The family level has been selected in order to include the majority of the identified specimens. It is often difficult to distinguish between genera within a family for certain taxa, while the identification to the family level is more easily accomplished and more analytically robust. Given the use of samples with different curatorial and analytical histories, the family level was considered preferable. Subfamilies have been used within the waterfowl family (Anatidae). Proceeding to a more specific level (genus/species) would result in the rejection of large numbers of important taxa (e.g. ducks) from consideration, while proceeding at the order level (e.g. ducks/swans/geese) would provide little information regarding differential exploitation or taphonomy.

The NISP counts of the five samples were calculated using the raw data available (Appendix I). Eggshell, scales, and small mammal remains were excluded from the analysis. The inclusion of eggshell and scales biases the distributions, while the small mammal remains are considered to be of non-cultural origin. Sturgeon (*Acipenser fulvescens*) scutes have been retained due to the primarily cartilaginous nature of the sturgeon skeleton which results in an underestimation of sturgeon in the samples. The removal of the scutes would almost entirely remove the presence of the sturgeon from the

samples.

A brief summary of the statistical tests used within this thesis is provided below. Class frequencies are then presented, followed by bird, fish, and mammal families. This section is closed by a summary, providing the basic interpretations that are possible at this level.

Summary of Statistical Tests Used

A number of statistical tests are used in this chapter to examine the patterning of taxonomic and element frequencies. The tests used include Spearman's rho (or rank order correlation coefficient), the Kolmogorov-Smirnov test (or K-S test), and the chi-square test. These are described briefly below, followed by a discussion of the selection of a level of significance.

The data are considered to be ordinal level only (Grayson 1984), which permits the ranking of observations by magnitude. The nature of the data limits the range of statistical tests which can be applied.

Spearman's Rank Order Correlation Coefficient

Spearman's rank order correlation coefficient, also called Spearman's rho and designated by $"r_s"$, is used to measure the strength of the relationship between two ordinal level variables. The statistic compares the similarity between two sets of ordinal ranks. The r_s value can range from -1.0 to +1.0, from a perfect negative correlation to a perfect positive correlation. The null hypothesis (H_0) states that there is no relationship between

the two variables, while H_i asserts that there is a relationship between the two variables.

In this thesis, r_s is used to examine the potential correlation between frequencies and sample size and to compare the similarity between the rankings of taxonomic frequencies and relative element frequencies (following Grayson 1984). A correlation between sample size and relative frequencies must be recognized in order to avoid a situation of interpreting variation in sample size rather than variation in relative frequencies. The test for correlation between sample size and frequencies must first be carried out in order to proceed with a meaningful analysis. For small sample sizes, a table of probability values was used (Drennan 1996:232). This table is for one-tailed tests only, in which the direction of association is clearly specified (Thomas 1976:401).

Kolmogorov-Smirnov Test

The use of this test follows Grayson (1984) and compares the form of species abundance distributions. The two-sided K-S test "compares the cumulative distribution functions of two samples, and provides a test of the null hypothesis that those functions do not differ significantly" (Grayson 1984:154-155). In this thesis, following Grayson (1984), the structure of the relative abundances are compared between samples. The test does not consider the specific taxa involved, nor their actual frequencies, but compares the "underlying structure" of the distributions.

Chi-Square Test

The chi-square test is used to examine the independence of two variables. The

null hypothesis states that the variables are independent and, therefore, that the distributions are randomly associated. The alternate hypothesis is, then, that there is an association between the variables. The chi-square statistic tests "whether the observed departure from expectation is more than random chance would suggest" (Thomas 1976:284). In this thesis, the chi-square test is applied to frequencies between samples and between "normal" samples and archaeological samples in order to determine whether or not the differences in proportions between the samples could have occurred through sampling alone. As Grayson (1984:153) phrases this, the "analysis shows that [the] assemblages are not homogeneous as regards the abundances of their component taxa." Yates' correction for continuity was performed for tables which contained more than two E_i values less than 5 (Thomas 1986:280-281).

Level of Statistical Significance

The level of statistical significance used in this chapter has been selected at $p=0.05$. This criterion means that there is only a 5% probability (or 1 chance in 20) that a Type I error will occur or, in other words, that a true null hypothesis will be incorrectly rejected. The selection of this level is based partially on the "traditional" use of this level and also because it seems to be a reasonable probability. The small size of n in a number of the tests in this chapter often means that the area of rejection of the null hypothesis is often quite small and that results must be extreme in order to be considered significant. In these cases, the small size of n is noted as a potential problem and those values which approach the critical value are also noted. In the presentation of the results

of the tests, the values regarded as significant at p=0.05 are identified using an asterisk.

4.1.i Class Frequencies

Class frequencies for the five samples are presented in Table 4.1. Spearman's rho was used to test for correlation between sample size and class frequency for each of the samples (following Grayson 1984). Interpretations based on taxonomic abundance are suspect if there is a significant correlation between total sample size and taxonomic frequency. A significant correlation would suggest that class frequencies could be predicted by sample size and, therefore, that variability in sample size is affecting the variability in taxonomic frequency. The total faunal sample sizes of each sample were ranked and compared to the ranking of each class frequency for each sample, using Spearman's rank order correlation coefficient (r_s). At p=0.05, n=5, the critical value of r_s is 0.9. Values $\geq$ 0.9 are considered significant and indicate that there is a significant correlation between the two variables. Resultant r_s values are as follows: bird frequency/sample size (-0.2); fish frequency/sample size (+0.7); mammal frequency/sample size (+0.9).

Table 4.1 Class frequencies by sample

Sample	Aves	Fish	Mammal	Total
Archaic	4	103,615	5476	109,095
Blackduck	45	4331	3849	8225
Fort Gibraltar I	437	3999	13,195	17,631
Fort Garry	1060	2529	5270	8859
Upper Fort Garry	398	1662	1402	3462

Neither the weak negative correlation between bird frequency and sample size nor the moderate positive correlation between fish frequency and sample size are significant at the $p=0.05$ level. The strong positive correlation between mammal frequencies and sample size is significant at $p=0.05$. Grayson (1984:121) suggests that such correlations may be due to the inclusion of small sample sizes. The correlation coefficient calculation was repeated, excluding the smallest sample (Upper Fort Garry) and the r_s value dropped to $+0.8$, which is not a significant correlation. Ideally, the Upper Fort Garry sample would be dropped from subsequent examination at the class level or the sample size expanded through additional excavation. Neither of these options are possible within the current analysis. The results, however, should be kept in mind during the analysis. The correlation between mammal frequency and total sample size also suggests that in some samples the increase in sample size is caused by the increase in mammalian frequency because these samples are dominated by mammalian taxa. Additionally, when n is small, the correlation must be very strong in order for it to be significant. In this case, the correlation between fish frequency and sample size should also be considered.

The inclusion of fish scales within the Spearman's rho calculation between fish sample size and overall sample size increases the value of r_s to $+0.9$, which is significant at $p=0.05$. This suggests that the increase in both fish sample size and faunal sample size are tied to the increase in the scale count. This argues for the rejection of scales within NISP counts for the remainder of the analysis. The inclusion of eggshell, however, does not affect the relative ranks of the avian samples.

The general lack of significant correlation between class frequency and total

sample size, excepting the mammalian frequencies, allows the analysis to proceed. The NISP counts for each class, per sample, are presented in Figure 4.1 and corresponding percentages are presented in Figure 4.2. It is evident that the Archaic sample contains a preponderance of fish bone, with a small amount of mammal bone and a negligible amount of bird bone. The Fort Gibraltar I sample contains a majority of mammal bone, with little bird and a median amount of fish. All samples contain relatively little bird bone, with extremely low representation in the Archaic and Fort Gibraltar samples. The extremely high NISP value of the Archaic fish sample tends to depress the other values within the graph and obscures other patterns.

The chi-square test was used to test for the homogeneity in abundances of the classes (following Grayson 1984). The test was carried out using the class NISP counts and paired samples (e.g. Archaic: Blackduck, Archaic: Fort Gibraltar I). All of the paired tests produced highly significant chi-square values ($p < 0.01$), indicating that the differences in class proportions cannot be due to chance alone and that the samples are not homogeneous in terms of class frequencies. The variability in class frequencies between the samples cannot be due to sampling error and indicates "real" differences between the samples.

The samples were viewed as percentage NISP values in order to examine their changing class composition (Table 4.2). Spearman's rho was used to test for correlation between percent representation within the sample for each class, repeating the initial test using percentages rather than raw counts. The null hypothesis states that there is no correlation between class percentage frequencies and overall sample size. Any values

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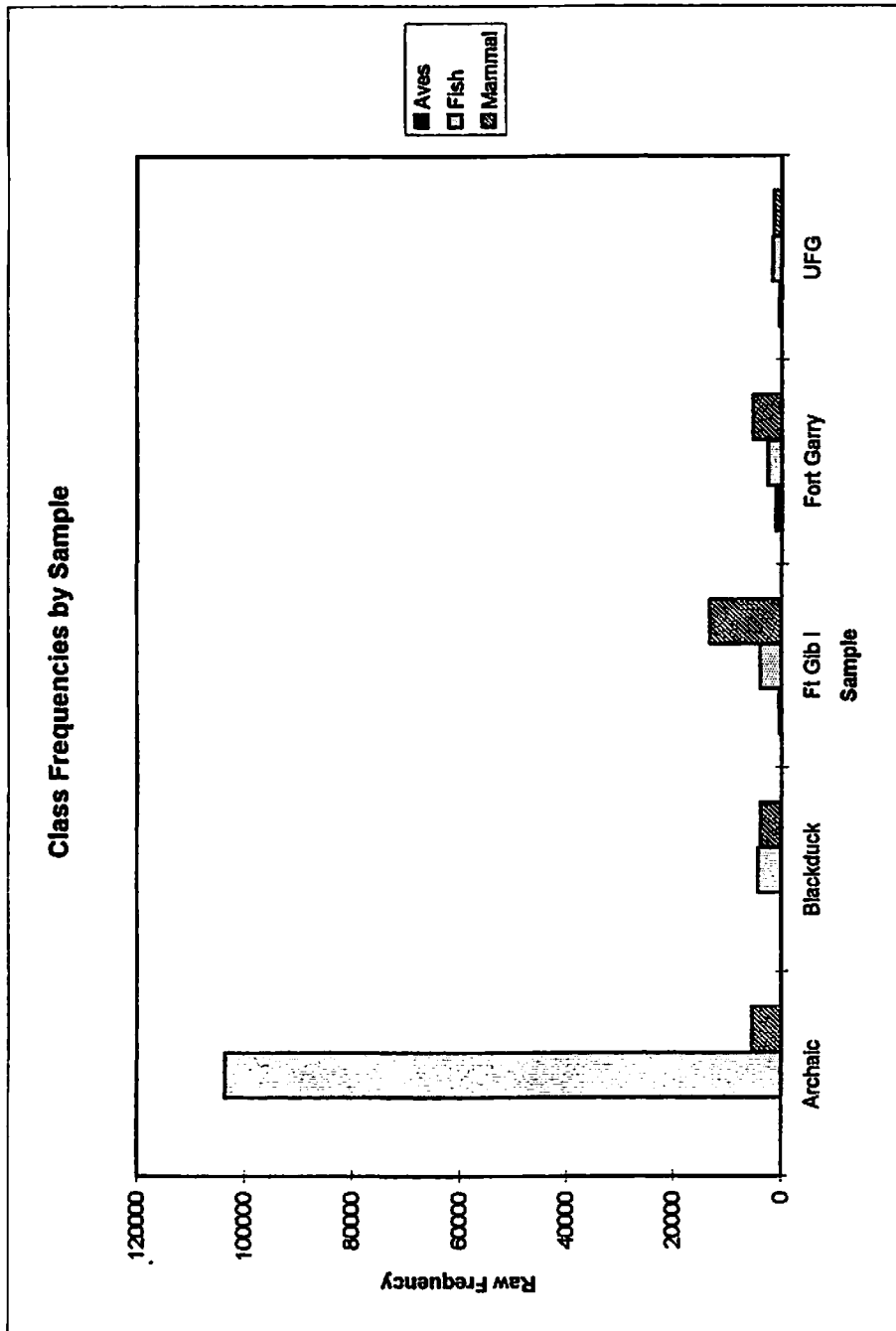
Figure 4.1 Histogram of class frequencies (NISP) by sample
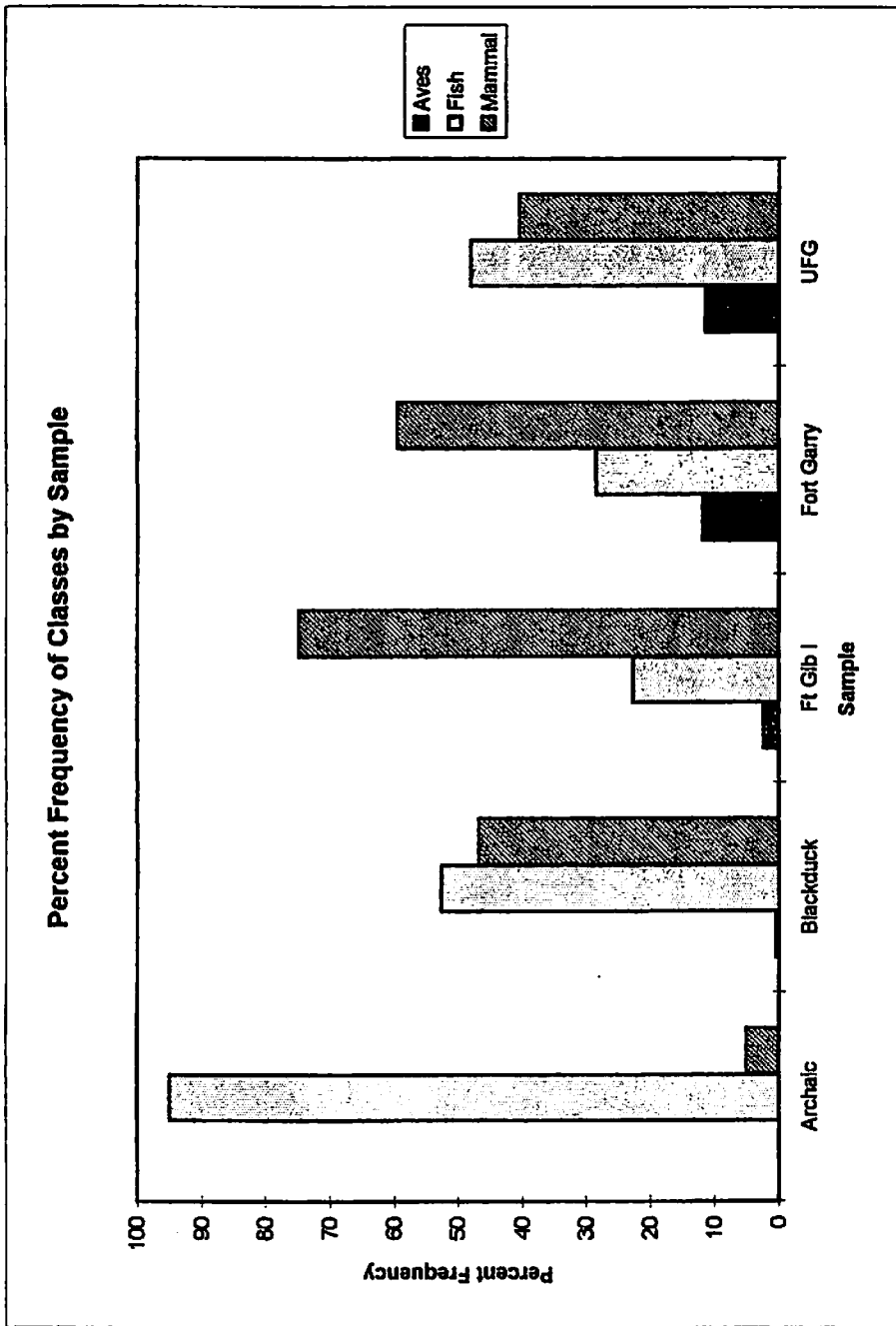
Figure 4.2 Histogram of class frequencies (% NISP) by sample

equal to, or greater than, the critical value (0.8) causes a rejection of the null hypothesis.
The results were as follows: % bird/sample size (-0.5); %fish/sample size (+0.1);
%mammal/sample size (0.00). None of the r_s values are significant at p=0.05 and all
of the correlations appear to be weak. This suggests that the percentage representation
of each class within each sample is not strongly correlated with overall sample size and
variability within them can thus be interpreted confidently.

Table 4.2 Percent class frequencies by sample

Sample	Aves	Fish	Mammal	Total
Archaic	0	94.98	5.02	100
Blackduck	0.55	52.66	46.8	100.01
Fort Gibraltar I	2.48	22.68	74.84	100
Fort Garry	11.97	28.55	59.49	100.01
Upper Fort Garry	11.5	48.01	40.5	100.01

The percent NISP values are presented in Figure 4.2. Some of the constituents
of the samples, obscured to a certain extent in Figure 4.1 by the extremely large Archaic
fish NISP values, are visible in this histogram. In Figure 4.2, the following patterns can
be observed: an extreme representation of fish within the Archaic sample; a low but
consistent presence of avian bone, increasing within the Postcontact period samples; an
overt similarity in patterning between the Blackduck and Upper Fort Garry samples and
between the Fort Gibraltar I and Fort Garry samples.

Following Tipper (1979) and Grayson (1984), the two-sided Kolmogorov-Smirnov test was applied to the varying combinations of samples, in an attempt to discern further patterning of the samples. This test compares the cumulative distribution functions of two samples, but not the frequencies of specific classes. The null hypothesis is that the cumulative distribution functions do not differ significantly. The selected significance value is again 0.05 (1 chance in 20) and, with $n=6$, the critical value for the K-S test statistic is 0.519 (Conover 1980:462). The results are presented in Table 4.3.

Table 4.3 Results of the K-S test on class frequencies

	Blackduck	Fort Gibraltar I	Fort Garry	Upper Fort Garry
Archaic	0.67*	0.34	0.67*	0.67*
Blackduck	----	0.34	0.34	0.67*
Fort Gibraltar I	----	----	0.34	0.67*
Fort Garry	----	----	----	0.67*

The calculated value 0.67 is greater than the critical value and indicates that the difference in cumulative distribution functions is significant for the Archaic:Blackduck, Archaic:Fort Garry and all combinations with Upper Fort Garry. The results of the K-S test support the intuitive reading of Figure 4.2, which shows two basic patterns of class distribution. The first pattern is the extreme representation of one class and is evident in the Archaic and Fort Gibraltar I samples. The second pattern is a more balanced representation of the three classes, evident in the Upper Fort Garry sample. The first

pattern appears to indicate a heavy reliance on, or intensive exploitation of, one class - fish in the Archaic sample and mammals in the Fort Gibraltar I sample. The more even class representation of the Upper Fort Garry sample suggests a diversified economy with no heavy reliance on one class. Seasonality may also play a role, as the Archaic and Fort Gibraltar I samples may indicate a particular seasonal exploitation, while the Upper Fort Garry indicates a more even class representation due to a year-round occupation.

The same data were examined excluding the domesticated species (*Gallus gallus domesticus*, *Meleagris gallopavo*, *Bos taurus*, *Ovis/Capra*, *Sus scrofa*, and *Equus caballus*). The raw NISP counts and percentages were graphed per sample (Figures 4.3 and 4.4). The Archaic and Blackduck samples are, of course, unchanged. The Fort Gibraltar I sample is also relatively unchanged due to the minor representation of domesticates. The Fort Garry and Upper Fort Garry samples present a slightly more even class representation but they, too, are relatively unchanged. Viewing the data as percentage frequencies (Figure 4.4), the similarities in class representation between Blackduck and Upper Fort Garry samples on the one hand and Fort Gibraltar I and Fort Garry samples on the other are even more evident. The K-S test, however, is not affected by the removal of the domesticates. The variability in arrangement of the class distributions across the samples may be due to differences between specific, scheduled activity occupations (e.g. Archaic fishing, Fort Gibraltar I bison procurement) and more generalized subsistence within the other three samples. It may, alternatively, indicate differences in fragmentation between the classes of the various samples. The overwhelming amount of fish within the Archaic may be due to numbers of vertebrae,

Class frequencies by sample size, using raw NISP and exluding domesticates
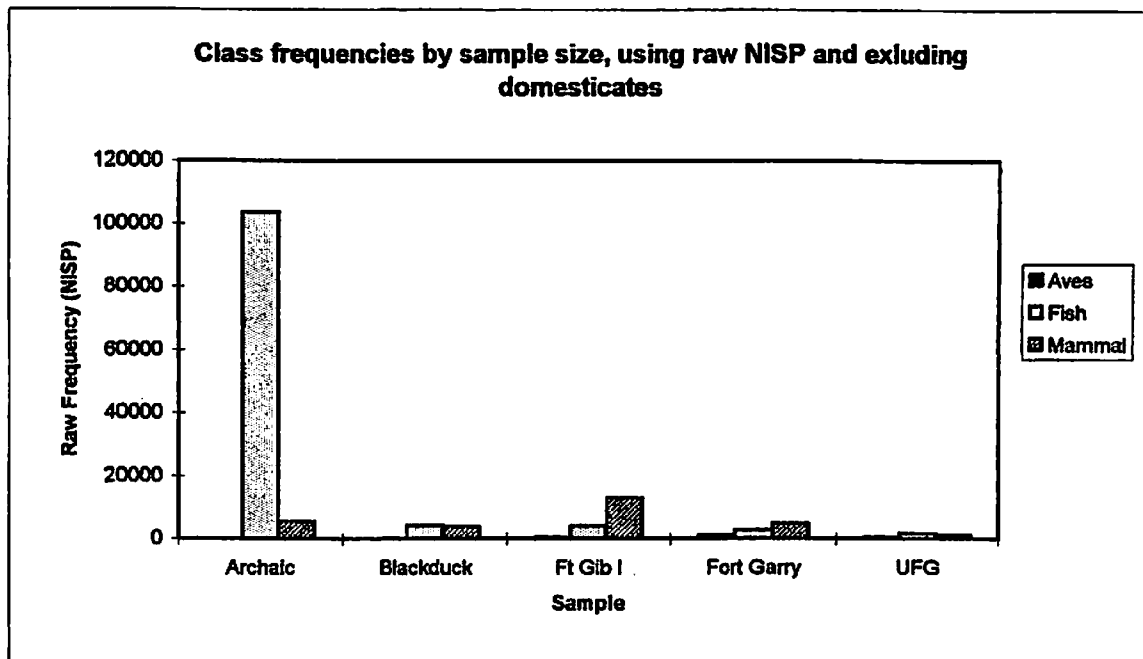
Figure 4.3 Histogram of class frequencies (NISP) per sample, excluding domesticates

Class Frequency by Sample
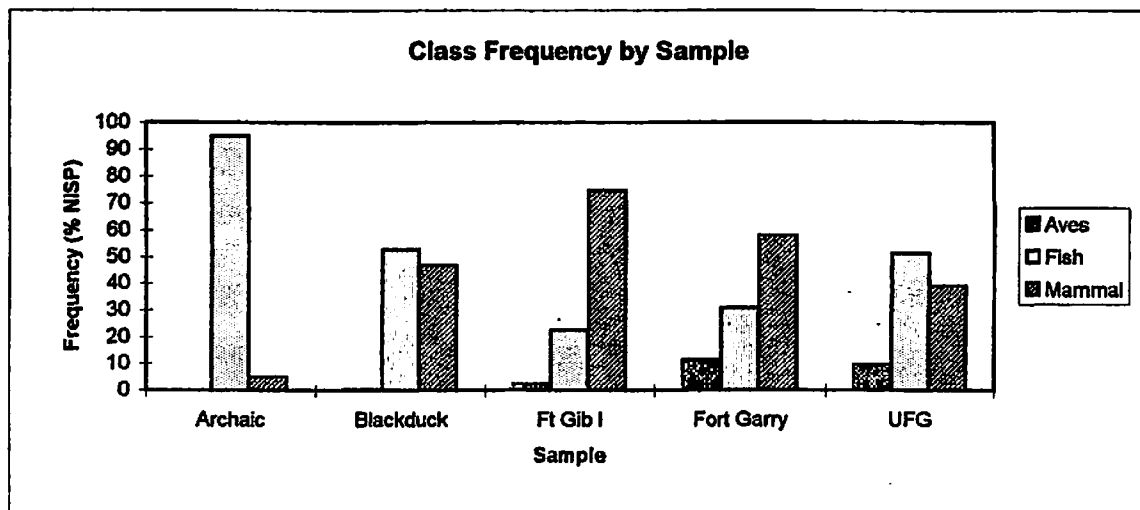
Figure 4.4 Histogram of class frequencies (% NISP) by sample, excluding domesticates

ribs, rays, and spines, while the exaggeration within the Fort Gibraltar sample may be due to processing of bison for bone grease. Such speculative interpretations may become clearer with the examination of relative frequencies of elements.

4.1.ii Avian Family Frequencies

As noted above, the family level of taxonomic classification was selected for further analysis. This serves to include various important taxa (primarily waterfowl) which are difficult to distinguish confidently at more specific levels of classification. Conversely, however, it does result in the rejection of some of the data provided. The Archaic sample, for instance, contains only five fragments assigned to bird, including one fragment of eggshell and four specimens identified only to the order level (Passeriformes). The exclusion of these data is not viewed as particularly problematic, as Passeriformes (perching birds) are often categorically considered to be of non-cultural origin and the numbers are also very low. The majority of the data rejected by use of the family level are represented by only one or two specimens in a single sample, while the remainder are representatives of families already considered at the family level (e.g. Anseriformes).

Subfamilies have been used within the waterfowl order (Anseriformes), rather than the general family level (Anatidae). Ducks have been grouped as Anatinae/Aythyinae due to the problem of distinguishing one subfamily from another.

The raw data for the bird assemblages are presented in Table 1, Appendix I, while the data used for the remainder of this analysis are presented in Table 4.4. Table 4.5

Table 4.4 Avian family frequencies by sample

	Blackduck	Fort Gibraltar I	Fort Garry	Upper Fort Garry
Cygninae	0	13	13	1
Anserinae	0	8	32	14
Anatinae/Aythyinae	8	15	209	32
Merginae	0	2	0	0
Accipitridae	1	0	1	0
Phasianidae	0	0	112	123
Meleagrididae	0	0	9	1
Tetraonidae	0	0	1	0
Gruidae	0	0	0	4
Scolopacidae	0	0	0	10
Columbidae	7	0	82	11
Corvidae	0	0	0	33
Totals	16	38	459	229

Table 4.5 Percent avian family frequencies by sample

	Blackduck	Fort Gibraltar I	Fort Garry	Upper Fort Garry
Cygninae	0	34.21	2.83	0.44
Anserinae	0	21.05	6.97	6.11
Anatinae/Aythyinae	50	39.47	45.53	13.97
Merginae	0	5.26	0	0
Accipitridae	6.25	0	0.22	0
Phasianidae	0	0	24.4	53.71
Meleagrididae	0	0	1.96	0.44
Tetraonidae	0	0	0.22	0
Gruidae	0	0	0	1.75
Scolopacidae	0	0	0	4.37
Columbidae	43.75	0	17.86	4.8
Corvidae	0	0	0	14.41
Totals	100	99.99	99.99	100

presents the family frequency data as percentages of the total avian specimens identified to the class level. These data are presented graphically in Figures 4.5 and 4.6. A number of observations result from these graphs: 1) the consistent, and generally primary, presence of ducks (Anatinae/Aythyinae) within all remaining samples; 2) the almost consistent presence of Columbidae, which implies the extinct passenger pigeon (*Ectopistes migratorius*); 3) the increase in the number of families represented ("taxonomic richness"), particularly within the two later Postcontact assemblages; 4) the expected increase in Phasianidae within the latter two Postcontact assemblages, indicating the presence of domestic chicken, *Gallus gallus domesticus*.

The number of taxa within an assemblage can be termed the taxonomic richness of the assemblage and provides indications of environment, catchment area, and exploitation (Grayson 1984:131-132). Following Grayson (1984), a Spearman's rho calculation was carried out in order to identify any correlation between the number of families represented within each sample and the NISP count of birds identified to the family level. Spearman's rho was used to measure the strength of relationship, or correlation, between avian taxonomic richness and avian sample size. This is done in order to ensure that any further interpretations regarding avian taxonomic richness are, indeed, interpreting richness and not merely sample size. The critical value for rejection of the null hypothesis is 1.00 ($n=4$; $p=0.05$). The resultant r_s value, $+0.8$, indicates a positive correlation but is not considered significant, so the null hypothesis of no correlation cannot be rejected. The strength of the correlation should, however, be noted as well as the problems inherent in the use of small n values, which tend to decrease the
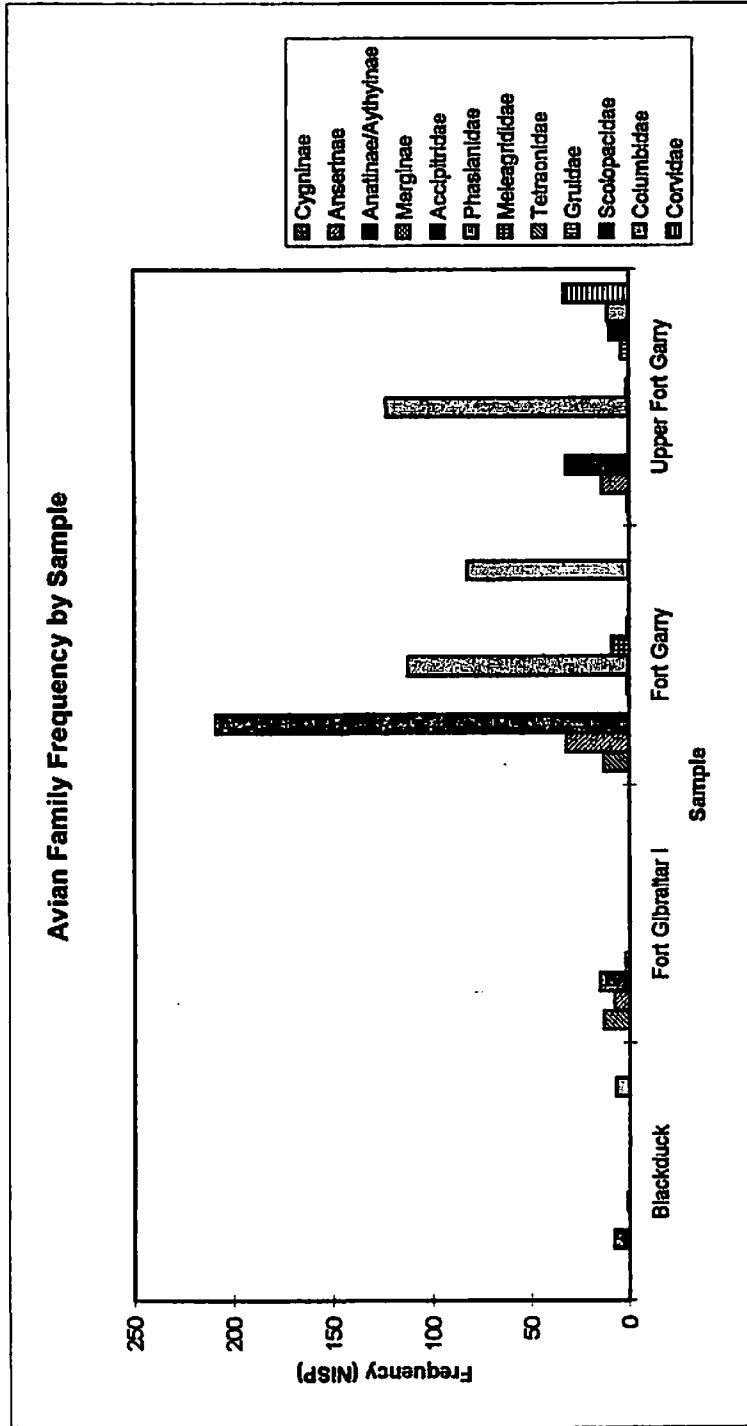
Figure 4.5 Histogram of avian family frequency (NISP) by sample
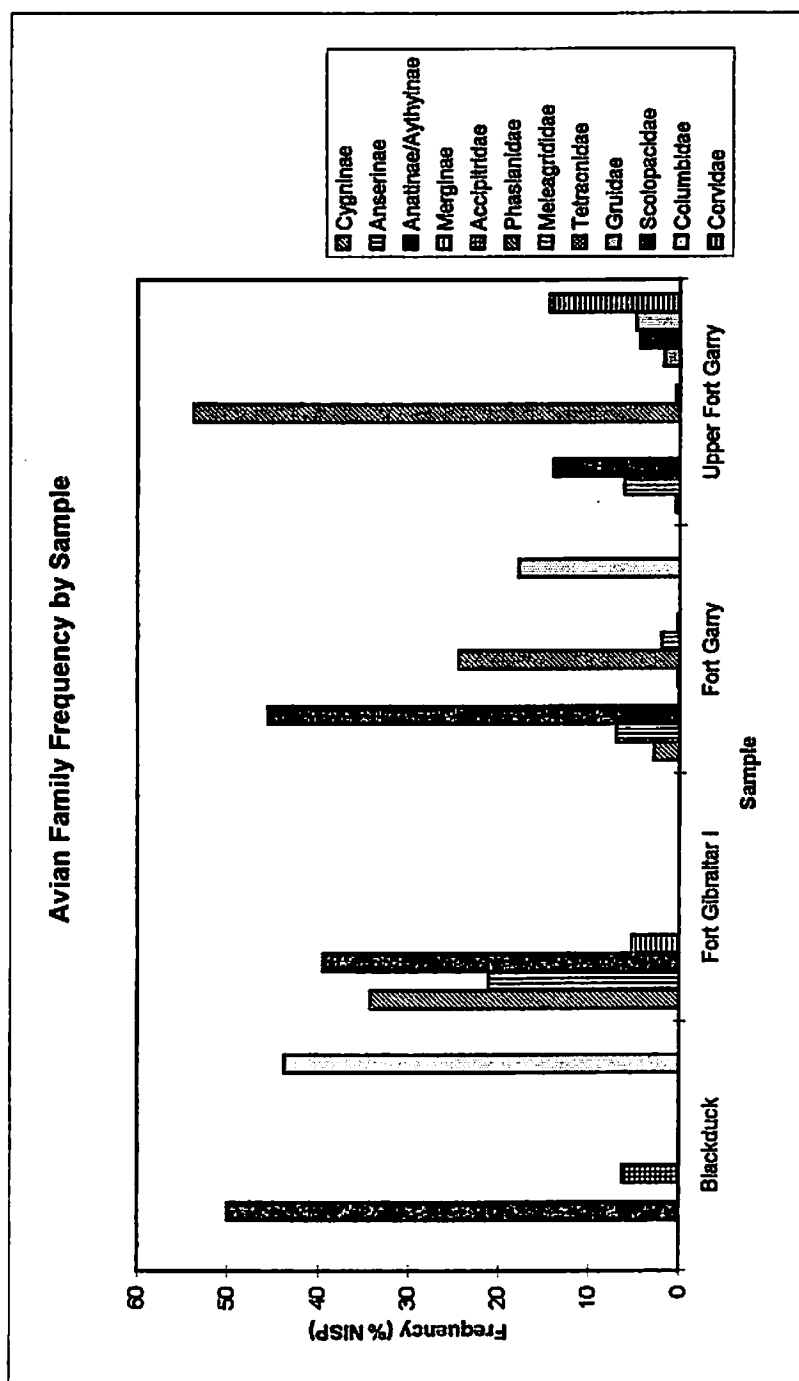
Figure 4.6 Histogram of avian family frequency (% NISP) by sample

likelihood of significance.

This increase in taxonomic richness does, however, appear to be real. Part of the increase can be attributed to the addition of two domesticated families (Phasianidae and Meleagrididae), as well as to the presence, in the Upper Fort Garry sample, of three families which are not typically associated with subsistence (Gruidae, Scolopacidae, Corvidae). The increase in richness may be partially due to the introduction of new technology (i.e. firearms) which facilitates the hunting of birds. The examination of relative element frequencies and the documentary record may aid in understanding the increase in richness during the Postcontact period.

The Kolmogorov-Smirnov test was calculated using the avian family frequency data (Table 4.4), with each sample compared to the others. The results of this test are presented in Table 4.6

Table 4.6 Results of the K-S test on avian family frequencies

	Fort Gibraltar I	Fort Garry	Upper Fort Garry
Blackduck	0.17	0.5*	0.5*
Fort Gibraltar I	----	0.34	0.42
Fort Garry	----	----	0.17

Those results considered significant ($n=12$; $p=0.05$) indicate a rejection of the null hypothesis of no difference in the cumulative distribution functions of avian families. The results indicate significant dissimilarities between Blackduck and Fort Garry

assemblages and between Blackduck and Upper Fort Garry assemblages. This is likely due to the greater taxonomic richness of Fort Garry and Upper Fort Garry and in the limited number of taxa represented within the Blackduck sample. Additionally, the two later samples indicate a noticeable reliance on one taxon, regardless of the richness of the samples. This extreme representation of certain taxa is quite different from the more even representation evident in the Blackduck sample. The greater emphasis on one taxon in the later two samples may indicate a greater reliance on avian fauna, while the Blackduck sample pattern is one of opportunistic exploitation of various taxa.

The patterning is not merely a result of the addition of domestic avian taxa within the latter two samples, as the K-S test results without the domestic taxa produce similar values. An examination of the percentage NISP values for wild families only (assuming Anatidae remains are wild) presents an interesting picture (Figure 4.7), in which the triad of duck, goose (Anserinae), and passenger pigeon are present in the assemblages.

A chi-square analysis was also carried out, using paired samples in testing (e.g. Archaic:Blackduck, Archaic:Fort Gibraltar I). Chi-square was used to test the homogeneity of the family abundances between samples. The sample sizes are small to non-existent for many of the avian families, however, with the result that only the Fort Garry and Upper Fort Garry samples could be examined in this manner, using six common families (Cygninae, Anserinae, Anatinae/Aythyinae, Phasianidae, Meleagrididae, Columbidae).

The resultant chi-square value, 110.5748, exceeds the critical value, indicating that the differences in abundances cannot be due to chance alone and represent a "real"
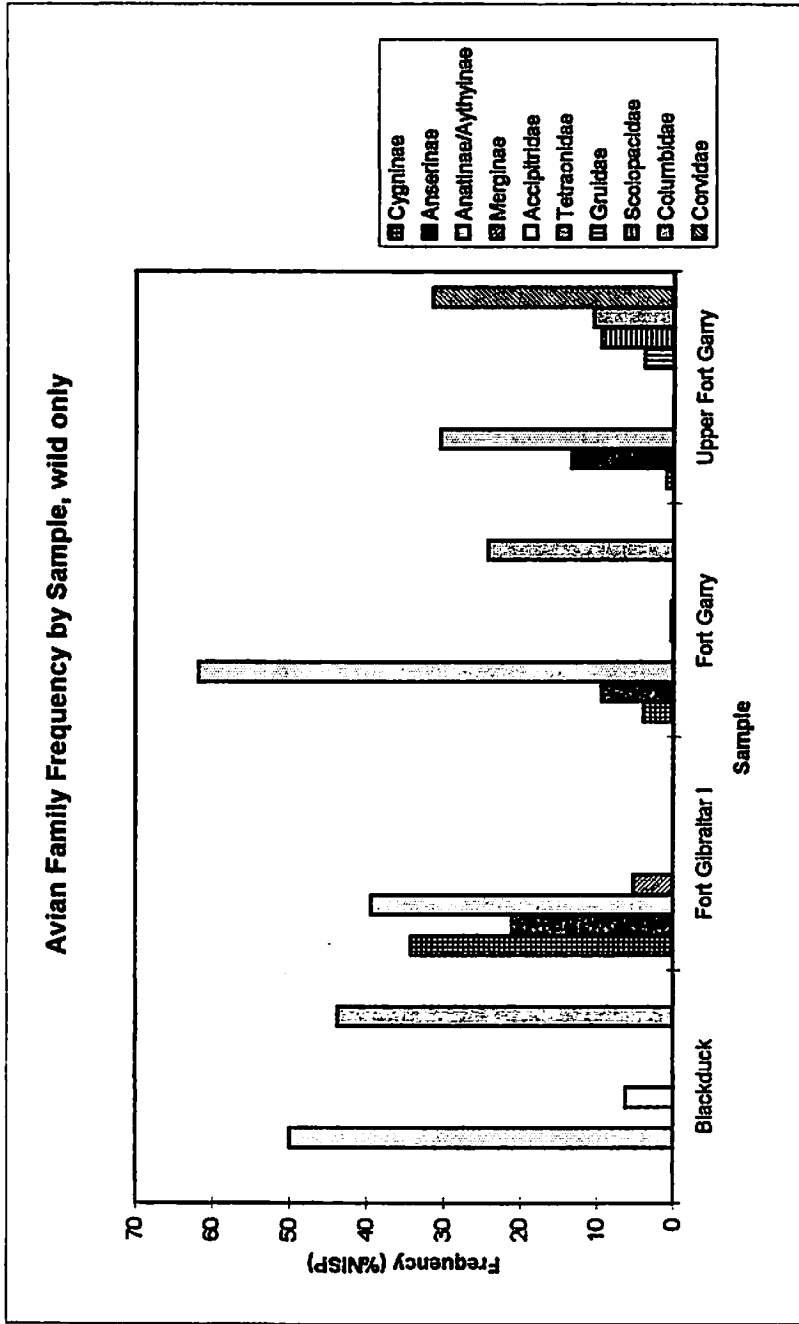
Figure 4.7 Histogram of avian family frequency (% NISP) by sample, excluding domesticates

difference in the relative abundances of these taxa between the samples. A quick examination of the "O-E" table indicates that the greatest discrepancies occur within the Anatinae/Aythyinae and Phasianidae family groups. This is at least partially due to the dominance of one of these families in each of the samples. Anatinae/Aythyinae dominates the Fort Garry avian assemblage, while Phasianidae dominates the Upper Fort Garry assemblage. As noted above, this more intensive exploitation of certain taxa indicates a greater reliance on birds within these later samples, rather than the apparent opportunistic exploitation evident within earlier samples.

The reciprocal of Simpson's index ($1/\Sigma p_i 2$) (Grayson 1984:160) is used in this thesis as the diversity index. This index was calculated for the avian families. The diversity index represents the number of equally common taxa (MacArthur 1972:189) within a sample. A higher value indicates a more even distribution of specimens across the sample (Grayson 1984:160). The diversity indices calculated for avian families for each sample are: Blackduck 2.25, Fort Gibraltar I 3.13, Fort Garry 3.28, and Upper Fort Garry 2.97.

Before interpreting these results, Spearman's rho was used to test for correlation between sample size (NISP of specimens identified to the family level) and diversity index. The null hypothesis of no correlation is rejected if the r_s value $\geq$ the critical value of 1.00. The resultant r_s value, 0.8125, is not considered significant ($n=4$) at $p=0.05$ nor at $p=0.10$. The lack of significance means that the diversity index is not correlated with avian sample size and can be interpreted.

The Fort Garry sample is the most diverse in terms of avian taxa, followed by

Fort Gibraltar I, Upper Fort Garry, and Blackduck. Diversity indicates an evenness of spread of the taxa across the sample. The greater diversity of the Postcontact samples may be due to a longer occupation period, reducing the effects of seasonal availability of avian taxa. The introduction of firearms during the Postcontact period may have also increased the ease of hunting waterfowl. The lower diversity index value within the Upper Fort Garry sample is due to the more intensive exploitation of the domesticated chicken. Given that the diversity index has been calculated using NISP counts, degree of fragmentation and completeness of element representation will be reflected within the diversity index, as well as taxonomic preferences and exploitation patterns.

4.1.iii Fish Family Frequencies

The examination of the changing frequencies of fish taxa was also conducted at the family level. It allows for the inclusion of individuals not identified further, while grouping taxa in a logical fashion, accounting for habitat and behaviour. In some cases, only one genus is represented by the family (e.g. Esocidae and *Esox* sp.), while in others (e.g. Catostomidae) multiple genera may be represented at the family level. The family level is the most inclusive while, at the same time, resulting in relatively little loss of detail. Few specimens have been identified only to the order level.

The raw data are presented in Table II, Appendix I. Further analysis of the taxonomic frequencies is carried out using the data presented in Tables 4.7 and 4.8. Scutes are included because the primarily cartilaginous skeleton of the sturgeon (*Acipenser fulvescens*) leaves little else in terms of identifiable elements. Exclusion of scutes would

Table 4.7 Fish family frequencies by sample

	Archaic	Blackduck	Fort Gibraltar I	Fort Garry	Upper Fort Garry
Acipenseridae	8	247	155	46	0
Esocidae	250	12	3	2	0
Salmonidae	0	0	0	4	52
Hiodontidae	4	33	3	294	39
Cyprinidae	0	0	0	0	4
Catostomidae	7246	39	52	26	44
Ictaluridae	5673	851	174	111	15
Gadidae	5	5	0	1	0
Percidae	225	50	25	185	95
Sciaenidae	126	63	7	478	2
Totals	13537	1300	419	1147	251

Table 4.8 Percent fish family frequencies by sample

	Archaic	Blackduck	Fort Gibraltar I	Fort Garry	Upper Fort Garry
Acipenseridae	0.06	19	36.99	4.01	0
Esocidae	1.85	0.92	0.72	0.17	0
Salmonidae	0	0	0	0.35	20.72
Hiodontidae	0.03	2.54	0.72	25.63	15.54
Cyprinidae	0	0	0	0	1.59
Catostomidae	53.53	3	12.41	2.27	17.53
Ictaluridae	41.91	65.46	41.53	9.68	5.98
Gadidae	0.04	0.38	0	0.09	0
Percidae	1.66	3.85	5.97	16.13	37.85
Sciaenidae	0.93	4.85	1.67	41.67	0.8
	100.01	100	100.01	100	100.01

render this taxon artificially absent within the assemblages. The frequencies of the fish families are presented in Figures 4.8 and 4.9. Notable patterns are: 1) the large size of the fish assemblage in the Archaic sample, dominated by two families (Ictaluridae and Catostomidae); 2) the consistent presence of Ictaluridae; 3) the more variable, but consistent, presence of Catostomidae; 4) the fairly dramatic increase in the frequencies of Sciaenidae (freshwater drum), Hiodontidae (mooneye/goldeye), and Percidae (primarily walleye/sauger) within the two later Postcontact samples; 5) the presence of Acipenseridae only within the Blackduck, Fort Gibraltar I, and Fort Garry samples; 6) the minor presence of Esocidae (*Esox* sp.) and Gadidae (*Lota lota*) throughout.

Spearman's rho was used to test for potential correlation between each family represented in all samples and sample size (all specimens identified to the family level or better), based on NISP counts. The null hypothesis states that there is no correlation, with the critical value at 0.9 ($n=5$, $p=0.05$). Significant values occurred for Esocidae ($r_s=0.9$), Ictaluridae ($r_s=0.9$), and Gadidae ($r_s=0.95$), indicating that for these families there is a significant correlation with sample size.

Two of these families (Gadidae and Esocidae) have the smallest NISP counts, while the third (Ictaluridae) has the consistently large sample size. The correlation would be weakened if the smaller samples were discarded, as suggested by Grayson (1984:121). This would remove necessary samples, however, so it must be sufficient to remain aware of the possible effects of sample size during further discussion. The fact that Gadidae and Esocidae occur only in large samples suggests that they are only rare inclusions.

Spearman's rho ($p=0.05$) was also used to test for correlation between samples
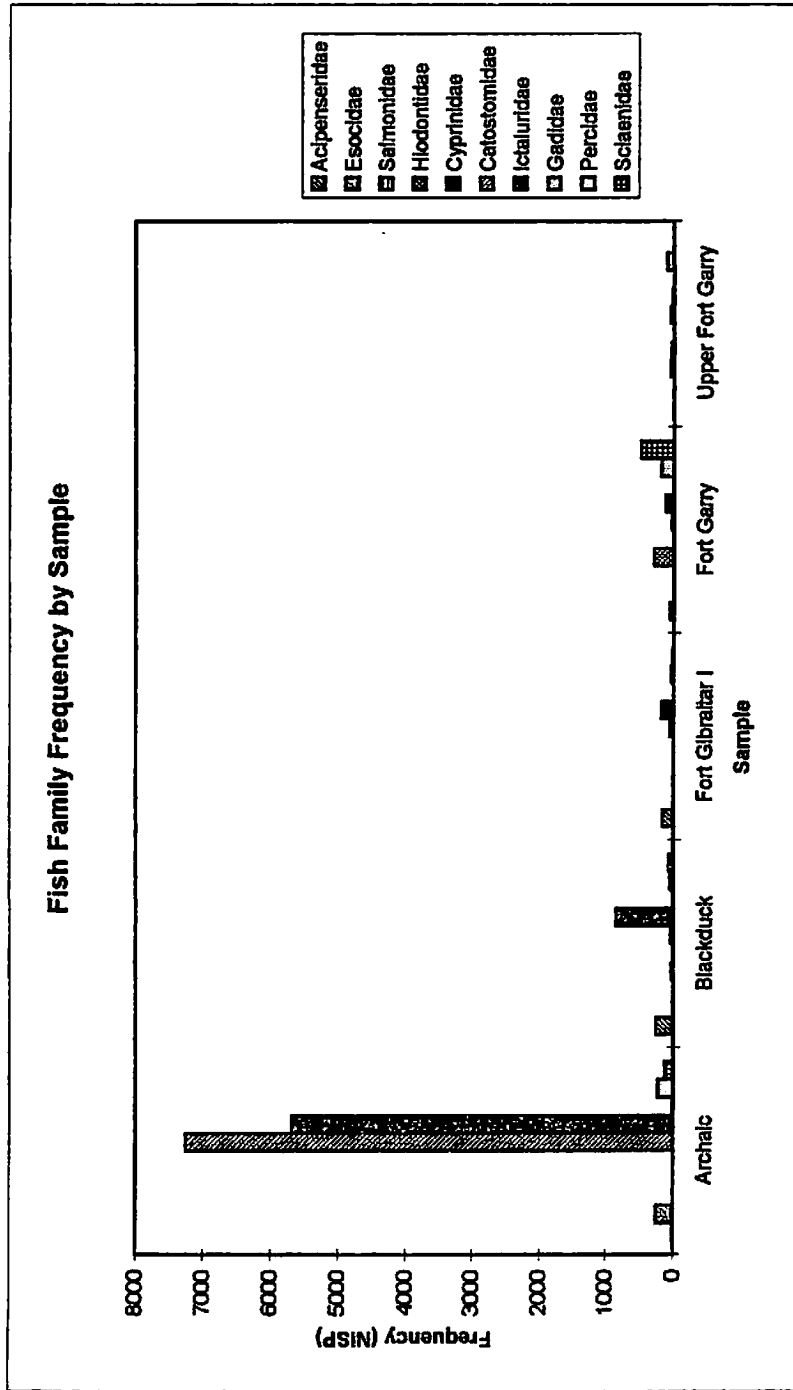
Figure 4.8 Histogram of fish family frequency (NISP) by sample
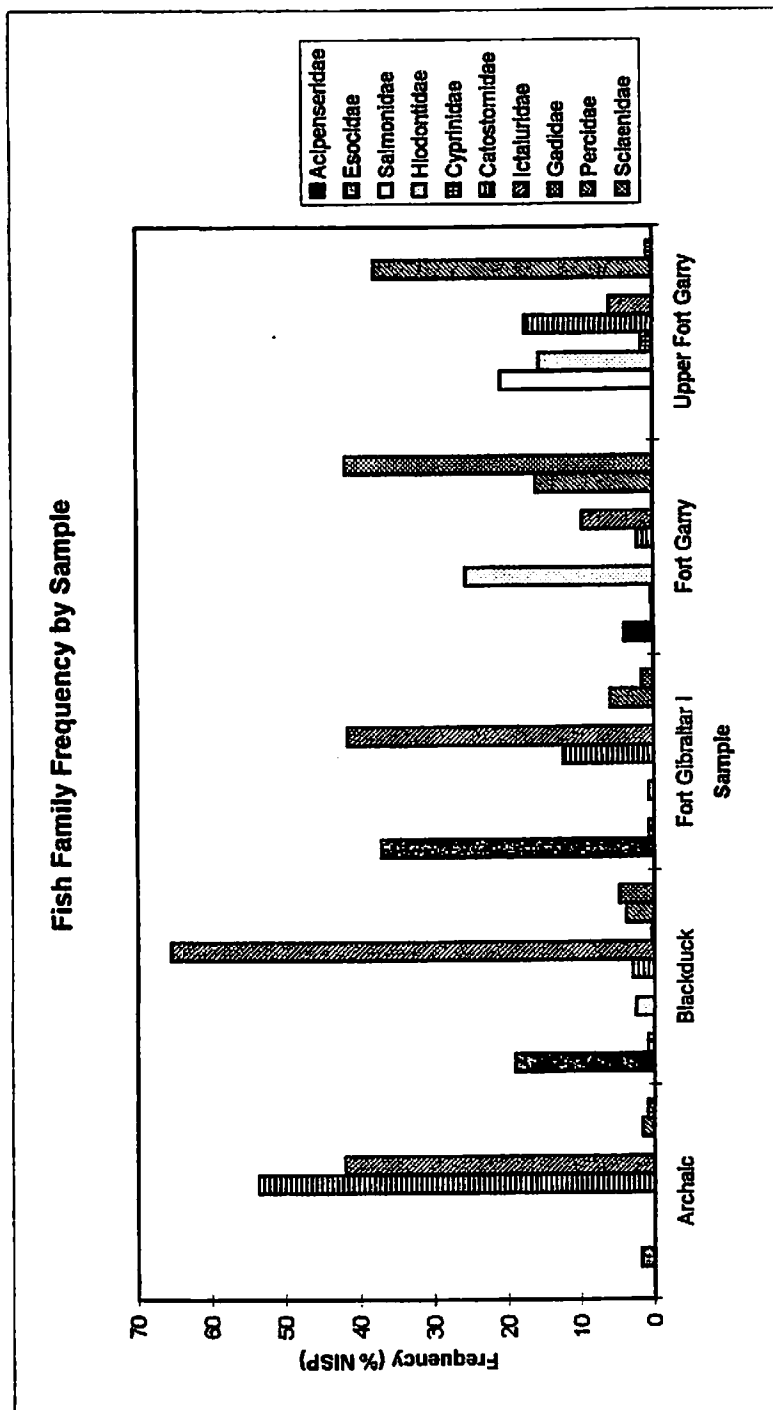
Figure 4.9 Histogram of fish family frequency (% NISP) by sample

in terms of frequencies (NISP) of families. The test should examine the similarity in ranking of families, providing an indication of parallels in exploitation of fish families. The results are presented in Table 4.9.

Table 4.9 Results of the Spearman's rho test for fish families.

	Blackduck	Fort Gibraltar I	Fort Garry	Upper Fort Garry
Archaic	0.64*	0.746*	0.277	-0.009
Blackduck	----	0.939*	0.704*	0.085
Fort Gibraltar	----	----	0.662*	0.057
Fort Garry	----	----	----	0.296

The results of this test indicate significant correlations between the Archaic, Blackduck, and Fort Gibraltar I samples and between the Blackduck and Fort Gibraltar I samples with Fort Garry. This supports the reading of Figures 4.8 and 4.9 in terms of the relative representation of the fish families. The earlier three samples show similarities in the importance of suckers, catfishes, and sturgeon with low representations of other taxa. The two later samples show quite different representations, with new taxa such as drum and walleye/sauger much better represented and the suckers, catfish, and sturgeon typical of the earlier samples in much smaller amounts or absent. The sample which appears "isolated" in terms of its lack of significant correlation with any other sample is Upper Fort Garry. This is due to the inclusion of previously "unrecorded" taxa (Salmonidae, Cyprinidae) as well as to remarkably different frequencies of more common

taxa (an increase in Percidae and Hiodontidae, a decline in Ictaluridae and Catostomidae).
Not surprisingly, perhaps, the distinctive pattern of the Archaic fish assemblage, with
fewer taxa and a more clearly defined dominance of two taxa, results in a weak
correlation with Fort Garry and Upper Fort Garry, which contain small numbers of those
taxa dominant within the Archaic.

Later consideration of relative frequencies of elements may clarify the cause of
such correlations. These changes may reflect shifting food preferences (e.g. against oily
bottom feeders), altered habitat, lack of distinct scheduling or seasonality due to increased
sedentism, enlarged catchment area (e.g. inclusion of lake-dwelling whitefish),
taphonomic effects (e.g. destruction of fish bone in earlier occupations, or of specific
types - e.g. Salmonidae - which are notoriously friable), changes in processing methods
or variability in site purpose (e.g. processing versus consumption). Clarification must
be sought within the analysis of relative element frequencies, seasonality, and
documentary evidence.

The richness of the sample - the number of taxa represented within each sample -
was examined, as well as the spread of the taxa within the assemblage. The Fort Garry
sample includes nine taxa, the Archaic and Blackduck samples eight, and Fort Gibraltar
I and Upper Fort Garry, seven. Spearman's rho was used to test for correlation between
the number of taxa represented within each sample and the sample size of identified fish.
The resultant r_s value, 0.629, is not considered significant (p=0.05) and fails to reject
the null hypothesis of no correlation. This result indicates that there is no correlation
between taxonomic richness and sample size. Further examination of richness could be

carried out. The taxonomic richness varies relatively little from sample to sample, as each sample includes *some* representation of each major local taxon.

The Kolmogorov-Smirnov test was used to test for significant difference in the cumulative distribution functions of paired samples in terms of fish family frequencies. The null hypothesis is one of no significant difference in the structure of the relative frequencies. Table 4.10 presents the results of the K-S test (p=0.05).

Table 4.10 Results of the K-S test for fish family frequencies

	Blackduck	Fort Gibraltar I	Fort Garry	Upper Fort Garry
Archaic	0.3	0.4	0.2	0.5*
Blackduck	----	0.3	0.2	0.3
Ft. Gibraltar	----	----	0.3	0.2
Fort Garry	---	----	----	0.4

The results indicate that only the Archaic and Upper Fort Garry samples are significantly different in terms of the spread of taxa across the samples. It is notable that two other combinations (Archaic:Fort Gibraltar I, Fort Garry:Upper Fort Garry) are "almost" significant. The Upper Fort Garry sample is notable in its more balanced representation of taxa, while the Archaic is notable in presenting the most uneven representation, dominated by two taxa. The intensive exploitation of a limited number of taxa evident in the Archaic sample may indicate procurement of seasonally abundant taxa, possibly during the spawning period. The Upper Fort Garry sample, in particular, may indicate

a more continuous, year-round exploitation of various taxa. The more even representation of taxa suggests that there may have been no conscious focus on any one taxon, perhaps due to the use of nets or night lines of hooks. The Archaic appears to represent a fish procurement and processing site, presumably with a fair amount of bone waste, while Upper Fort Garry is a collection of post-consumption food waste, possibly of already processed fish. This should be clarified by a consideration of element frequencies.

A chi-square test between paired samples was also carried out using fish family NISP counts. The chi-square values were all extremely high (and highly significant), indicating that the differences in fish family proportional frequencies between the samples could not be due merely to sampling or chance. The greatest discrepancies between observed and expected values generally focused on those taxa which were most numerous within each sample.

The potential effects of sample size should be noted when viewing the results of the chi-square tests. Small sample sizes can result in the significance of only very strong result and, conversely, large sample sizes (such as within the fish assemblages) can result in very high significances for weak results (Drennan 1996:195).

Diversity indicates the evenness of spread of the taxa across the samples. The diversity of the samples was examined using the diversity index, $1/\Sigma p_i^2$, in which higher values indicate a greater evenness of spread. The resultant values were: Archaic 2.16, Blackduck 2.13, Fort Gibraltar I 3.04, Fort Garry 3.61, Upper Fort Garry 4.08. Prior to interpreting the results of the diversity index, Spearman's rho was used to determine

whether or not there was any correlation between diversity and sample size. The null hypothesis of no correlation was not rejected, as the resultant r_s value, -0.8, was not considered significant ($n=5$, $p=0.05$). Given the small size of n, the strong negative correlation should be noted. This suggests that, as sample size increases, the diversity index decreases.

The Upper Fort Garry sample produces the highest diversity index value in which few taxa contain few specimens. Interestingly, those samples with the greatest percentage representation of fish are also those with low diversity indices, possibly due to a more focused exploitation of a limited number of taxa. The Postcontact samples, with a lower percentage representation of fish bone, are nevertheless coupled with a more even distribution of specimens across the fish taxa. This may be linked to intensive seasonal exploitation of fish at the Forks as part of a more diversified seasonal round within the Precontact periods relative to a more even exploitation of taxa year-round within the Postcontact periods. Fort Gibraltar I appears to provide a transitional, median value between the Precontact and Postcontact samples.

4.1.iv Mammalian Family Frequencies

The mammalian data were examined primarily at the family level. The NISP and percent NISP values for the mammalian families are presented in Tables 4.11 and 4.12. The raw NISP data are presented in Tables III and IV, Appendix I. For the purpose of this analysis, small mammals considered to be of non-cultural origin (e.g. voles, shrews) have been removed, but are included in Table III, Appendix I.

Table 4.11 Mammalian family frequencies by sample

	Archaic	Blackduck	Fort Gibraltar I	Fort Garry	Upper Fort Garry
Leporidae	7	32	15	501	80
Castoridae	32	39	70	9	0
Cricetidae	0	4	13	0	0
Canidae	325	18	19	17	70
Ursidae	1	0	1	10	1
Felidae	0	0	2	0	15
Mustelidae	132	2	2	0	0
Cervidae	18	7	29	1	2
Bovidae	104	63	421	611	264
Suidae	0	0	4	126	46
Antilocapridae	0	0	0	0	1
Equuidae	0	0	11	1	1
Totals	619	165	587	1276	480

Table 4.12 Percent mammalian family frequencies by sample

	Archaic	Blackduck	Fort Gibraltar I	Fort Garry	Upper Fort Garry
Leporidae	1.13	19.39	2.56	39.26	16.67
Castoridae	5.17	23.64	11.93	0.71	0
Cricetidae	0	2.42	2.21	0	0
Canidae	52.5	10.91	3.24	1.33	14.58
Ursidae	0.16	0	0.17	0.78	0.21
Felidae	0	0	0.34	0	3.13
Mustelidae	21.32	1.21	0.34	0	0
Cervidae	2.91	4.24	4.94	0.08	0.42
Bovidae	16.8	38.18	71.72	47.88	55
Suidae	0	0	0.68	9.87	9.58
Antilocapridae	0	0	0	0	0.21
Equuidae	0	0	1.87	0.08	0.21
Totals	99.99	99.99	100	99.99	100.01

Figures 4.10 and 4.11 present the frequency data for the mammalian families expressed both as raw NISP counts as well as percentage frequencies. The following patterns can be observed in a brief examination of these graphs: 1) the expected presence of domesticates, primarily within the two most recent samples; 2) the consistent presence of bovids, particularly when viewed as a percentage, with a definite peak within the Fort Gibraltar I sample; 3) the presence of Castoridae and Cervidae only within the first three occupations; 4) the extraordinarily high frequencies of carnivores (Canidae and Mustelidae) within the Archaic sample; and 5) the consistent presence of Leporidae within all samples and an extraordinarily high frequency within the Fort Garry sample.

As a first step, Spearman's rho was used to test for correlation between family frequencies (NISP) and sample size, in order to determine whether or not the frequency changes through time were "real" or partly a function of sample size. Rank orderings of each family were compared to mammal sample size. The null hypothesis of no correlation ($p=0.05$) was not rejected for the bulk of the families. Only Cricetidae (represented by *Ondatra zibethicus*, muskrat) and Ursidae resulted in significant r_s values and, thus, significant correlation with sample size. These families were negatively correlated with sample size, suggesting that as sample size increased, their frequency decreased. These two families are the least well-represented of the families. The small NISP counts within both families are the likely causes of this correlation. The other families can be examined with little concern for effects of sample size.

Spearman's rho was also used to compare the samples, using only families that were present in at least three of the samples (rejecting Felidae and Antilocapridae). For
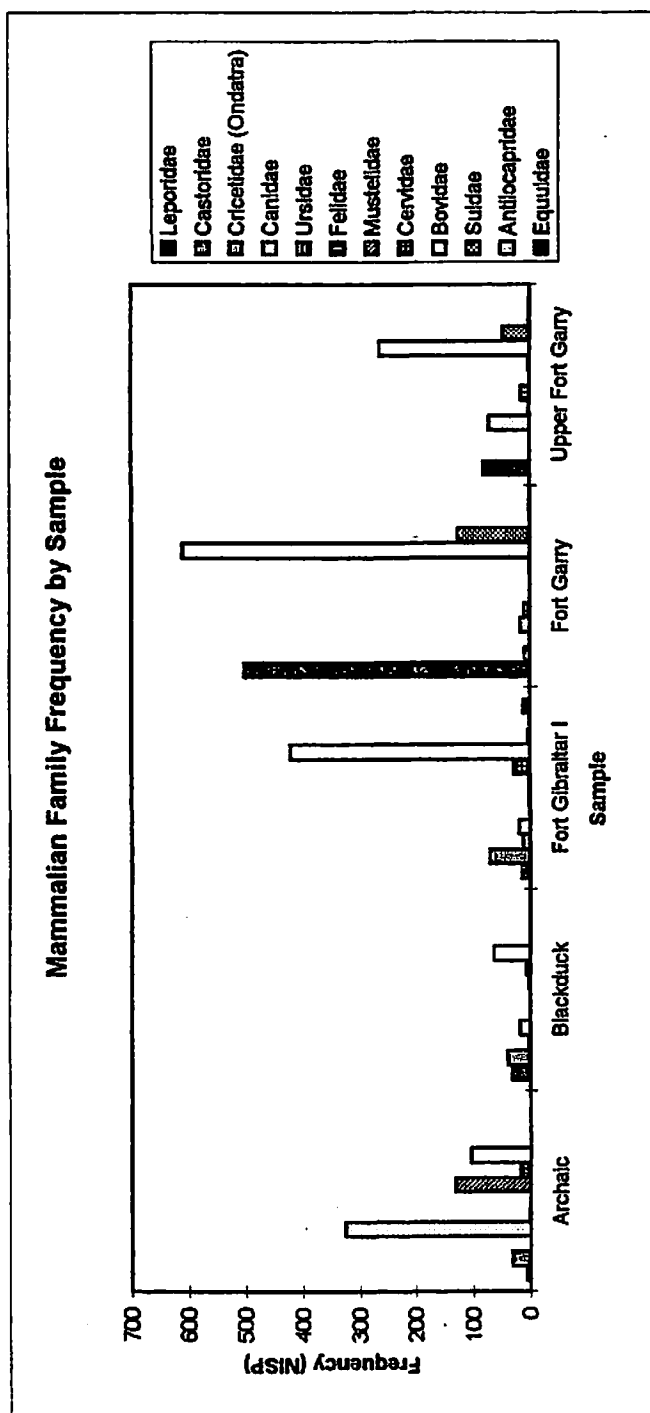
Figure 4.10 Histogram of mammalian family frequency (NISP) by sample
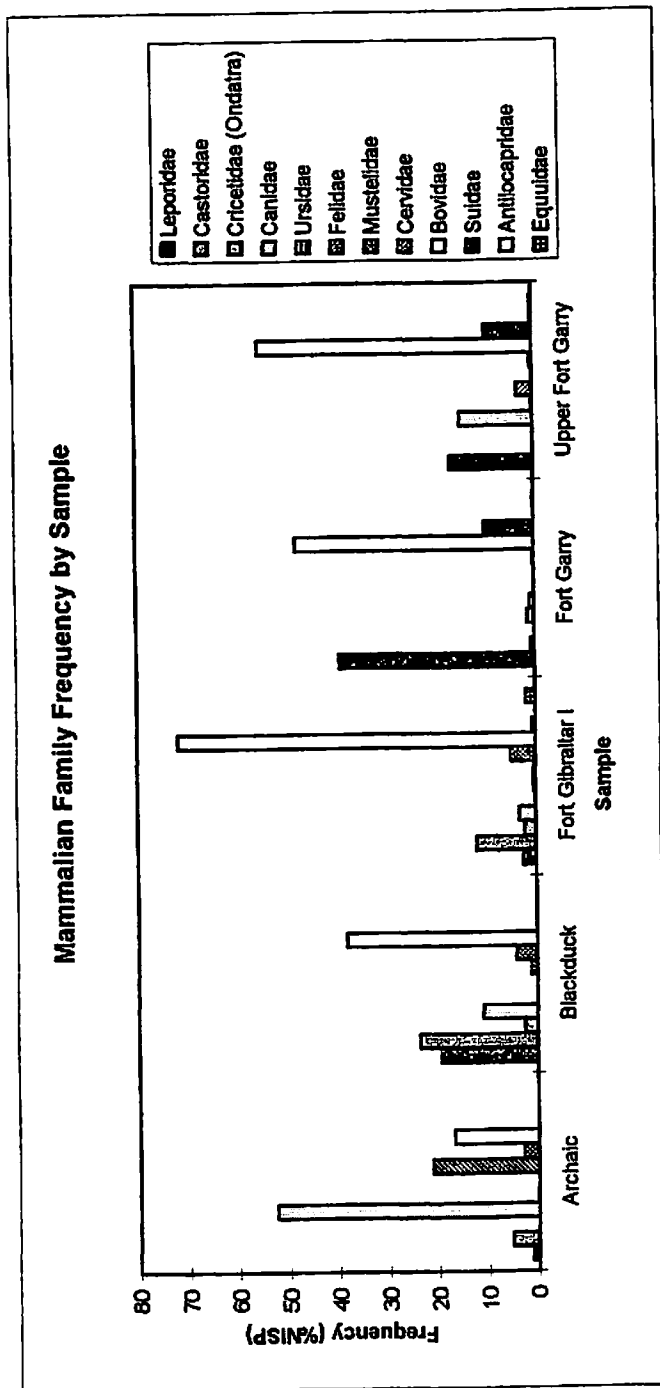
Figure 4.11 Histogram of mammalian family frequency (% NISP) by sample

the Archaic to Blackduck comparison, Suidae and Equuidae were not included because both represent only domesticates. The rank orderings of families, based on NISP, were compared from sample to sample. The null hypothesis (p=0.05) is that there is no significant correlation - and thus no significant similarity in rankings - between the samples. This test should indicate similarities in exploitation of the families. Table 4.13 presents the results of the Spearman's rho test.

Table 4.13 The results of the Spearman's rho test for mammalian families.

	Blackduck	Fort Gibraltar I	Fort Garry	Upper Fort Garry
Archaic	0.25	0.408	-0.047	0.051
Blackduck	----	0.843*	0.412	0.366
Fort Gibraltar	----	----	0.324	0.390
Fort Garry	----	----	----	0.846*

Only two sets of paired samples resulted in significant r_s values. The Blackduck:Fort Gibraltar I and Fort Garry:Upper Fort Garry samples are both positively correlated, indicating a similarity in the rank orderings of the mammalian family frequencies. The correlation between Fort Garry and Upper Fort Garry is not surprising when viewing the frequency graphs and the NISP counts themselves, including all domestic families and similar frequency distributions. The correlation between Blackduck and Fort Gibraltar is less expected, but the presence of domesticates within the Fort Gibraltar I sample is minimal and similar frequency distributions exist, particularly for

the most abundant taxa. The Archaic mammalian assemblage is quite anomalous in its lack of dominance by bovids (i.e. bison), presumably due to the intensive exploitation of fish taxa.

The taxonomic richness of the samples was also examined. It is evident from viewing the graphs that the richest sample (i.e. that sample containing the greatest number of taxa) is Fort Gibraltar I, with eleven taxa represented, while the four additional samples contain nine (Upper Fort Garry), eight (Fort Garry), and seven (Blackduck, Archaic) respectively. Prior to interpreting these values, a Spearman's rho test was carried out in order to identify any correlation between the number of taxa represented within each sample and sample size. The resultant r_s value, 0.026, shows a very weak correlation of no significance, indicating that there is no significant correlation between taxonomic richness and sample size. The pattern of taxonomic richness noted above, therefore, can be interpreted without the potentially problematic effect of sample size.

The Fort Gibraltar I sample, the earliest Postcontact sample within the analysis, represents a transitional sample in its inclusion of both wild and domestic animals. Its greater taxonomic richness may be due to a mixture of both wild and domestic families. The variation in wild to domestic taxa is somewhat masked by the inclusion within the Bovidae family of one of the most important wild species (*Bison bison*) as well as the most important domestic species (*Bos taurus, Ovis/Capra* sp.). A histogram (Figure 4.12) of wild and domestic components of the samples clearly shows the transitional nature of the Fort Gibraltar I sample in terms of domestic versus wild taxa. The small percentage of domesticates in the Blackduck sample are considered to be due to
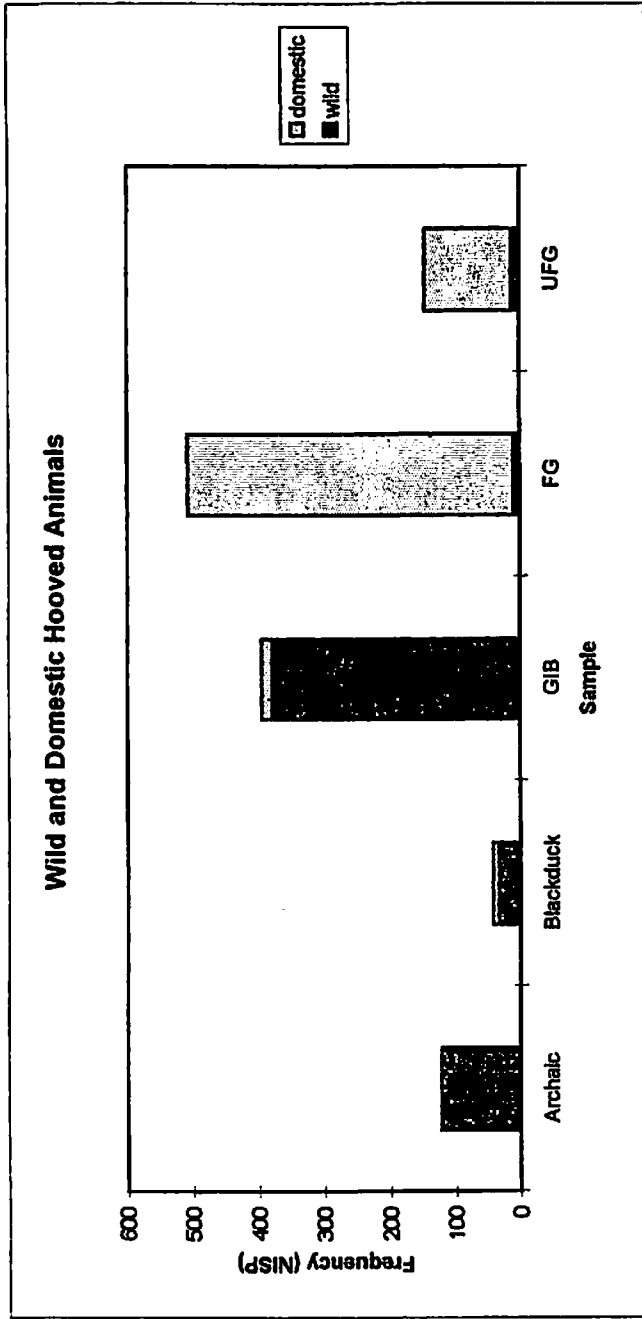
Figure 4.12 Histogram showing frequencies (NISP) of wild and domestic hooved animals by sample

stratigraphic mixing (Tisdale, pers. comm, 1999). This sample overwhelmingly contains wild species over domesticates, while the Fort Garry sample, representing a time period only a few years later, contains largely domesticates. The shift from a subsistence base of wild to domestic species occurred quite rapidly. It did not, however, occur immediately following European occupation but approximately one hundred years following the first documented European settlement within the area. It should be remembered at this point that the changing NISP counts could also be partially due to varying taphonomic histories of the samples, rather than solely taxonomic preferences.

The Kolmogorov-Smirnov test was used to compare the general distribution of taxa between the samples. Significant values cause the rejection of the null hypothesis of no difference in the cumulative distribution functions between the samples ($p=0.05$). Table 4.14 presents the results of these tests.

Table 4.14 Results of the K-S test for mammalian families.

	Blackduck	Fort Gibraltar I	Fort Garry	Upper Fort Garry
Archaic	0.25	0.34	0.17	0.17
Blackduck	----	0.34	0.25	0.25
Fort Gibraltar	----	----	0.33	0.33
Fort Garry	----	----	----	0.17

Unlike the other classes, the pattern of the spread of taxa within these samples is not significantly different ($p=0.05$). This may be due to the relatively similar taxonomic

richness (varying from seven to eleven taxa represented) as well as the dominance of one or two taxa and a more or less even distribution of the remainder within each sample. The patterning of the spread of taxa within each sample is not notably different, although the taxa making up that pattern may be quite varied from sample to sample. In all of the samples excepting the Archaic, Bovidae is the dominant taxon, represented by *Bison bison* in the Blackduck and Fort Gibraltar I samples and also by *Bos taurus*, *Ovis aries*, and *Capra hircus* in the Fort Garry and Upper Fort Garry samples.

The chi-square test was also applied to the paired mammalian assemblages. The resultant values were extremely high and significant ($p < 0.01$), indicating that the samples are not homogeneous in the proportions of families. The highly significant results may be partially due to large sample sizes which serve to exaggerate the significance of the results. Although the samples show similar cumulative distribution functions, the taxonomic composition of the samples are not at all alike.

The diversity of the mammalian assemblages was examined through the application of the diversity index, $\Sigma 1/p_i^2$. Resultant values are: Archaic 2.83, Blackduck 3.94, Fort Gibraltar I 1.87, Fort Garry 2.54, Upper Fort Garry 2.76. Prior to interpretation, these values were examined for correlation with sample size using Spearman's rho. The null hypothesis of no correlation was not rejected, as the resultant r_s value of -0.5 is not considered significant ($n=5$; $p=0.05$). It is notable, however, that the correlation is a negative one, similar to that of the fish diversity index. This indicates that, as the sample size increases, the diversity index decreases, possibly indicating a more focused exploitation. The diversity index values are highest for the Blackduck sample, followed

by the Archaic, Upper Fort Garry, Fort Garry, and Fort Gibraltar I. This is visually evident in Figures 4.10 and 4.11 in which the Fort Gibraltar I and Fort Garry samples are primarily dominated by one or two taxa, while the Blackduck sample exhibits a more even distribution of specimens across the taxa. The Precontact samples present the greatest diversity within the mammalian assemblage, while the Postcontact present the least.

It is interesting that the samples with lower diversity indices are also those with the greatest percentage representation of those classes. For instance, the Fort Gibraltar I sample is dominated by mammals, but presents the lowest diversity index for mammalian taxa. This is similar to the situation noted within the fish assemblages. This patterning may be due to an intensive exploitation and processing of a few important taxa within certain samples. In this case, Fort Gibraltar I is one of the *forts des prairies*, established to procure bison for pemmican production to supply the continuous fur trade expansion. Bovid remains might therefore be expected to be most common, reflecting a focus on procurement and processing of bison to the exclusion of other taxa. The background spectrum of other taxa may represent the remains of immediate consumption, while the intensively exploited bison represent the results of processing and storage for future consumption. Similarly, the fish remains within the Archaic represent an emphasis - perhaps seasonal - on certain taxa for preparation, storage and future consumption, with a background taxonomic composition of immediate subsistence items.

4.1.v Summary

A number of patterns are evident at this point in the analysis: 1) a dramatic increase in bird taxa represented over time, an increase which is not solely explained by the addition of domesticated avian taxa; 2) similar richness in fish taxa across time; 3) low fish diversity indices and high mammalian diversity indices within the Precontact samples; 4) an apparent intensive exploitation of fish taxa within the Archaic sample and of mammal taxa within the Fort Gibraltar I sample, in contrast to a more even representation of classes in all other samples; 5) an apparent link between the lowest diversity indices by class and the lowest diversity indices within the dominant class. For instance, the Archaic presents the lowest class diversity (fish dominated) and also produces the lowest diversity within that class. Upper Fort Garry, with the highest class diversity index also presents the highest diversity index within the most important class (fish). These are correlated with an r_s value of 0.9, considered significant at $n=5$ and $p=0.05$. Those samples with the greatest emphasis on one class, therefore, also appear to present a greater emphasis on certain taxa within that class. Conversely, those samples with a more even distribution within one class also produce even distributions within that class.

The two later Postcontact samples do appear to indicate a much more even exploitation of the classes, with the Archaic and Fort Gibraltar I samples distinctly different in their respective emphases on fish and mammal. These more intensive class exploitations are coupled with emphasis on a small number of taxa within the class. These differences could be due to an intensive seasonal exploitation of Ictaluridae and

Catostomidae during the Archaic occupation of the Forks and an intensive exploitation of bison during the Fort Gibraltar I occupation. These two occupations appear to represent specialized, focused exploitation patterns. The later Postcontact occupations represent more generalized exploitation, possibly due also to the year-round occupation of the site. These concerns should be clarified with continued analysis.

4.2 Butchering and Processing

The basic methodology for the examination of butchering and processing patterns across the samples, as presented in Chapter 3, includes the examination of relative element frequencies and butchering marks. A brief analysis of the effects of heat (thermal alteration) and evidence of animal chewing is also included. As in section 4.1, the discussion is presented by class (birds, fishes, mammals) and moves from general to specific within each class.

4.2.i Avian Element Frequencies

Avian elements vary in their ease of identification beyond the class level. This may cause an apparent absence of elements within a taxon when they may be present but not identifiable beyond the class level. Element frequencies were first examined at the class level. Eggshell, ossified tendon, and tracheal rings were not included. None of these elements have been identified past the class level and will not affect the analysis at the family level.

Class Level

The total NISP counts for each element were tallied. These data are presented in Table 1, Appendix II. Tables 2, 3, 4, and 5 (Appendix II) present basic element frequency data at the family/subfamily level for the Blackduck, Fort Gibraltar I, Fort Garry, and Upper Fort Garry samples, respectively. The Archaic sample contains only

eggshell and four specimens identified to Passeriformes and was excluded from the avian

analysis.

It is immediately obvious that vertebrae are underrepresented at both the class and

family levels. In order to determine how ubiquitous this pattern might be, the axial and

appendicular elements were tallied for each sample and a chi-square test conducted

between the paired samples. The use of this test should determine whether the

differences in proportions between the samples could have occurred through sampling,

or chance, alone. The results are presented in Table 4.15.

Table 4.15 Results of the chi-square test for axial and appendicular avian elements

	Fort Gibraltar I	Fort Garry	Upper Fort Garry
Blackduck	0.5769	0.11389	0.88142
Fort Gibraltar I	----	1.94282	0.223675
Fort Garry	----	----	4.25981*

Only the value of the paired test Fort Garry:Upper Fort Garry is significant at

$p=0.05$, indicating that the other samples can be considered homogeneous. Only the

axial:appendicular proportions from the Fort Garry:Upper Fort Garry test can be

considered sufficiently different from each other to constitute two distinct samples. The

pattern of fairly low axial (primarily vertebrae) representation is consistent across most

of the samples. The cause of the significance within the last calculation appears to be an

extreme overrepresentation of appendicular elements (leg and wing bones) within the

Upper Fort Garry sample. This pattern may be due to the different depositional natures of the samples. The Upper Fort Garry sample consists primarily of privy deposits which likely represent the remains of meals (i.e. post-consumption waste). Axial elements would have been deposited in a kitchen waste midden instead.

The number of elements included within the "axial" and "appendicular" categories differs. The patterning of axial:appendicular representation can be compared between the samples, but a clear picture of relative representation requires an alternate approach. Presenting or analyzing the data at the element level is difficult due to the varying sample sizes and the numerous zero values which result. It was decided, for these reasons, to group the NISP element counts into body areas, as follows: head/neck, trunk/tail, upper wing, lower wing, upper leg, and lower leg. The head/neck area includes the skull, mandible, and cervical vertebrae; trunk/tail includes all other axial elements; upper wing includes pectoral girdle, humerus, ulna, radius, and carpals; lower wing includes carpometacarpus and phalanges; upper leg includes femur, tibiotarsus, patella, and fibula (if separate); and lower leg includes the tarsometatarsus and phalanges. The class data, grouped in this manner, are presented graphically in Figure 4.13 and a generalized pattern of trunk/tail, upper wing, and upper leg dominance is apparent.

This pattern may be due, however, to the dominance of body areas containing larger numbers of elements. The body areas were therefore "normed" by determining the average number of elements within each body area and presenting a proportional representation figure equal to the number of observed elements within each body area divided by the number of elements within that body area per individual. The results are
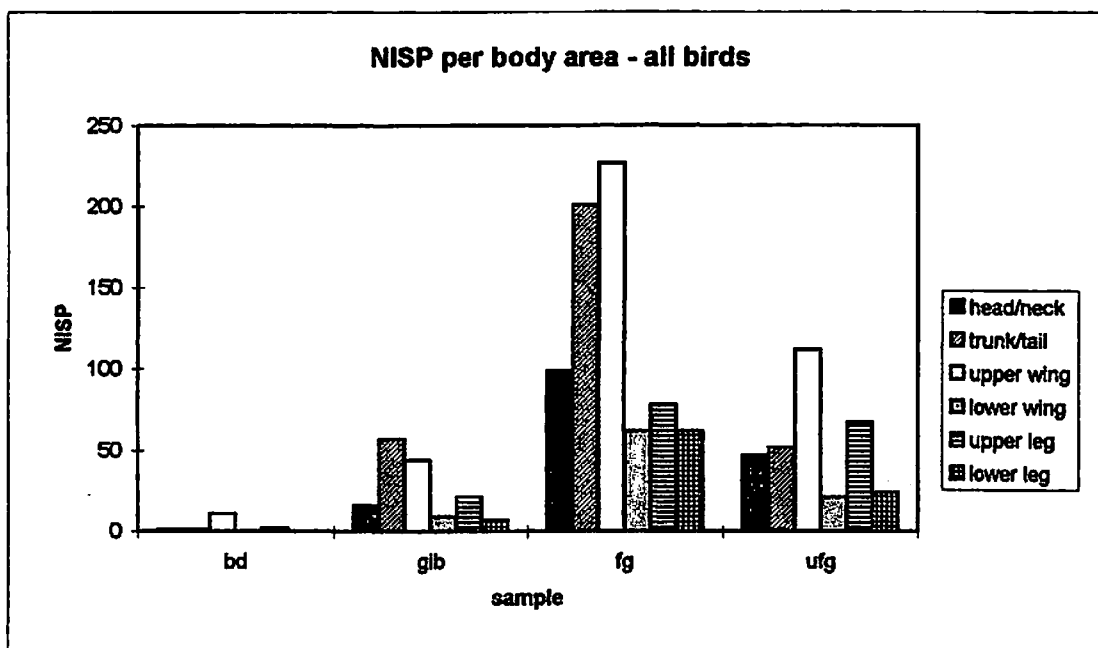
Figure 4.13 Histogram of NISP counts per body area for all birds
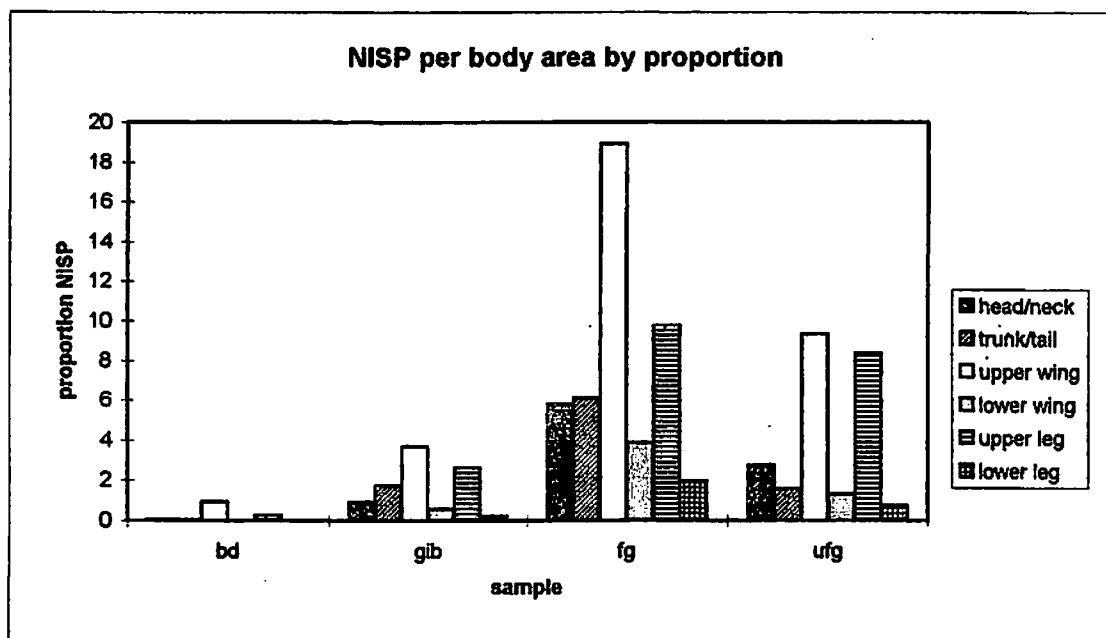
Figure 4.14 Histogram of NISP counts per body area by proportion, for all birds.

graphed in Figure 4.14. The major effects of this procedure were to increase the dominance of the upper wing, produce a dominance of the upper leg, and reduce the representation of the trunk/tail and head/neck. The representation of the lower wing and lower leg is consistently minor. What appeared to be an overrepresentation of the appendicular elements is actually an overrepresentation only of the upper appendicular elements. The proportional figure provides a more accurate picture of body area representation.

The higher proportional frequencies of upper appendicular elements may represent "post-consumption waste." It has been suggested (Lyman 1994b:448) that discarded elements following human consumption would include proximal limb elements of both wings and legs. The birds have been minimally butchered prior to consumption, removing the lower extremities and, perhaps, dismembering the bird. The prepared edible portions are likely the upper wing, upper leg, with breast meat removed from the trunk area. The underrepresentation of trunk/tail, head/neck, and lower extremities may be due to their deposit elsewhere, such as a kitchen midden, rather than within a post-consumption deposition situation.

The lower extremity elements are also the smallest within the avian skeleton and may have been selected against by screen size. In order to test this last hypothesis, Spearman's rho was calculated between screen size and proportional representation of lower extremities between the samples. The ranking of screen sizes also incorporated the use of water screening. Spearman's rho provides a test for correlation between variables, the null hypothesis stating that no correlation exists. The r_s values of the test for

correlation between screen size and lower wing and lower leg representation are the same: -0.8. This indicates a strong negative correlation between lower extremity representation and screen size, but is not significant at p=0.05. The strong negative relationship indicates that as screen size increases, lower extremity representation decreases. Although this is not significant at p=0.05, it *is* significant at $0.20 > p > 0.10$. The potential significance of this correlation should not be ignored, given the effects of small n on determining significance in the Spearman's rho test. Even considering, however, the potential for loss of smaller elements due to larger screen size, there are notable discrepancies between upper and lower limb representation even for the sample (Fort Gibraltar I) with the smallest screen size and potentially the best recovery rate. While the use of different screen sizes may exaggerate the effect, the lower representation of lower extremities is still a real issue.

Spearman's rho was used to test for similarity in the rankings of body area representation between the samples. The test was first conducted using the basic NISP counts grouped to body area. The results are presented in Table 4.16.

Table 4.16 Results of the Spearman's rho test for avian body area representation

	Fort Gibraltar I	Fort Garry	Upper Fort Garry
Blackduck	0.7286	0.7973	0.9715*
Fort Gibraltar I	----	0.8680*	0.7714
Fort Garry	----	----	0.8092

The r_s values of the paired tests Blackduck:Upper Fort Garry and Fort Gibraltar I: Fort Garry are significant at p=0.05, indicating similarity in ranking of body area representations. The Blackduck and Upper Fort Garry samples are similar in the high ranking of upper wing and upper leg counts, while the Fort Gibraltar I and Fort Garry samples are similar in their high ranking of upper wing and trunk/tail. Before interpreting these results, however, it was noted that the results of the other paired tests are significant at p values between 0.10 and 0.05. This fact, coupled with the effects of small n, suggested that the distribution of body areas is not dramatically different between the samples.

Spearman's rho was again conducted, replacing the body area counts by the "normed" distribution figures. Table 4.17 presents the results of this second version of the test.

Table 4.17   Results of the Spearman's rho test for avian proportional body area representation

	Fort Gibraltar I	Fort Garry	Upper Fort Garry
Blackduck	0.927*	0.927*	0.9859*
Fort Gibraltar I	----	1.00*	0.943*
Fort Garry	----	----	0.943*

Interestingly, examining the counts as proportions of body areas maintains a similar pattern of correlation to the first approach. Blackduck:Upper Fort Garry and Fort

Gibraltar I:Fort Garry each produce the higher values and, thus, the stronger correlation. All of the r_s values, however, are significant at p=0.05, indicating a strong positive correlation. This indicates that the proportional body area representations are similar throughout the samples. Except for the Blackduck and Upper Fort Garry samples, the remaining values suggest greater similarity in body part distribution between the Postcontact samples than between the Precontact and Postcontact samples. In all samples, the upper wing and upper leg ranked highest, the lower wing and lower leg lowest. This seems to suggest that the initial butchering/dismemberment of avian taxa remains the same through time. This is not surprising given the fact that the bulk of the meat on birds is located in the area of the upper leg, upper wing, and sternum and this fact provides little scope for variability in butchering patterns.

Family/Subfamily Level

The relative element frequencies were then examined at the family level, both as body area (NISP) counts and as proportional body areas. These data are graphically presented in Figures 4.15 to 4.22, showing the small NISP counts for most of the taxa and samples. The small NISP counts make it difficult to identify and discuss body area representation with a high degree of confidence for most of the families.

Only two families are represented within the Blackduck sample. The overrepresentation of upper wing elements and the underrepresentation of lower extremities, noted in the class level discussion, is evident in both families.

Within the Fort Gibraltar I sample, the pattern of underrepresentation of lower
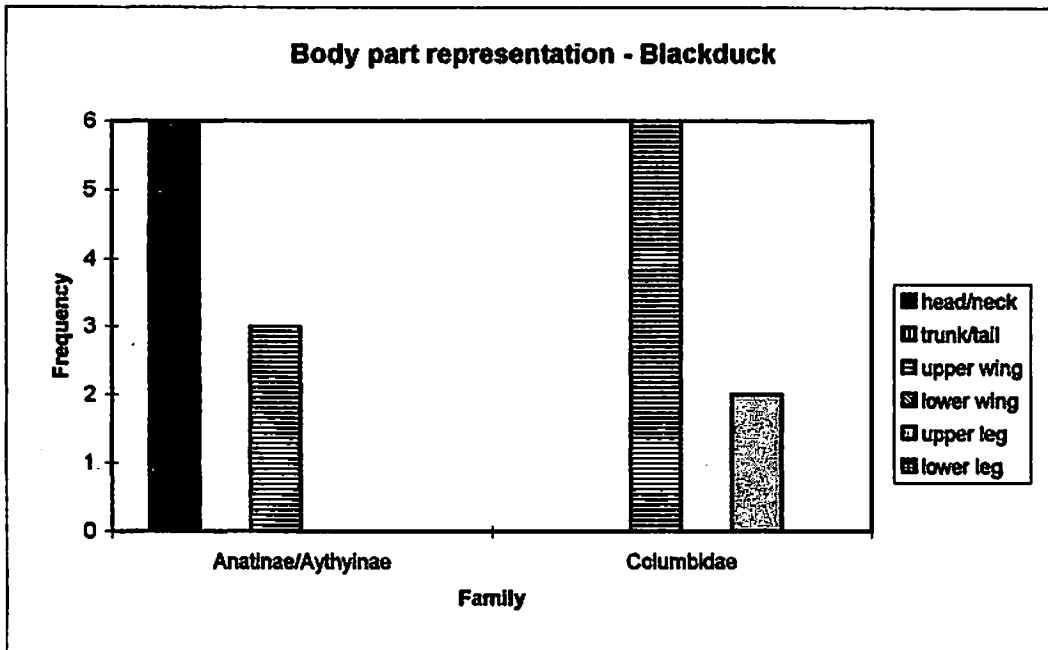
Figure 4.15 Histogram of body area frequencies in the Blackduck sample, by avian family
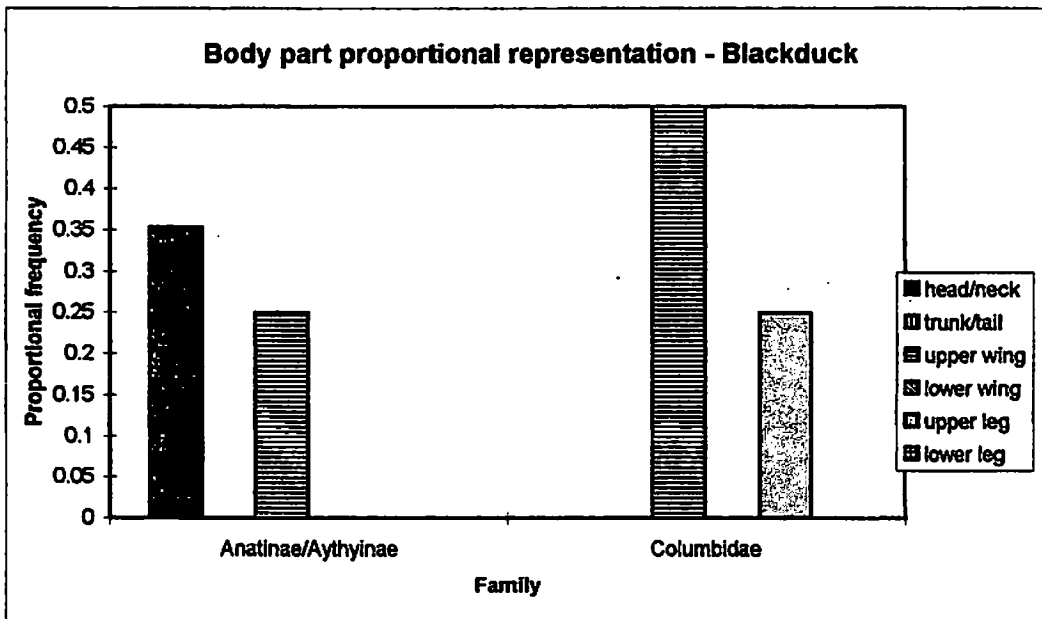
Figure 4.16 Histogram of proportional body area frequencies in the Blackduck sample, by avian family
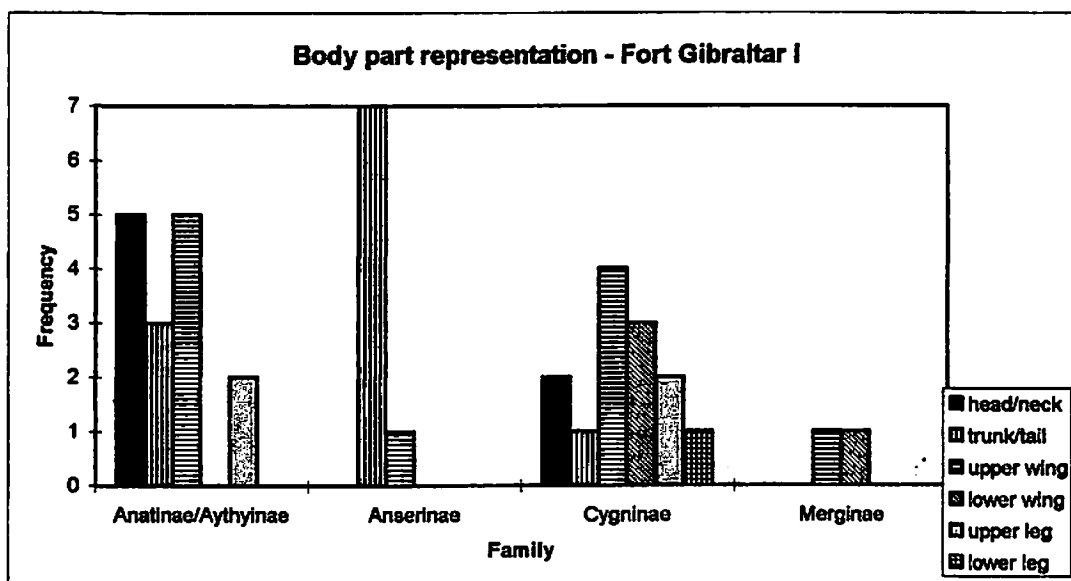
Figure 4.17 Histogram of body area frequencies in the Fort Gibraltar I sample,
by avian family
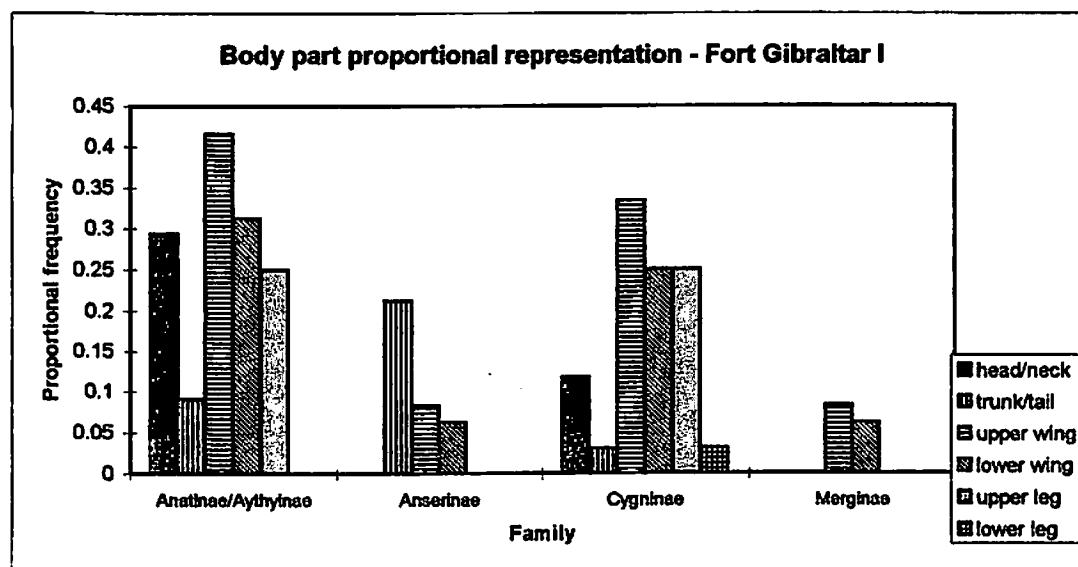
Figure 4.18 Histogram of proportional body area frequencies in the Fort Gibraltar I sample,
by avian family

extremities is limited primarily to the lower leg, which is absent from three of the four families and only minimally present within the fourth. The body part distributions are similar between Anatinae/Aythyinae and Cygninae groups.

Fort Garry presents a fairly complete representation within Anatinae/Aythyinae, Cygninae, Columbidae, and Phasianidae. Anserinae is missing head/neck and lower leg portions (both low utility parts), while Meleagrididae is represented only by upper and lower wing and upper leg portions. The general pattern is one of upper wing dominance, with lower representation of upper leg and head/neck areas. The lower leg is consistently underrepresented, while the lower wing shows slightly better representation. This pattern is particularly noticeable within the duck family.

The Upper Fort Garry sample also displays an upper wing area dominance pattern, with the notable exception of Phasianidae (chickens), where the upper leg and upper wing are primary and secondary in importance. Columbidae is minimally represented by upper wing and trunk/tail elements. Corvidae appears to provide the most even body part representation.

Chi-square tests were run on the body part representations of the various bird families between the samples in order to test for homogeneity in body area representation. In some cases, small values of n or a high number of zeroes made this impossible. Yates' correction for continuity was carried out when more than two expected values were lower than 5 within a table more than 2 x 2.

The chi-square value for the Anatinae/Aythyinae body part comparisons between the three Postcontact samples is 17.916, which is not significant at $p=0.05$, $df=10$. The

Body part representation - Fort Garry
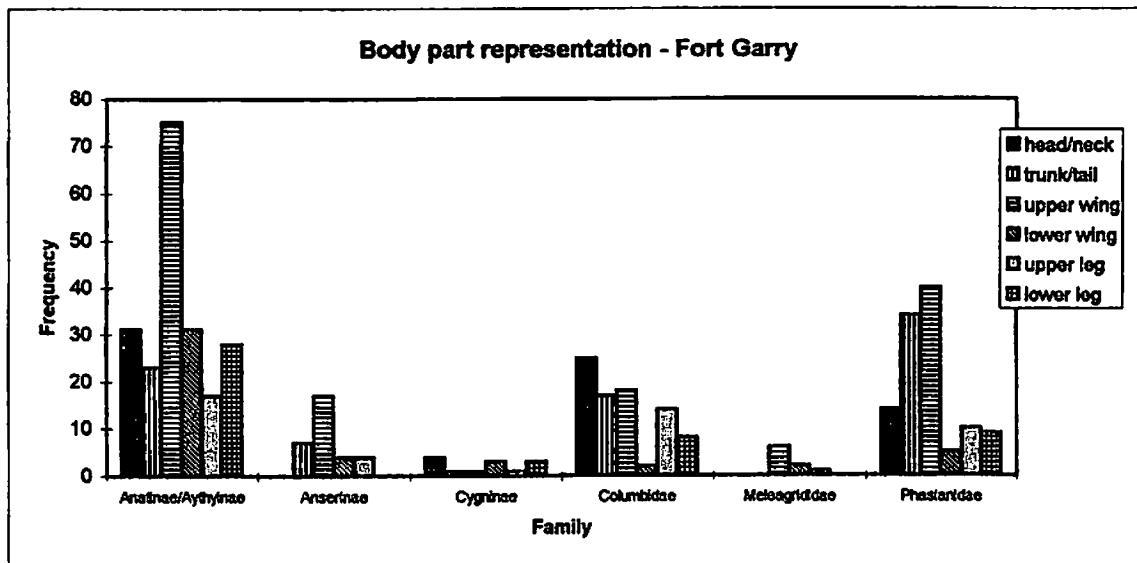
Figure 4.19 Histogram of body area frequencies in the Fort Garry sample, by avian family

Body part proportional representation - Fort Garry
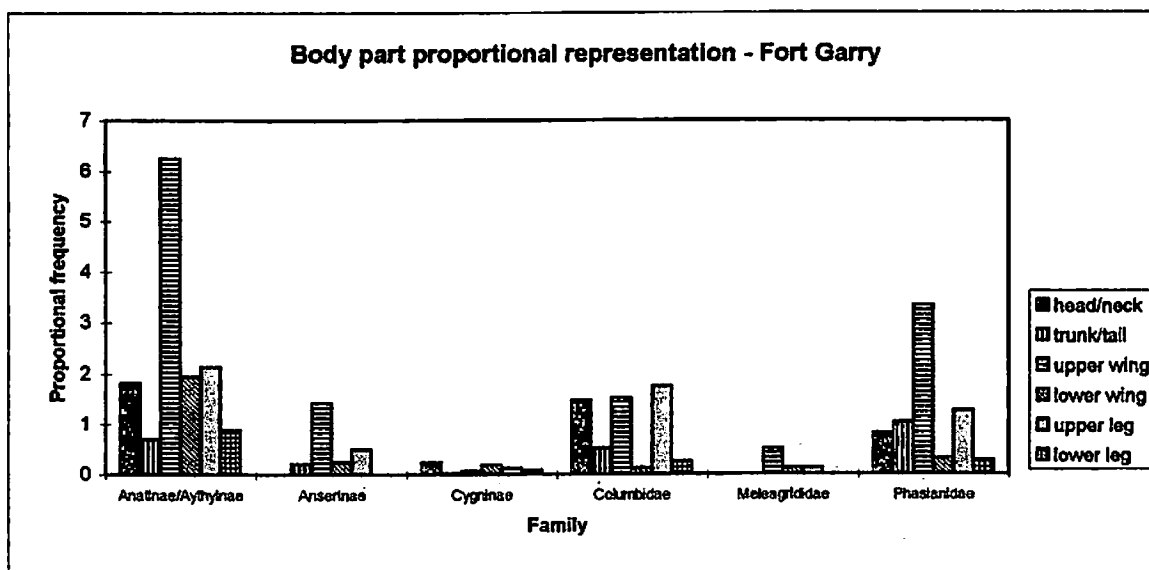
Figure 4.20 Histogram of proportional body area frequencies in the Fort Garry sample, by avian family

null hypothesis cannot be rejected and the samples can be considered homogeneous in their body area representation. Notably, the greatest disagreements (greatest O-E values) relate to the overrepresentation of wing elements within the Fort Garry sample. The duck family is consistently one of the "best represented" families within each sample, suggesting that this family was brought to the site area intact and possibly disposed of in a complete form.

The chi-square test for the goose family (Anserinae) was carried out for the Fort Garry and Upper Fort Garry samples. The resultant value, 10.2132, is not significant ($p=0.05$, $df=5$). This indicates that the body area representation of goose is fairly homogeneous between the two samples. The chi-square test result for Cygninae, between Fort Gibraltar I and Fort Garry, is 1.8833, which is also not significant ($p=0.05$; $df=5$).

The only chi-square test which resulted in a significant value (32.1337; $p=0.05$; $df=5$) is that of the body area representation for Phasianidae, conducted on the last two Postcontact samples. Predictably, the greatest differences here rest on the overrepresentation of upper leg values for the Upper Fort Gary sample and the lower trunk/tail values for this sample also. The overrepresentation of upper leg rather than upper wing is notably different from the other avian families and indicates a more intensive use of this area in chickens.

A brief summary and interpretation of patterns is provided here. The consistent overrepresentation of upper wing elements could be due to post-consumption waste of previously butchered carcasses. It should be noted, however, that these bones are often the largest, longest, and most robust of bird bones and therefore most resistant to density

mediated attrition (Lyman 1994b:449). The density and robusticity of bone affects the likelihood of survival following consumption by domestic dogs or other scavengers (Lyman 1994b:235-236). Head/neck, trunk/tail, lower wing and lower leg bones are generally smaller and/or more fragile. These characteristics could result in the complete destruction of elements by scavenging carnivores or render elements unidentifiable. The lower extremity bones are small but often quite dense and their absence could be due to the use of larger screen mesh sizes during excavation, as noted above.

The relative sizes of the families may also have affected relative presence. The largest individuals under consideration are Cygninae (swans) and Gruidae (cranes). It is notable that the swan family elements are more evenly represented, which may suggest little destruction of smaller and/or more fragile parts. The cranes (Gruidae) are represented only by lower wing and lower leg portions, suggesting butchery into smaller, more manageable portions. Generally speaking, birds are small enough that they would not have been dismembered prior to transport to the occupation site. Each of these samples, however, is the result of an incomplete excavation of the occupation. Butchering would have taken place prior to consumption and the deposit of these uncooked, discarded portions and the cooked, consumed portions could have been in distinct, discrete locations.

The smallest bird, Columbidae (pigeons), is represented quite completely within the Fort Garry sample but unevenly within the Upper Fort Garry sample. It is possible that the breast meat was all that was readily usable on this species (*Ectopistes migratorius*). Stripping of the breast meat could have resulted in the subsequent discard

of skeletally complete specimens (i.e. the Fort Garry sample) or involved the association with sternum and upper wing bones, as is the case within the Upper Fort Garry sample (sternum, coracoid, scapula, humerus).

The underrepresentation of vertebrae and ribs is notable. Most of the identified trunk/tail specimens are from the sternum, anatomically linked to the pectoral girdle through the coracoid. Excluding the sternum specimens would drop the trunk/tail representation further. The underrepresentation of the vertebrae and ribs could be due to: density mediated attrition - particulary consumption by carnivores; a post-consumption pattern of discard, with meat content focused on the upper wing, upper leg, and sternum. As determined through an examination of axial/appendicular elements using the entire avian assemblages, the underrepresentation of vertebrae is not due solely to the lower degree of identifiability of these elements.

4.2.ii Butchering Marks, Thermal Alteration, and Carnivore Chewing on Avian Bone

The examination of butchering marks, thermal alteration, and carnivore chewing can aid in determining the potential causes of the element/body part representations discussed in section 4.2.i. Percentage frequencies of butchering marks, thermal alteration, and carnivore chewing are presented in Tables 4.18 to 4.21.

Blackduck Sample

Butchering marks and carnivore chewing are absent from the Blackduck sample.

Table 4.18 Percent NISP of bird specimens identified to the family level that show butchering marks, heat alteration, and chewing

Sample	Butchering Marks	Heat Alteration	Chewed
Archaic	0	0	0
Blackduck	0	12.5	0
Fort Gibraltar I	5.26	0	2.63
Fort Garry	13.51	1.96	4.58
Upper Fort Garry	2.62	0	0.44

Table 4.19 Percent NISP of bird specimens with butchering marks, by family and sample

Family	Fort Gibraltar I	Fort Garry	Upper Fort Garry
Anatinae/Aythyinae	6.67	14.83	0
Anserinae	0	18.75	14.29
Cygninae	7.69	15.38	0
Columbidae	0	8.54	0
Phasianidae	0	17.86	2.44
Gruidae	n/a	n/a	25

Table 4.20 Percent NISP of bird specimens showing heat alteration, by family and sampl

Family	Blackduck	Fort Gibraltar I	Fort Garry	Upper Fort Garry
Anatinae/Aythyinae	12.5	0	2.87	0
Columbidae	14.29	0	0	0

Table 4.21 Percent NISP of bird specimens showing chewing, by family and sample

Family	Fort Gibraltar I	Fort Garry	Upper Fort Garry
Anatinae/Aythyinae	0	1.91	0
Anserinae	0	21.88	0
Cygninae	7.69	7.69	0
Columbidae	n/a	2.44	0
Meleagrididae	n/a	22.22	0
Phasianidae	0	4.46	0.81

One cervical vertebra (black duck/mallard) and one tibiotarsus (passenger pigeon) are charred. Their presence does not radically affect any interpretation of this small assemblage. The Blackduck sample includes material from hearths and likely represents food remains. The inconsistent charring serves to reinforce the interpretation that these are subsistence remains rather than natural deposits.

Fort Gibraltar I Sample

Two identified specimens within the Fort Gibraltar I sample exhibit butchering marks: one incomplete, chopped *Anas* sp. humerus and one cut/sawn incomplete left *Olor* sp. tibiotarsus. The humerus may have been chopped during removal of the wing from the body/pectoral girdle. The cut mark on the tibiotarsus suggests meat removal or disarticulation. Unfortunately, lack of information regarding location and orientation of butchering marks limits the analysis.

The Fort Gibraltar I sample also contains a number of heated bones, including a complete tibiotarsus (Anseriformes), incomplete vertebra (Anatidae), proximal ulna (Anatidae), central tibiotarsus fragment (Anatidae), Charadriiformes left furculum fragment, and Galliformes left tibiotarsus fragment. The limited taxonomic identification reduces the utility of this information, which only serves to support the interpretation that the waterfowl were probable subsistence items.

Fort Garry Sample

The Fort Garry sample is the most intensively butchered, as measured by the large

number of butchering marks. Twenty-seven of sixty-one butchering marks are noted on ducks (Anatinae/Aythyinae), with twenty of these (74.07%) located on the upper wing and sternum. The bulk of these are located on complete elements and are surficial cuts, suggesting that they occurred during meat removal/consumption.

Seven cut marks occur on goose (Anserinae) bones, including sternum, furculum, humerus, and femur. The most intensive butchering is again focused on the sternum/upper wing area and on the upper leg, suggestive of consumption and/or meat removal.

Seven cuts occur on the passenger pigeon bones, again occurring on sternum, coracoid, humerus, and ulna (upper wing/sternum area), but also on the femur, tibiotarsus, and tarsometatarsus. Many of these cuts occur on complete elements, suggestive of meat removal/consumption. The marks on the proximal tibiotarsus and distal tarsometatarsus, however, are chop marks and indicate removal of the lower extremities which would also partially explain the patterning noted above.

Within the swan family, one cut occurs across the metacarpal process of the carpometacarpus and one across the proximal shaft of the tibiotarsus. The carpometacarpus mark, given its location close to the joint, may indicate disarticulation of the bone and removal of the lower extremities. The cut across the proximal tibiotarsus shaft may indicate meat removal during consumption.

Nineteen cuts occur on the Phasianidae (*Gallus* sp.) bones. Nine of the nineteen occur in the sternum/upper wing area. Four cuts occur on incomplete cervical vertebrae, suggesting removal of the head and neck. One cut across the dorsal surface of a rib is

likely due to meat removal during consumption. Cut marks on the sternum occur near both costal and coracoidal facets, possibly due to meat removal. Cut marks also exist on the coracoid, as well as a chop mark through the proximal scapula. This latter could be a byproduct of wing removal. The humerus appears to have been intensively butchered with four out of ten humeri bearing cut marks, principally across the shaft and probably due, again, to meat removal. Both radius and carpometacarpus bear cut marks on complete elements, while the leg, femur, tibiotarsus, fibula, and proximal tarsometatarsus all bear cut marks. Many of these elements are complete and the cut marks appear to be generally related to meat removal rather than disarticulation. Chop marks in joint areas are more likely a by-product of disarticulation.

All of the bird taxa identified at least to the family level appear to have been intensively butchered, particularly in comparison to the earlier samples. Additionally, the apparent intensive butchering within this sample may also be a function of interanalyst variability which affects the recognition and identification of butchering marks as it does taxonomic and element identification.

It is also interesting to note which elements and body areas do not exhibit butchering marks. Within the duck subfamilies, these are the skull, mandible, vertebrae, lower wing, and lower leg areas. This pattern also holds true for the remaining families excepting Phasianidae (which includes cuts on the vertebrae) and Meleagrididae (which exhibits no cuts at all). This pattern may indicate low-utility areas which were removed during primary butchery and/or contain little or no meat.

Few of the Fort Garry specimens exhibit evidence of heating, including only six

duck specimens, one pigeon ulna, and two leg bones of Phasianidae. Four of the six duck specimens, the pigeon element, and one of the chicken leg elements are calcined rather than charred, indicating longer exposure to high temperatures. Intensive burning may have been used as a means of garbage disposal and reducing odour.

The numbers of specimens exhibiting chewing marks is generally quite low (from 1.9 to 22.22% by family) and varies considerably from family to family. Within the duck subfamilies, only three specimens (1.44%) bear chewing marks - two humeri and one radius fragment. One of these also bears a cut mark and all are types of elements which do exhibit cut marks, suggesting that dogs or scavengers were taking - or were given - meal refuse following consumption by human occupants. Within the goose family, seven specimens (21.88%) were chewed, three of which also bore cut marks and all of which are elements which generally show butchering marks. Again, the pattern appears to be one of carnivores being provided with, or taking, the remains of meals.

Only two pigeon bones (2.44%) show chewing: one humerus fragment and one distal tarsometatarsus. The former may be meal remains but the latter is more likely to represent discard at the butchering stage. The butchering pattern appears to include the dismemberment of lower legs or, at least, does not include the consumption of these bones within the context of human meals. One swan bone (7.69%), a central tibiotarsus fragment, shows chewing and is also cut, again suggesting that dogs were perhaps given the remains of meals. Two turkey bones (22.22%), neither of which show butchering marks, have been chewed, one a proximal scapula and the other a proximal humerus. The pattern of cut marks on other families suggests that these may also represent the

remains of meals of the human occupants. Within the chicken family, five specimens (4.46%) show chewing. None of these show cut marks and two specimens which have been chewed (innominate fragments) do not show cut marks in any family. Again, the pattern is one of dogs/scavengers eating kitchen garbage - discard from human meals. Interestingly, those families which are most intensively butchered (ducks and chickens) exhibit the lowest percentages of chewed specimens.

Upper Fort Garry Sample

Relatively few of the Upper Fort Garry bird remains exhibit butchering marks, heating, or chewing. Families with evidence of butchering are Anserinae (geese), Phasianidae (chicken), and Gruidae (cranes). Those without butchering marks include ducks (Anatinae/Aythyinae), swans (Cygninae), turkey (Meleagrididae), Scolopacidae, pigeons (Columbidae), and crows/ravens (Corvidae). The cut marks on the goose are both on the upper wing (humerus and radius). On the chicken bones, all three cut marks are located on complete or nearly complete tibiotarsi. These cut marks are consistent with meat removal patterns. The cut mark on the crane is on a complete carpal (scapholunar). As the crane family is represented only by one complete left carpometacarpus, one complete scapholunar, and one incomplete tibiotarsus, this appears to be an isolated incident. The cut mark across the carpal suggests disarticulation of the upper and lower wing and the deposit of the carpometacarpus and carpus as an articulated unit. None of the bird bone specimens within the Upper Fort Garry deposits show evidence of heating, while only one (a chicken distal tarsometatarsus) shows evidence of

chewing. This latter element is a low utility portion which may have been discarded prior to human consumption. The lack of intensive butchering, heating, and chewing within the Upper Fort Garry deposits is interesting. The lack of butchering marks may indicate that few portions of these birds were actually consumed. The selection of choice parts, such as the breast meat, may have been removed for consumption and the remains discarded. The Upper Fort Garry birds may have been cooked "whole". These birds may also have been the result of "shooting parties" in which birds were shot for sport, not consumption.

The lack of heating is surprising because the Upper Fort Garry deposits are within privies and without burning of the rubbish, the deposits would likely have been aromatic and unsanitary. Perhaps these deposits represent only a last deposit prior to burial, rather than the remains of an ongoing, maintained privy situation. The lack of dog chewing is consistent with privy deposits. The bird remains would have been deposited immediately prior to butchery/consumption and removed from the reach of dogs.

4.2.iii Fish Element Frequencies

Fish element frequencies were first examined at the class level. An examination of element frequencies at the class level was considered useful 1) to provide a general idea of the distribution of elements from sample to sample; 2) due to the low degree of taxonomic identifiability of many fish elements (e.g. rays, ribs, spines); and 3) due to the variability in completeness of identification of all potentially identifiable elements from sample to sample.

The large number of different elements within each fish makes element frequency comparisons difficult, so the fish elements were first grouped into body areas. The following body areas were used: head, trunk, appendicular, and unknown. The head included all cranial bones; trunk includes all vertebrae, ribs, undifferentiated rays and spines; appendicular includes pectoral and pelvic elements; "unknown" includes all those elements identified to fish but unidentified to element. The raw element frequencies per sample and taxon are presented in Tables 6 to 10, Appendix II.

Class Level

The data, compiled into body areas, are presented in Tables 4.22 and 4.23. Table 4.24 presents percentage data, excluding the "unknown" category. These data are presented graphically in Figures 4.23 and 4.24. Each body area incorporates varying numbers of individual elements. The samples can be compared, but over- or underrepresentations of body areas are not evident.

The most obvious pattern evident in Figure 4.23 is the variation in "unknown" and "trunk" categories between the first three and last two samples. The Archaic, Blackduck, and Fort Gibraltar I samples are dominated by a large percentage frequency of "unknown" elements, while Fort Garry and Upper Fort Garry samples contain much fewer "unknown" elements and are, instead, dominated by the "trunk" area. Less striking is the more even representation within the Fort Garry sample of head, trunk, and appendicular groupings, contrary to the apparent underrepresentation of the appendicular grouping evident in the other four samples.

Table 4.22 Body area frequencies (NISP) for fish

Sample	head	trunk	appendicular	unknown
Archaic	15972	28612	1701	59656
Blackduck	729	674	210	2765
Fort Gibraltar I	282	1172	119	2425
Fort Garry	307	1700	248	285
Upper Fort Garry	233	983	70	369

Table 4.23 Percentages of body area frequencies (% NISP) for fish

Sample	head	trunk	appendicular	unknown
Archaic	15.08	27.01	1.61	56.31
Blackduck	16.65	15.4	4.8	63.16
Fort Gibraltar I	7.05	29.31	2.98	60.66
Fort Garry	12.09	66.93	9.76	11.22
Upper Fort Garry	14.08	59.4	4.23	22.3

Table 4.24 Percentages of body area frequencies for fish (% NISP), unknown category excluded

Sample	head	trunk	appendicular
Archaic	34.51	61.82	3.68
Blackduck	45.2	41.79	13.02
Fort Gibraltar I	17.93	74.51	7.57
Fort Garry	13.61	75.39	11
Upper Fort Garry	18.12	76.44	5.44
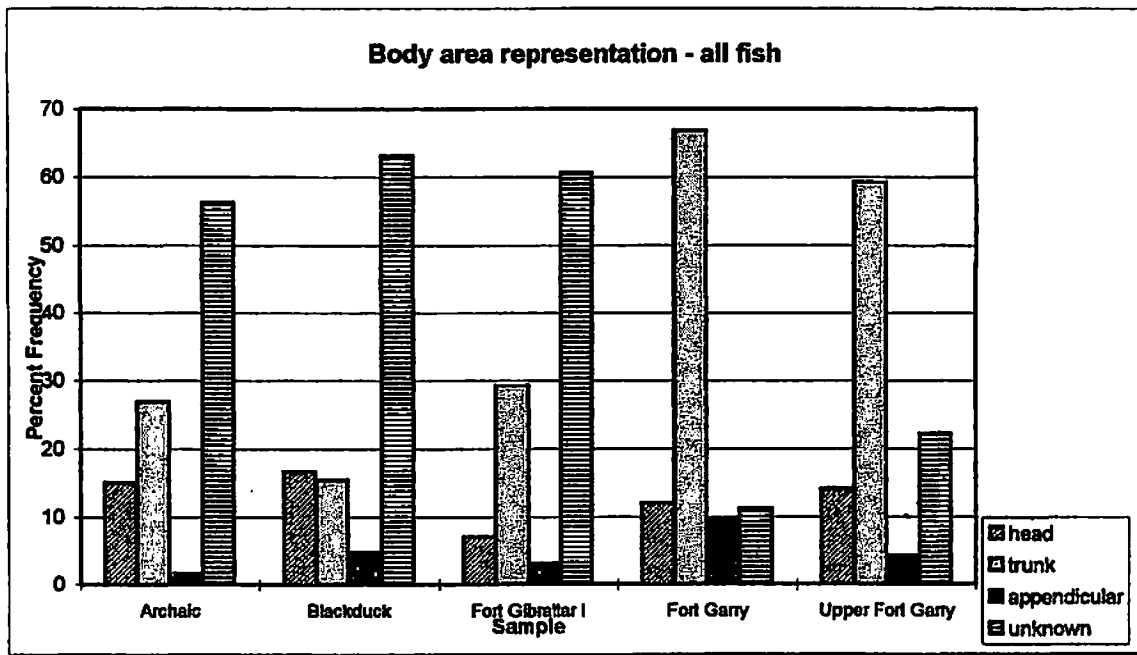
Figure 4.23 Histogram of body area representation (% NISP) for fish
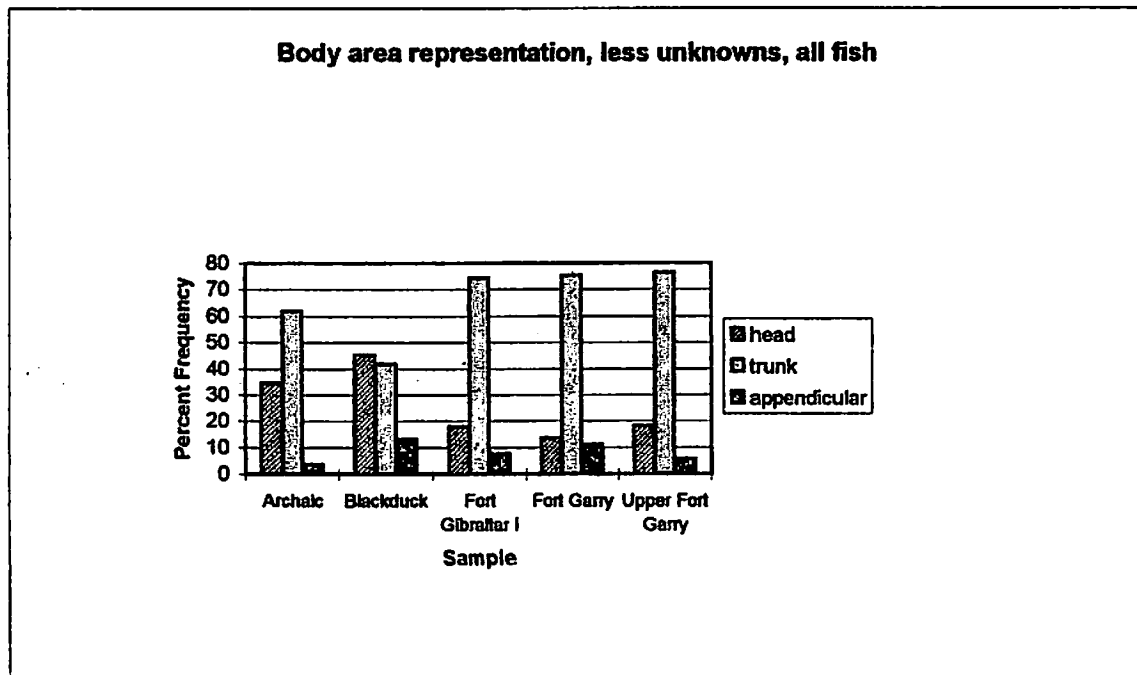
Figure 4.24 Histogram of body area representation (% NISP) for fish,
unknown category excluded

Figure 4.24 presents the body area percentages, discounting the "unknown" category. The striking dominance of trunk elements within the latter two occupations, viewed in Figure 4.23, now appears to have extended to the Fort Gibraltar I sample and, to a lesser extent, to the Archaic. The Precontact samples both exhibit a notable representation of cranial elements. Fort Garry maintains its more even representation of head and appendicular groupings. Considering the relatively few elements incorporated within the appendicular grouping, this suggests a surprisingly large number of appendicular elements and/or an extraordinarily small number of head elements.

The raw frequencies (NISP), grouped by body area, were used in a Spearman's rho test between samples ("unknown" category included). The Spearman's rho test should provide an indication of similarities in ranking of body areas between the samples. Table 4.25 presents the results of this test.

Table 4.25 Results of the Spearman's rho test for fish body area frequencies

	Blackduck	Fort Gibraltar I	Fort Garry	Upper Fort Garry
Archaic	+0.8	-0.4	+0.4	+0.8
Blackduck	----	-0.8	+0.2	+0.4
Fort Gibraltar I	----	----	-0.4	-0.2
Fort Garry	----	----	----	+0.8

None of the resultant values are significant at $n=4$, $p=0.05$, although the 0.8 values must be noted as strong correlations. The lack of significance is partially due to the small

n, which demands a perfect correlation ($r_s = 1.00$) for significance at p=0.05. These r_s values support the initial reading of the graphs. The two Precontact assemblages and the two later Postcontact assemblages are similar, while the Fort Gibraltar I assemblage is unique in body area representation - similar to the later Postcontact with a high trunk representation, but similar to the earlier samples with a high representation of unknowns.

The variable percentages of "unknown" specimens is problematic and the following three factors were considered as possible causes: screen size and consequent retrieval of small fragments, degree of fragmentation, and interanalyst variability. The first two factors were tested using Spearman's rho. Neither of the tests resulted in significant values, although correlations were noted between screen size and percent unknowns and between degree of fragmentation and percent unknown. Both screen mesh size and fragmentation may have had some influence on the variability in the percentage of unknowns within each sample. The Archaic, Blackduck, and Fort Gibraltar I samples show a tendency towards greater fragmentation and improved recovery due to smaller screen mesh size. Given the extreme variability in the quantity of "unknowns," further analysis was carried out excluding this category.

As noted above, the histograms in Figures 4.23 and 4.24 are useful for examining differences in overall patterning between the samples, but do not permit an examination of the over- or underrepresentations of certain body areas. In order to examine the variability in representation between the body areas, an "average" fish frequency was created for each of the body areas. In other words, the frequency of elements within each body area was calculated for one individual fish. This number was averaged for the

taxa present within the five samples. Resultant numbers were: head - 102; trunk - 194; appendicular - 18. These figures were used in a chi-square test, paired with the frequencies of body areas for each sample, in order to determine whether or not the difference between the "average" fish and the samples can be considered significant. The resultant chi-square values are: Archaic 3.9492, Blackduck 44.9781, Fort Gibraltar I 320.6551, Fort Garry 75.9432, Upper Fort Garry 32.2834. At p=0.05 and df=2, the critical value is 5.991. The Archaic sample cannot be considered significantly different from the "average fish" in terms of body area proportion, while the remaining samples are significantly different.

The percent frequencies of the body areas per sample are presented graphically in Figure 4.25, which includes the percent frequencies of an "average" fish as used in the chi-square test, above. The three Postcontact samples exhibit very close patterning, with lower head and appendicular representations and larger trunk representation. The trunk area is where the bulk of the fish flesh is located and this pattern of representation suggests either post-processing and/or post-consumption waste, with the initial fish processing (head and pectoral fin removal) carried out elsewhere. The Blackduck pattern is closer to a butchering/processing site pattern, with heads being removed and discarded and bodies processed and removed. The low appendicular count may indicate that the pectoral/pelvic fins were not removed with the head during the initial processing. The similarity between the Archaic sample proportions and those of the "average" fish is evident in this graph. This does not agree with a butchering/processing area disposal pattern nor with a consumption site pattern. The pattern may be due to the natural death
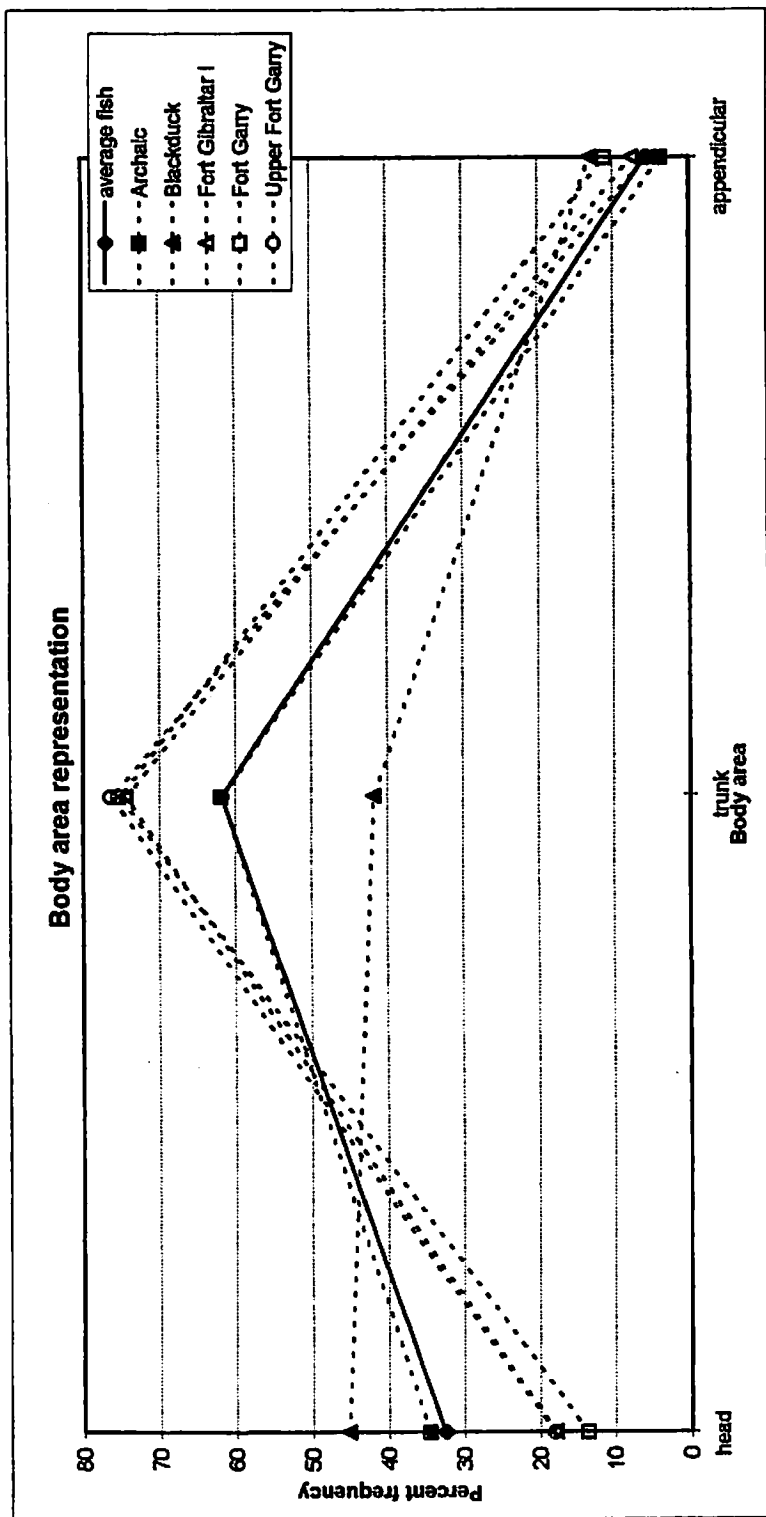
Figure 4.25 Fish body area representation by percent frequency for each sample and compared to body area representation of an "average" fish

of fish during a flood episode, but the extreme representation of one taxon (Catostomidae) and the existence of other butchering and cultural evidence argues against this. Alternatively, the pattern may indicate that so many fish were procured at one time that it was not possible to process all of them before they spoiled and, consequently, many were not processed at all. Yet another possible explanation is that the treatment of fish for drying and/or smoking involved stripping the flesh from the carcass (filleting), which would result in the discard of the skeleton, with head intact. This is a distinct possibility and suggests that the large numbers of fish procured were being preserved for future consumption.

Family Level

Analysis continued at the family level. The grouping of the element frequencies into body areas was again carried out. The percent frequencies for each body grouping, by sample, are presented graphically in Figures 4.26 to 4.30. The body area groupings are head, trunk, pectoral, pelvic, and unknown. Again, while these graphic representations are useful for examining the patterns within the samples, they do not show under- or overrepresentation of body areas. It should be remembered when viewing these that the average number of elements within these groupings is quite different - highest for the trunk area, lowest for the pelvic and pectoral areas.

Figure 4.26 presents the body area proportions for each family within the Archaic sample. Acipenseridae, Gadidae, and Hiodontidae are particularly small sample sizes, in which Gadidae and Hiodontidae are represented only by cranial elements. The
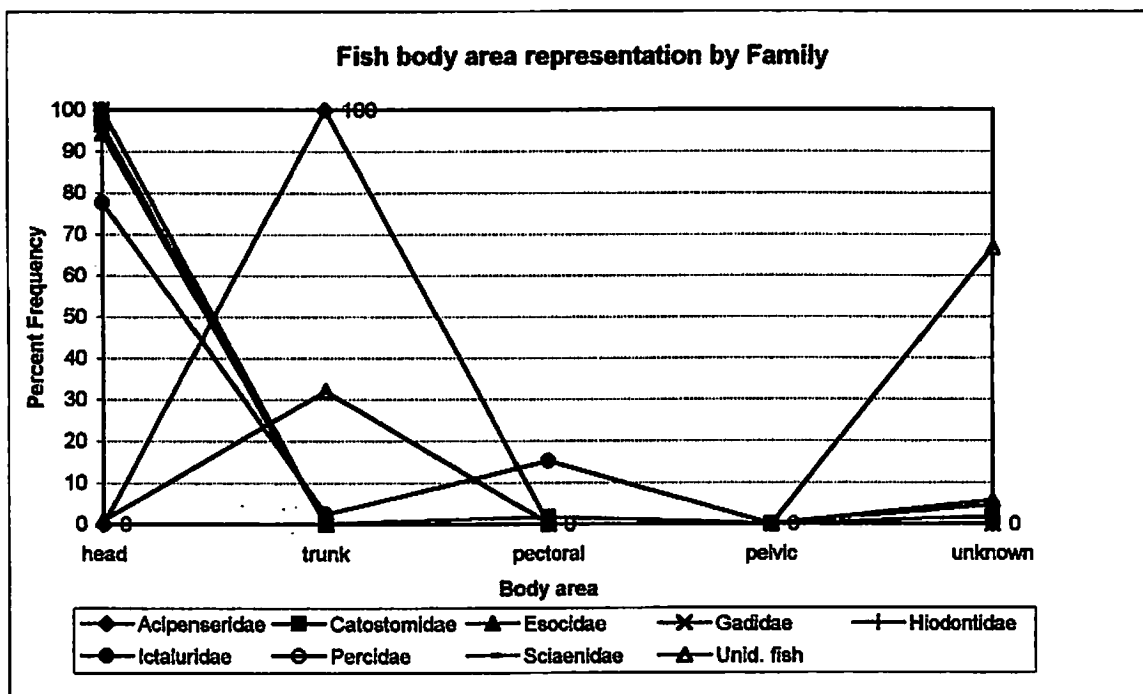
Figure 4.26 Fish body area representation (% NISP) in the Archaic sample, by family
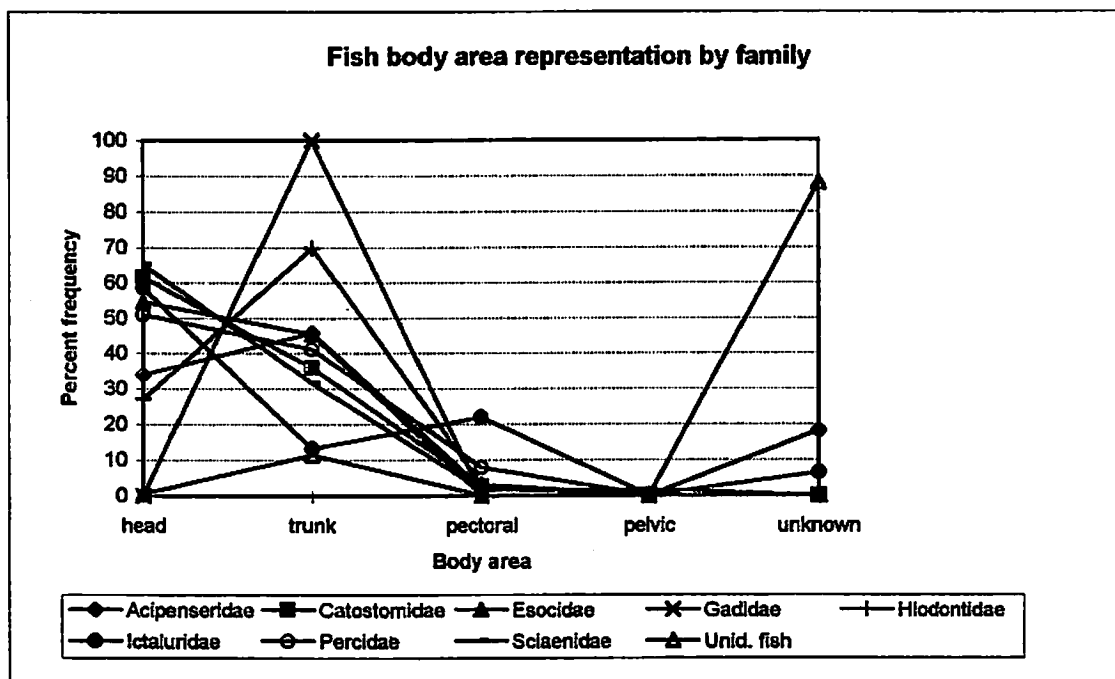
Figure 4.27 Fish body area representation (% NISP) in the Blackduck sample, by family

overwhelming pattern is one of high head representation in all but two taxonomic groups - Acipenseridae (represented only by scutes) and unidentified fish. Conversely, the bulk of the trunk elements are represented within the unidentified fish category. This patterning is in apparent contradiction to the class level pattern (see Figure 4.25) for the Archaic, of a body area representation close to that of the "average" fish. This apparent contradiction is due to the fact that the vertebrae were generally not identified beyond the class level, thus any further analysis of element frequency is difficult. It is interesting to note, however, that the pectoral representation is quite high for Ictaluridae. This may be due to the addition of a highly identifiable pectoral element - the pectoral spine - and/or to a difference in butchering pattern for these fish. Glands are located at the base of the pectoral spine in catfishes which cause pain or irritation when wounded by the sharp points on the spine (Dolan 1960). This effect of the pectoral spine may have encouraged the removal of the pectoral spine or entire pectoral fin prior to further handling - perhaps with the removal of the head.

Figure 4.27 presents the body area percentages for each fish family within the Blackduck sample. Esocidae, Gadidae and to a lesser extent Hiodontidae have small sample sizes and their body area distributions may not be truly representative. Acipenseridae is represented only by scutes and head bones. The "unidentified" fish category again contains many vertebrae, but not to the extent of the Archaic sample. The distribution of body areas for the remaining families follows roughly the class level pattern (Figure 4.24). Hiodontidae and Gadidae, however, show notably higher trunk values. This may indicate that these fish were not caught at this site, but brought in from

elsewhere. However, as noted above, they have very small sample sizes and thus may not be accurately represented within this assemblage. Ictaluridae show high head representation, very low trunk representation, and a notably higher pectoral percentage. This suggests that the heads and pectoral fins were removed and discarded within the site, while the meat on the vertebrae may have been removed for consumption elsewhere - either at a different area within the site which was not sampled, at another site, or were processed (dried/smoked) for future consumption. The remaining families (Catostomidae, Esocidae, Percidae, and Sciaenidae) all exhibit a pattern of high head element representation and low trunk representation. This again suggests that the results of primary butchering, at least, were recovered from the site while the remainder were deposited elsewhere or consumed by scavengers.

Figure 4.28 presents the data for the Fort Gibraltar I sample. The situation is similar to that of the Archaic sample. Figure 4.25 presents a pattern of low head, high trunk, low appendicular representation, while Figure 4.28 presents a pattern wherein most families have high head and low trunk representation. The reason for this is, as with the Archaic, that the vertebrae have not been identified past the class level. Interestingly, the Ictaluridae pattern of high pectoral representation is even more pronounced within this sample, possibly due to the depression of the trunk numbers. This pattern of higher pectoral representation is also evident within the Esocidae, Catostomidae, and Sciaenidae, but less so within the Percidae. This may suggest a pattern of removal of the pectoral fin with the head for most of these families.

The class level pattern for the Fort Garry sample is one of low head, high trunk,
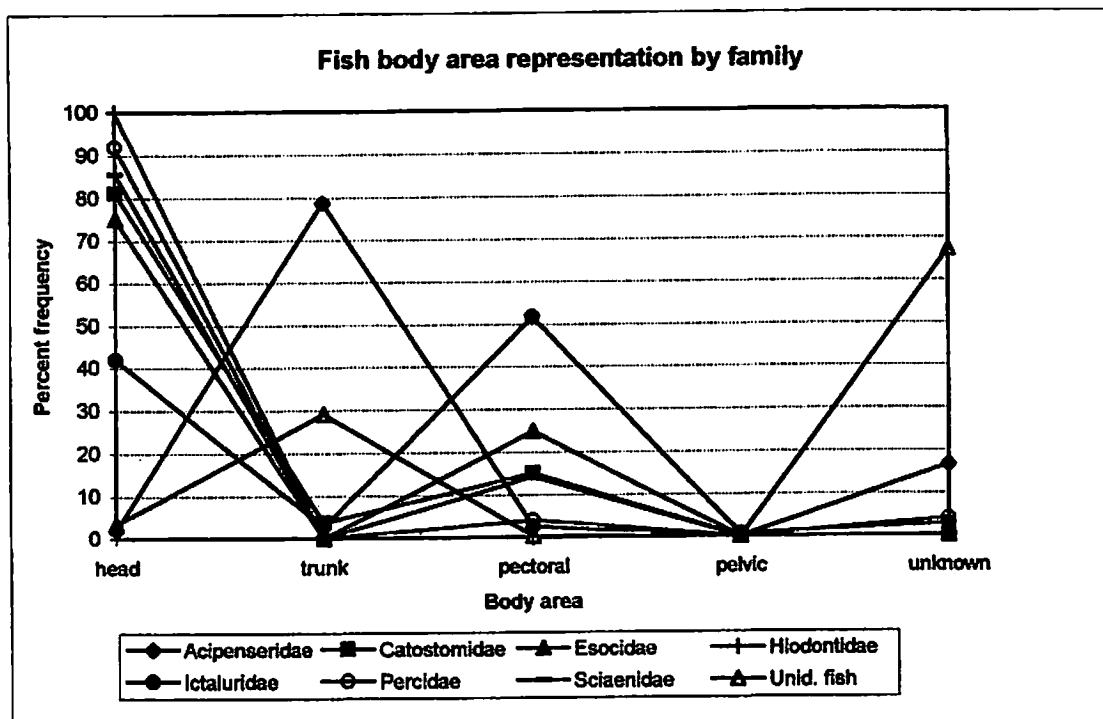
Figure 4.28 Fish body area representation (% NISP) in the Fort Gibraltar I sample, by family
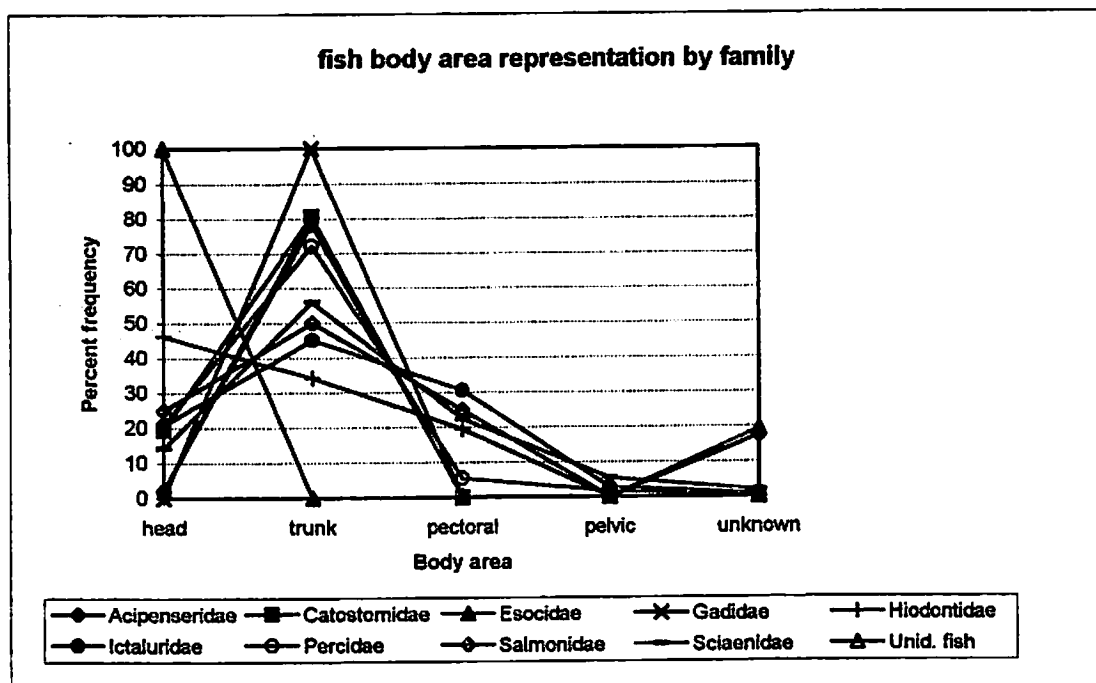
Figure 4.29 Fish body area representation (% NISP) in the Fort Garry sample, by family

and low appendicular representation. Figure 4.29 presents the family data for this sample, which clearly shows this general trend continuing for the bulk of the families. The notable exceptions are Esocidae, which is represented only by head elements, and Hiodontidae, which also has higher head, lower trunk, and more or less "typical" pectoral representation. While Esocidae is represented only by two specimens and this pattern cannot be viewed as representative, Hiodontidae is represented by a substantial number of specimens. This low trunk percentage could be due to a number of factors - the small size of the vertebrae which could pass through a 1/4" screen mesh; consumption destruction also due to their small size; the use of whole fish due to their small size.

Salmonidae and Gadidae are also represented by few elements and their body area patterning cannot be viewed as representative. Within the remaining families, the pattern is split into two groups. Catostomidae and Percidae have very low head, high trunk, and low pectoral representation, suggesting that primary butchering was carried out and discard deposited elsewhere. Sciaenidae, Salmonidae, and Ictaluridae, on the other hand, do not present such an exaggerated pattern. The pattern of low head values, higher trunk values, and low pectoral values is present, but not to the same extent as with the foregoing. It is possible, therefore, that some of these fish were present as entire carcasses.

Figure 4.30 presents the data for the Upper Fort Garry sample, showing much less obvious patterning than all the other samples. Many of the vertebrae do not appear to have been identified past the class level, so that the high trunk representation apparent in Figure 4.25 is not clearly apparent within Figure 4.30. Ictaluridae data show high
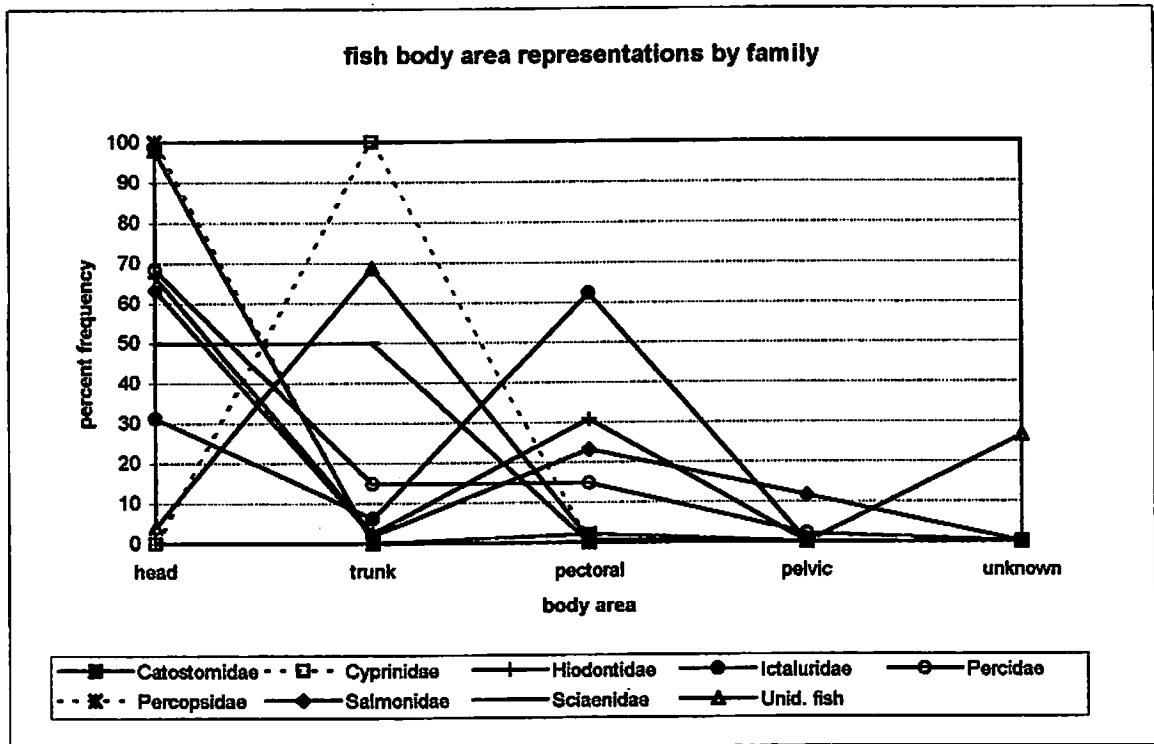
Figure 4.30 Fish body area representation (% NISP) in the Upper Fort Garry sample, by family

representation of the pectoral region. Percidae, Salmonidae, and Hiodontidae present similar patterns, with high head frequencies and relatively high pectoral frequencies also, suggesting that pectoral regions were removed with heads. Sciaenidae shows a higher trunk representation, possibly due to the ease of identifiability of these elements.

Variability in body part representation for each family and sample was examined. Figures 4.31 to 4.35 present these data as percentages for Catostomidae, Hiodontidae, Ictaluridae, Percidae, and Sciaenidae. The percentage representations of "average" fish are included for comparison. These percentages vary slightly from taxon to taxon due primarily to the variation in the number of vertebrae. It is unfortunate that the vertebrae were not always identified, making any butchering analysis rather difficult. A quick look at Figures 4.31 to 4.35 shows clearly that the trunk representation for the Archaic and Fort Gibraltar I samples and, to a great extent, the Upper Fort Garry sample is extremely low due to this lack of vertebral identification.

Figure 4.31 presents the data for the suckers (Catostomidae), showing a clear overrepresentation of trunk elements and low representation of head and appendicular elements within the Fort Garry sample. Within the Blackduck sample, the head is overrepresented and the trunk and appendicular regions are underrepresented. The Blackduck seems to represent a site of waste disposal following initial butchery, while Fort Garry represents the remains of filleting of fish or, perhaps, post-consumption waste.

Figure 4.32 presents the data for Hiodontidae. The Blackduck results are very close to those of an actual fish. This is not surprising given the small size of mooneyes/goldeyes relative to other fishes. It is unlikely that these fish required much
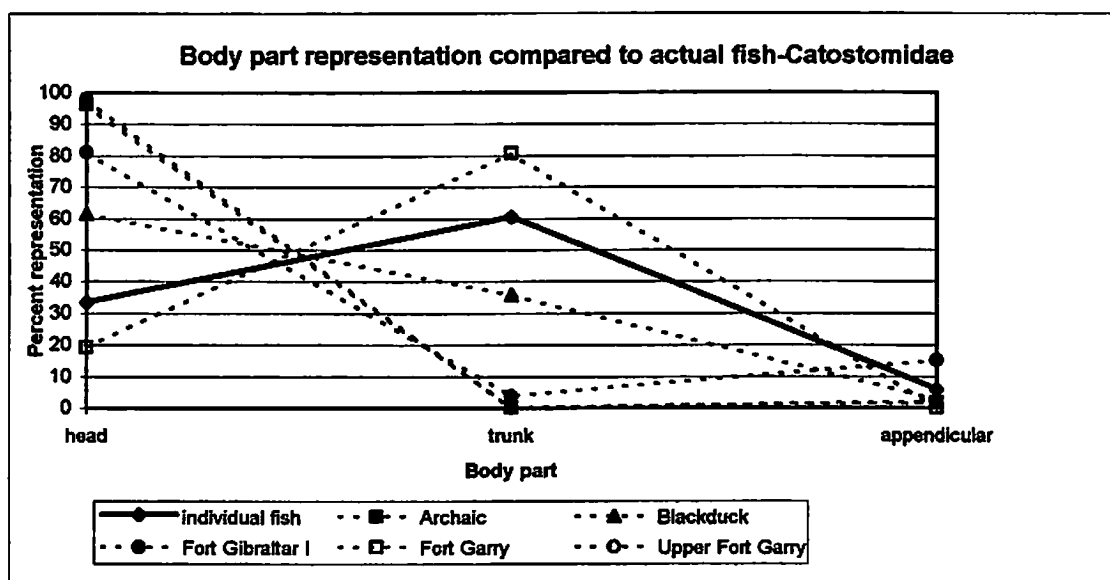
Figure 4.31 Catostomidae body area representation (% NISP) by sample
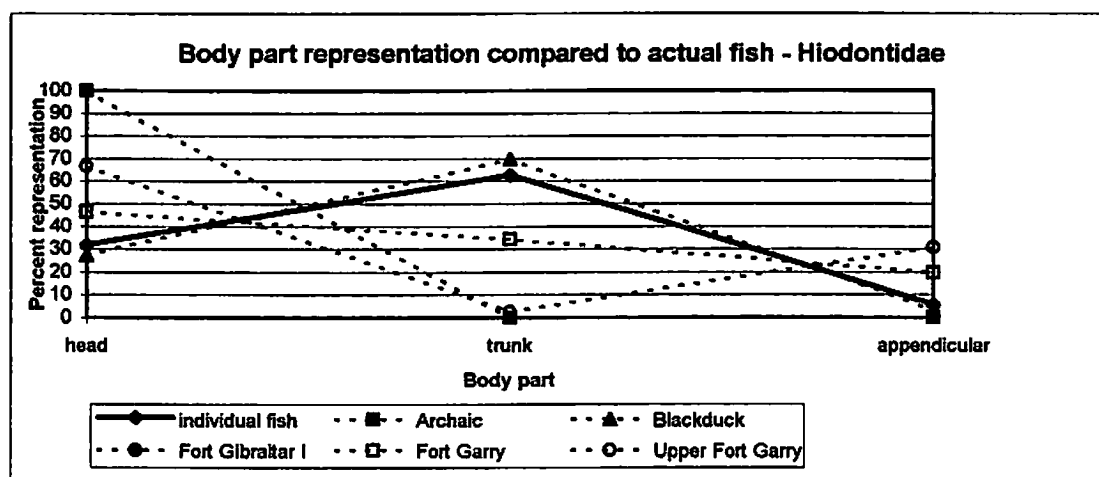
Figure 4.32 Hiodontidae body area representation (% NISP) by sample

processing prior to consumption. These fish were likely caught and consumed at the site. The Fort Garry sample, however, presents a higher head, higher pectoral, and lower trunk representation. This may be due to loss through large screen mesh or size-mediated destruction. The Upper Fort Garry sample, although skewed by the lack of trunk identifications, may also have had a similar pattern, and, interestingly, was also excavated using large screen mesh size.

Figure 4.33 presents the Ictaluridae data. All samples show a high appendicular representation. This could be attributed to the purposeful removal of the pectoral spine. The Blackduck sample shows a dramatic underrepresentation of trunk elements, compared to a fairly natural head representation and high pectoral representation, suggesting the results of primary butchering. Perhaps the Ictaluridae were again being processed for future consumption. The Fort Garry sample shows high appendicular representation.

Figure 4.34 presents the data for Percidae. The Fort Garry distribution is close to that of the original fish, although with a slight overrepresentation of trunk elements and low head elements. The Blackduck again shows a similar pattern of higher head and lower trunk representation, again suggestive of primary butchering and removal of the high utility areas. Upper Fort Garry presents a pattern of high head, high appendicular, and low trunk representation which is closer to a pattern expected of primary butchering.

Figure 4.35 presents data for Sciaenidae. The Fort Garry sample pattern is similar to that of the other families, with a low head and higher trunk value. The high appendicular value may be due to the easily identified, dense elements of the anal fin. This pattern suggests that the results of primary butchery were discarded elsewhere and
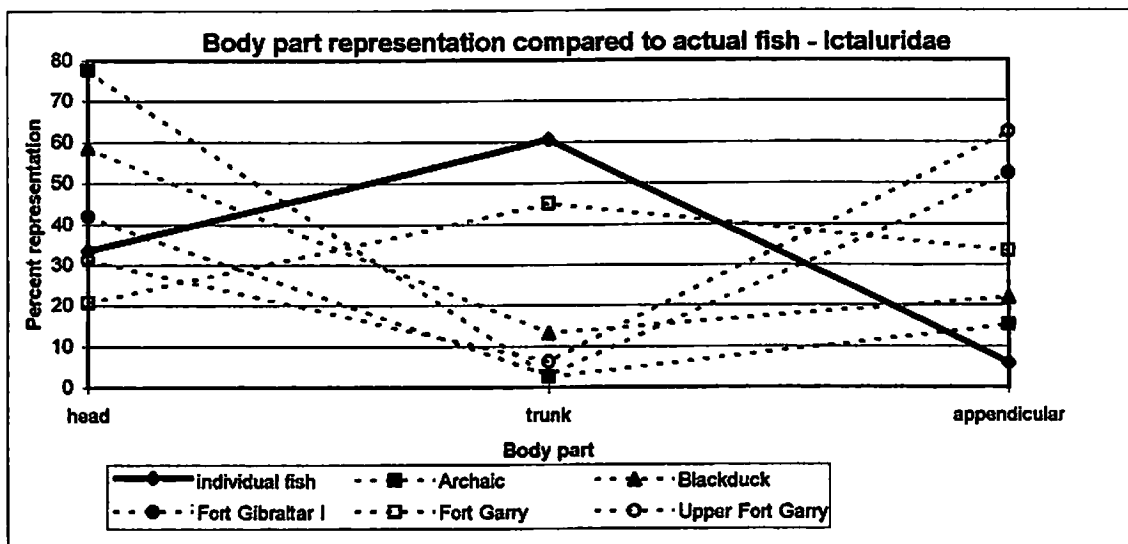
Figure 4.33 Ictaluridae body area representation (% NISP) by sample
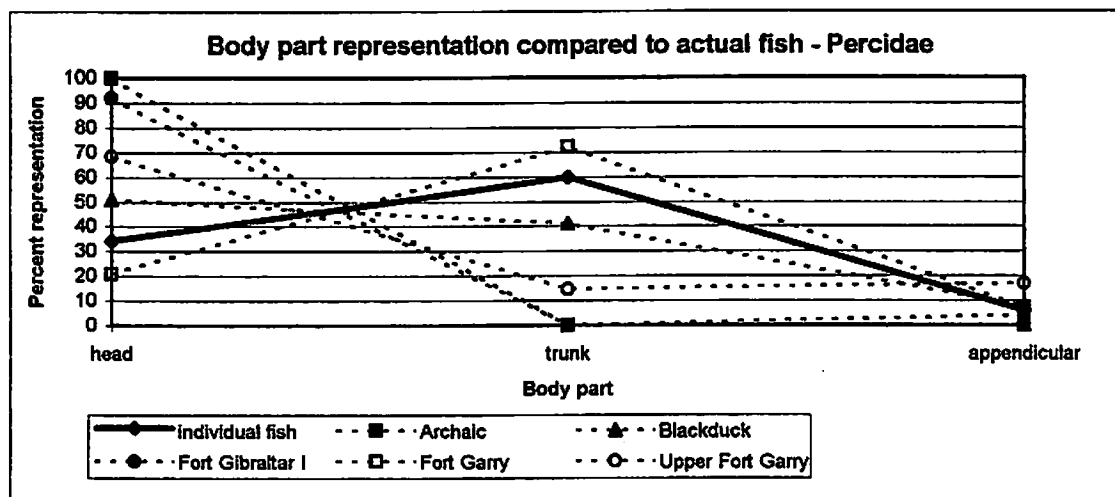
Figure 4.34 Percidae body area representation (% NISP) by sample
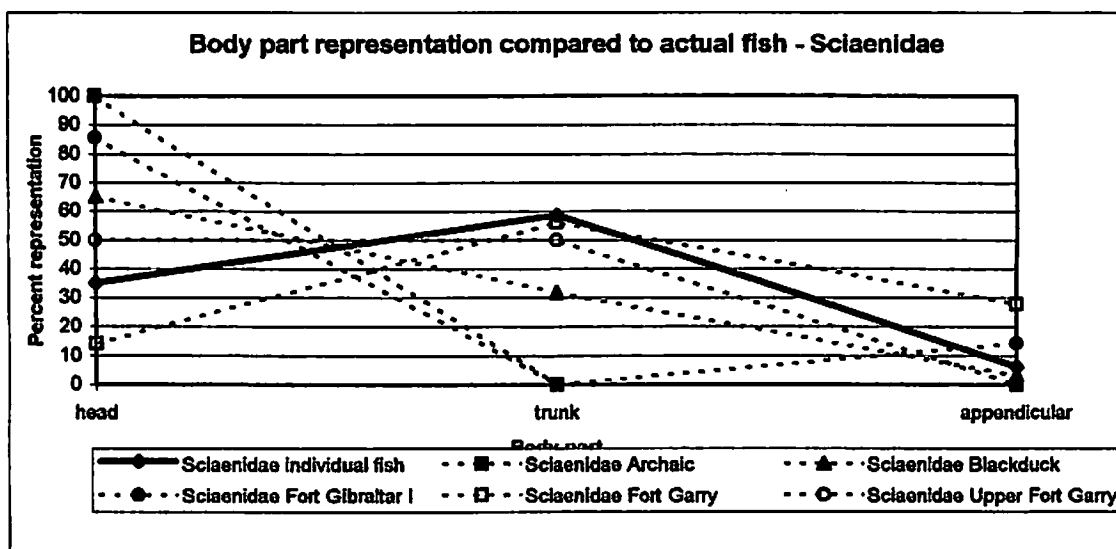
Figure 4.35 Sciaenidae body area representation (% NISP) by sample

these may be the remains of further processing or consumption. The Blackduck sample shows a pattern of high head and low trunk elements, suggesting that these fish were consumed elsewhere or processed for future consumption. In both of these cases, it appears as if the anal spine was transported with the trunk and was not removed during initial processing. The Upper Fort Garry sample presents a pattern of high head, slightly lower trunk, and low appendicular representation. It is not, however, as dramatically different as the other families. The body area representations of each family were subjected to the chi-square test, in paired tests of samples. The results are provided in Table 4.26. The tests should indicate the homogeneity, or lack thereof, in the proportional representations of body areas.

Table 4.26 Results of the chi-square test for fish family body area representation

Catostomidae

	Fort Gibraltar I	Fort Garry	Upper Fort Garry
Blackduck	18.12171*	12.75862*	20.74164*
Fort Gibraltar I	----	50.44333*	4.46241
Fort Garry	----	----	54.17034*

Ictaluridae

	Fort Gibraltar I	Fort Garry	Upper Fort Garry
Blackduck	68.50778*	87.26388*	13.07329*
Fort Gibraltar I	----	76.58943*	1.183379
Fort Garry	----	----	9.06033*

Percidae

	Fort Gibraltar I	Fort Garry	Upper Fort Garry
Blackduck	15.2386*	19.18862*	13.25817*
Fort Gibraltar I	----	58.15592*	7.638562*
Fort Garry	----	----	83.24285*

Hiodontidae

	Fort Garry	Upper Fort Garry
Blackduck	16.91825*	37.49186*
Fort Garry	----	16.37098*

Sciaenidae

	Fort Gibraltar I	Fort Garry	Upper Fort Garry
Blackduck	1.549448	89.84899*	3.291761
Fort Gibraltar I	----	21.31599*	0.895408
Fort Garry	----	----	0.266859

Unidentified Fish

	Blackduck	Fort Gibraltar	Fort Garry	Upper Fort Garry
Archaic	0.835496	169.4912*	2.917149	22.02894*
Blackduck	----	14.12394*	0.680969	3.104154*
Fort Gibraltar	----	----	62.99266*	17.77752*
Fort Garry	----	----	----	17.45582*

It is apparent from these chi-square test values that few of the body area representations are similar. It is evident that the Fort Gibraltar I and Upper Fort Garry samples are more often similar in this characteristic, while Sciaenidae (freshwater drum) is most likely to exhibit a similar patterning from sample to sample.

4.2.iv Butchering Marks, Thermal Alteration, and Carnivore Chewing on Fish Bone

Carnivore Chewing

There is very little evidence of carnivore chewing (i.e. punctures, grooves) on the fish bone from any of these samples. Table 4.27 presents the data on chewing evidence. The percentage of the assemblage chewed ranges from 0.00% to 0.07%. None of the chewed specimens are from the fleshy trunk area, suggesting that scavengers or domestic dogs were given only those elements which were of little utility to the human inhabitants of the site. Studies (e.g. Wheeler and Jones 1989:69-74) have shown that fish consumption by carnivores is extremely destructive, leaving behind only a small proportion of the original sample. The chewed bones from the five Forks samples are all large, robust bones which have a better chance of survival. The small number of chewed bones suggests that destruction by carnivores was not a major source of taphonomic bias at these sites. The problem would be more severe for the smaller fishes (e.g. *Hiodon* sp.; *Coregonus* sp.) with smaller and generally less robust bones.

Table 4.27 Table of chewed fish elements

Sample	Taxon	Element	Percentage of sample chewed
Archaic	none		0
Blackduck	*Aplodinotus grunniens*	lepidotrichia	
Blackduck	*Ictalurus punctatus*	cleithrum	
Blackduck	*Ictalurus punctatus*	spine	0.07
Fort Gibraltar I	*Ictalurus* sp.	pectoral spine	0.03
Fort Garry	none		0
Upper Fort Garry	*Ictalurus* sp.	pectoral spine	0.06

Thermal Alteration

The degree of thermal alteration is quite variable from one sample to another. The two Precontact samples have very small percentages of thermally altered fish bone (Archaic - 0.9043%; Blackduck - 0.6167%). This is surprising given the large sample sizes, particularly for the Archaic sample. The two earlier Postcontact samples have notably higher percentages of burnt/calcined fish bone (Fort Gibraltar I - 9.85%; Fort Garry - 4.37%), although still only a small percentage of the total. The Upper Fort Garry sample contains 0% thermally altered fish bone. This is probably due to the use of the privies as midden deposits. The data suggest that there was greater likelihood of burning of refuse for the Postcontact period.

The percentage of unidentified fish which were noted as thermally altered is generally quite small. The largest percentage is within the Fort Gibraltar I sample, where 11.05% of the unidentified fish are noted as thermally altered. This suggests that thermal alteration was unlikely to have affected the identifiability of fish specimens except, perhaps, within the Fort Gibraltar I sample.

The percentages of thermally altered bone for each taxon within each sample were determined and Spearman's rho was calculated for paired samples in order to determine whether there was any similarity in the taxa which showed thermal alteration. Such patterning might be related to taxonomic differences in cooking or disposal of remains. Only two r_s values were significant ($n=7$; $p=0.05$) - that between the Archaic and Blackduck and that between the Blackduck and Fort Garry. The first of these was a strong, significant positive correlation, with Esocidae containing the highest percentages

of thermal alteration, followed by Catostomidae. The correlation between Blackduck and Fort Garry is a strong, significant, negative correlation. Within the Fort Garry sample, the taxa showing the greatest percentage of thermal alteration are Ictaluridae, Percidae, and Hiodontidae - those which are amongst the lowest in the Blackduck sample. The lack of correlation between other samples suggests a lack of consistency in dealing with these taxa.

Within each taxon in each sample, the percentage of thermal alteration was determined per body area. Given the small percentage of each assemblage altered, the patterning cannot be considered as very accurate. Within the Archaic sample, the bulk of the charring/calcination occurred on the head elements for identified fishes. Interestingly, the Ictaluridae pectoral areas were most frequently burnt, followed by head elements. This pattern shifts for the Blackduck sample, where each taxon exhibits greater charring/calcination within the trunk area, possibly indicative of post-consumption waste. The Fort Gibraltar I sample varies more dramatically from taxon to taxon. Ictaluridae again show a higher percentage of thermal alteration within the pectoral area, followed by the head. Percidae and Catostomidae, however, are primarily within the head area and, for Catostomidae, secondarily within the pectoral area. Within the Fort Garry sample, most taxa show most charring within the trunk area (Sciaenidae, Ictaluridae, and Percidae) suggesting burning of post-consumption waste, while Hiodontidae shows most charring within the head and pectoral areas, suggesting burning of discard.

Butchering Marks

Butchering marks - primarily cut marks - are present only on a small proportion of the fish assemblages. The percentages of the fish assemblages (less scales) which show butchering marks are: Archaic - 0.01%; Blackduck - 0.09%; Fort Gibraltar I - 0.03%; Fort Garry - 3.44 %; and Upper Fort Garry - 0.12%. Fort Garry exhibits the greatest intensity of butchering as measured by butchering marks, as is the case within the avian class.

The areas which show butchering marks should help in determining how the fish were butchered and the activities which resulted in the butchering marks. Of course, the number of butchering marks represents only a small portion of the butchering activities which would have occurred. In fact, it has been argued (Wheeler and Jones 1989:65) that butchers would attempt not to cut the bones as this would dull the tools they were using. A greater frequency of butchering marks, therefore, may not indicate a greater intensity of butchering.

For each sample, the percentage of butchered bone by body area was calculated (Table 4.28). The only sample in which the butchering marks are not focused on the head and/or pectoral area is Fort Garry, where 51.72% of the cut marks are found in the

Table 4.28 Percentages (% NISP) of butchered fish by body area

Sample	head	trunk	pectoral	pelvic
Archaic	30	10	60	0
Blackduck	50	0	25	0

Fort Gibraltar I	100	0	0	0
Fort Garry	6.9	51.72	19.54	8.05
Upper Fort Garry	0	0	100	0

trunk area. The focus on the head and pectoral area is not surprising, given the general process of removal of the head and filleting, which may leave marks on cleithra, postcleithra, and post-temporals. The cut marks on the trunk area may have resulted from filleting or transverse cuts might occur when dividing the fish into "steaks". The Fort Garry sample exhibits the greater frequency of cut marks and also the least amount of patterning of cut marks.

Within each sample, the frequency of cut marks varies with taxon. Within the Archaic sample, only the Ictaluridae and Catostomidae exhibit any cut marks and only 0.1% and 0.01% of each of these families' remains show cut marks. Within the Blackduck, only the Ictaluridae show butchering marks (0.34% of the sample). Fort Gibraltar I contains butchering marks on 0.03% of unidentified fish specimens, while Upper Fort Garry contains only 2.11% of Percidae showing cut marks. Fort Garry, not surprisingly, shows the greatest variety of taxa exhibiting cut marks. Within this sample, Salmonidae (25%), Catostomidae (19.23%) and Ictaluridae (14.41%) are the most intensively butchered, while the remaining four families all contain less than 10% butchered bone. The Fort Garry cut mark frequencies were examined in relation to average fish weight and length for each of the families under consideration. The Spearman's rho values were 0.0286 for length:%butchered bone and 0.3714 for

weight:%butchered bone. Neither of these are significant, indicating no correlation between the intensity of butchering and fish weight and/or length. These calculations were carried out using current "average" fish weights and lengths, however, which may not be representative of the populations exploited archaeologically.

Spearman's rho was used to test for correlation between the frequency of cut marks for each family within the Fort Garry sample and the sample size for each family. The resultant value of r_s was 0.5150, which is not significant ($n=6$; $p=0.05$) and indicates that there is no correlation between cut mark frequency and sample size.

Within each sample and each taxon, the actual location and orientation of cuts can assist in determining part of the butchering process. Within the Archaic sample, one "sawn" Catostomidae operculum may be a result of head removal prior to further processing. Within the Ictaluridae, the highest percentage of butchering marks occurs in the pectoral region, namely the pectoral spines and cleithra. It is suggested that both of these could have been caused by removing the head. The head area, specifically the dentary and frontal areas, also shows some butchering marks. There is no obvious reason for marks on these elements. Wheeler and Jones (1989:66) note that the dentary area may be chopped "in an attempt to retrieve a deeply swallowed hook." The trunk area is represented only by one dorsal spine. The removal of the head further back from the cleithrum/pectoral spine area may impact the dorsal spine, and the point of head removal may have varied.

Within the Blackduck assemblage, only Ictaluridae exhibit any cut marks. One of these is on the dentary, one on the ceratohyal, and one on the cleithrum. The

cleithrum mark may be due to decapitation, while the ceratohyal mark may be due to gutting the fish. Wheeler and Jones note (1989:66) that marks on the lateral surface of the cleithra may be due to filleting the fish and this may be the case here, although this does not explain the pectoral spine cuts.

Only one fish fragment within the Fort Gibraltar sample exhibits cut marks. This specimen, an unidentified "skull fragment", is noted as "cut/sawn".

The Salmonidae specimens within the Fort Garry sample exhibit the highest frequency of cut marks. This, however, is at least partially due to the small sample size of the *Coregonus* sp. within this sample. This high percentage of cuts actually includes only one post-temporal bone, bearing a longitudinal cut across its lateral surface. This could be due to decapitation or filleting.

Within the Fort Garry sample, Catostomidae exhibit the second highest percentage of cut frequencies (19.23% of the total Catostomidae sample). This includes, however, only six cut marks. The bulk of these occur on the vertebrae (4), with one on a rib. Cut marks on the vertebrae could be a by-product of filleting the fish.

Ictaluridae also have a high percentage of butchering marks (14.41%). Some of these mirror the previous catfish cut mark patterns. Coracoids and pectoral spines show cut marks, possibly due to the removal of pectoral spines or to decapitation. One dorsal spine has been split longitudinally, possibly due to halving the fish, perhaps in preparation for drying. One branchiostegal exhibits a saw mark through its distal end. The distal end of the branchiostegal coincides with the location of the cranial end of the cleithrum and, again, this likely indicates head removal. One dentary also shows cut

marks, perhaps for hook removal. The variation in the Ictaluridae pattern within this sample is, however, the focus on vertebrae. These cut marks are of varying types. One is a vertical chop through a vertebra - suggestive either of head removal or of subdivision of the fish into "steaks". The remaining vertebrae, where noted, show longitudinal cuts on the ventral surface. This may be due to splitting the fish or a by-product of filleting or gutting the fish.

Sciaenidae, of which 6.49% of the assemblage bears cut marks, also shows a focus on the trunk area. Cut mark percentages by area for this family are: 48.39% trunk, 25.81% pectoral, 22.58% pelvic, and 3.23% head. Within the trunk area, the most frequently cut elements are vertebrae, some of which are chopped rather than cut. One hypural has also been chopped, suggesting that the tail fin was removed. Within the pectoral area, pectoral spines, cleithra, postcleithra, and particularly supracleithra show cut marks. The cuts on the supracleithra occur on both medial and lateral surfaces, suggesting that these occurred during gutting and/or filleting process. The pelvic area exhibits cut marks on the anal fin spines and basipterygium, possibly during gutting. At least one of the interhaemal spines is split longitudinally, suggesting that fish were halved at some point in the process. The sole head bone bearing cut marks is a branchiostegal ray, with transverse cuts across the ventral surface - possibly during head removal or during the gutting/filleting process.

Only four Percidae (*Stizostedion* sp.) bones bear cut marks - three vertebrae and one supracleithrum. The cuts on the supracleithrum are transverse cuts across the lateral surface, again possibly the result of filleting the fish. The three vertebrae again show a

distinctive difference from the other samples. *Hiodon* sp. bones bearing cut marks are focused on the operculum, cleithrum, and postcleithrum. Again, this is likely to be due to the filleting process.

Only two Upper Fort Garry fish bones bear cut marks - one cleithrum and one supracleithrum of *Stizostedion vitreum*. These, again, are likely due to the filleting process.

The butchering marks appear to show a more-or-less consistent butchering pattern excepting that of Fort Garry, where many more of the trunk elements (primarily vertebrae) show cut marks. The remaining samples indicate a focus on the posterior region of the cranium and the pectoral area. These areas could be impacted both during head removal and/or filleting. The bulk of the cuts are probably due to filleting as the bones show slicing on the lateral surfaces and are not generally chopped through.

Few of the cut marks were recorded on fish specimens which had not been identified to taxon. The high incidence of cut marks on the cranial and pectoral areas in most of the samples may be a function of the identification process. These areas include elements which are more easily identified to taxon, encouraging a greater focus of the analyst's attention to these areas. The degree of attention paid to these areas might also result in a greater likelihood of recognition of butchering marks. Conversely, the lack of focus on vertebrae, ribs, and spines for taxonomic identification purposes might also have resulted in a lower likelihood of the recognition of butchering marks.

4.2.v Mammalian Element Frequencies

The analysis of mammalian element frequencies was approached slightly differently than the analyses of the bird and fish assemblages. An overall mammalian pattern was not examined because the differences among mammalian taxa are so great in terms of morphology, size, and potential use that the analysis would produce little useful information. The mammalian element frequencies were, instead, examined at the level of order and family. These two levels are discussed below, followed by a consideration of butchering marks, thermal alteration, and carnivore chewing evident on the bones within the mammalian assemblage. It should be noted, again, that due to the variability in cataloguing, identification, and analysis, the attempt to include all databases equally and evenly has meant that in some cases more detailed information has been under utilized. The element frequency data, grouped into body area, are presented in Appendix II, Tables 11-15.

Order Level

The mammalian specimen frequencies were grouped by body area, including head (skull, mandible, teeth, atlas, axis), trunk (ribs, vertebrae, sternum), upper fore (scapula, humerus, radius, ulna, clavicle), upper hind (innominate, femur, tibia, fibula, patella), and lower limb (tarsals, carpals, metapodials, phalanges, sesamoids). The "lower limb" group allowed for the inclusion of many elements which had not been identified to fore or hind.

The initial frequencies were "normed" to facilitate more meaningful comparisons

between taxa. This was accomplished by dividing the frequency per body area by the number of bones expected in that body area within one individual animal of that taxon. This resulted in a proportional representation for each body area. In this way, the representation of lower limbs of carnivores, for instance, could be compared with the lower limbs of an artiodactyl, free of the bias of a much higher number of bones within this body area for carnivores. These proportional body area representations were then expressed as percentages of representation by dividing the proportional frequency by the sum of the proportional frequencies for each body area and multiplying by 100. A complete representation of each body area would result in a proportional percentage of 20%. Variability in the representations of body areas of the archaeological assemblages should help in determining butchering processes and body area use patterns, while keeping in mind the potential biases created by taxonomic factors. Although this process is more complex than that used for "norming" the frequencies for fish and birds, it is necessary due to the variability in the number of elements between the different taxa.

Using these groupings and "proportional body area representations", the relative element frequencies were graphed by sample (Figures 4.36 to 4.40) and by taxon (Figures 4.41 to 4.44).

The Archaic proportional body area representations by order are presented in Figure 4.36. Rodentia (primarily *Castor canadensis*) and Lagomorpha both show incomplete representation, possibly due to discard of low utility parts. The high occurrence of Rodentia head representation may also be linked with the known use of beaver incisors as gouging and chiselling tools within the Precontact period. The
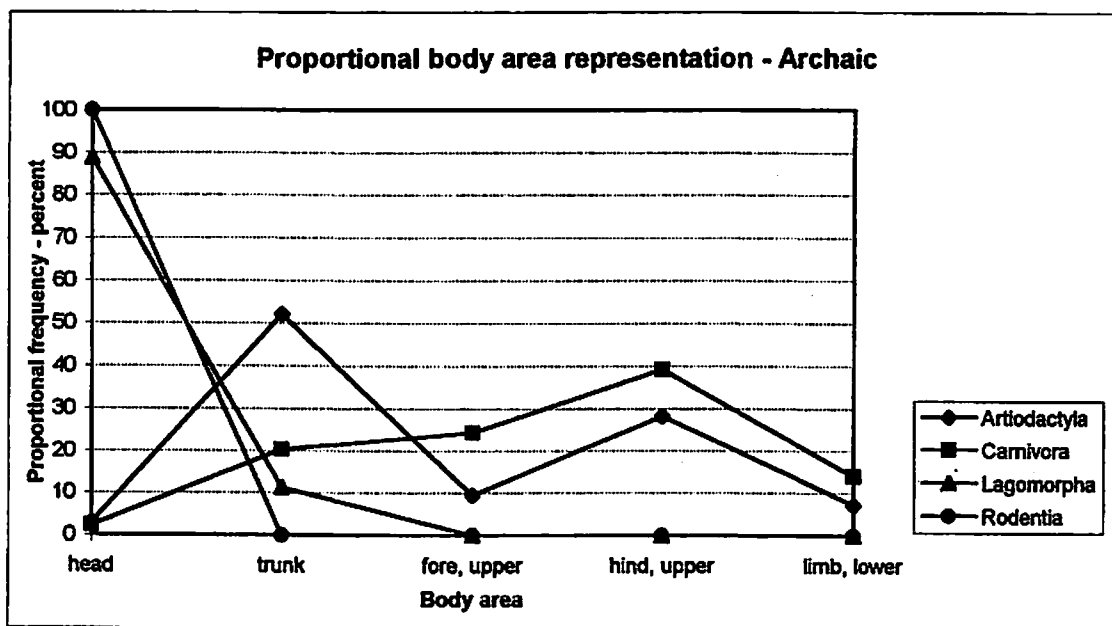
Figure 4.36 Proportional body area representation of mammals in the Archaic sample, by order
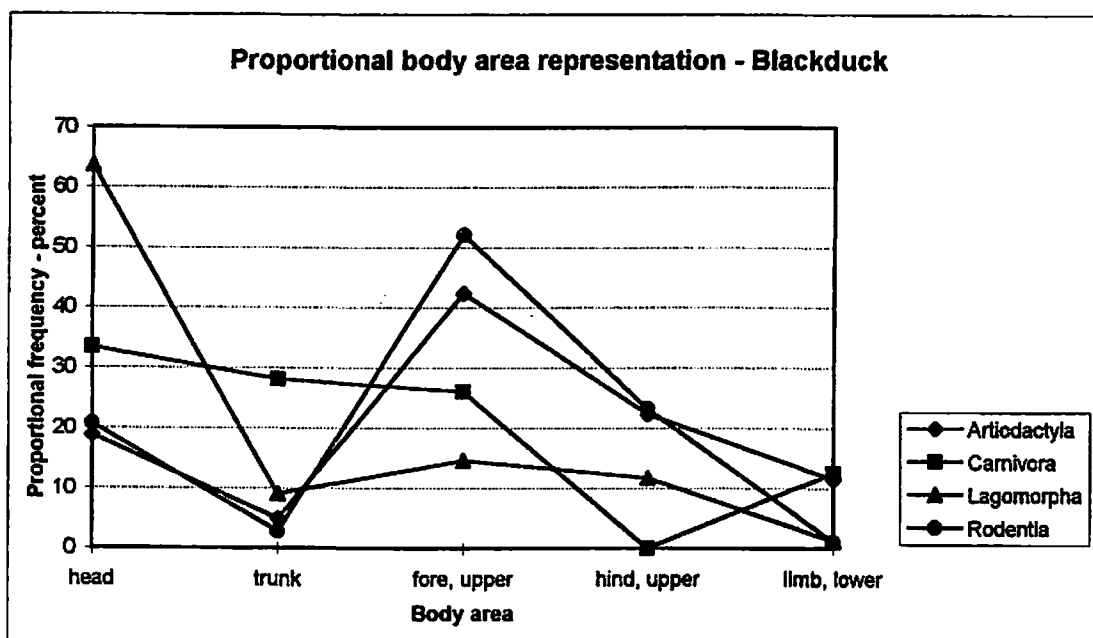
Figure 4.37 Proportional body area representation of mammals in the Blackduck sample, by order

Artiodactyla representation includes higher trunk and upper hind leg counts, with lower representation of upper fore and lower limb bones. This suggests a form of "heavy butchering", with low utility head and lower limb bones discarded at a nearby kill. The Carnivora pattern, interestingly, presents the most even body area representation and is suggestive of the deposition of a relatively unbutchered carcass. The Spearman's rho test was applied to the proportional representation (not percentages) of body areas between Artiodactyla and Carnivora, in order to assess the similarities of rankings of body areas and thus, indicate similarities in butchering/processing and disposal patterns. The resultant r_s value of 0.2 is not considered significant at $n=5$ and $p=0.05$, indicating that there is no significant correlation between the rankings of proportional representation of body areas between Artiodactyla and Carnivora. This reinforces the visual pattern of dissimilarity of body area representation between the two taxa.

The Blackduck order data are presented in Figure 4.37. Two distinct patterns are apparent. The Artiodactyla and Rodentia data present similar patterns of low trunk, high upper foreleg representation, with low lower limb representation. The upper fore and upper hind bones are heavy meat bearing bones, suggestive of a post-butchering assemblage. The Carnivora and Lagomorpha pattern is one of more equal body area representation and indicates less intensively butchered carcasses. The proportional body area frequencies for the orders were subjected to the Spearman's rho test in pairs of orders. This was done in order to identify any correlations between the body area proportions between the orders. Only one paired test r_s value is significant ($r_s=0.9$; $n=5$, $p=0.05$). This value resulted from the paired test between Artiodactyla and

Rodentia and serves to support the visual relationship viewed in the graph, in which these two taxa present high proportions of upper forelimbs.

Figure 4.38 presents the Fort Gibraltar I proportional representations. Carnivora and Lagomorpha are again similar in patterning, while Artiodactyla and Rodentia are quite dissimilar. The Artiodactyla pattern of high upper fore and upper hind limb representation is suggestive of the use of the heavy meat bearing upper limb bones, with the prior disposal of lower utility head and lower limb bones. The low presence of trunk bones may be an indication of meat stripping and removal at the kill or a primary butchery site. The Rodentia (primarily *Castor*) pattern is also one of higher upper fore and upper hind limb bone representation. These are the meat bearing bones. The pattern evident for Carnivora and Lagomorpha is one of high head, low trunk, high upper fore, low upper hind, and low lower limb bones. The proportional representations of the orders were used in Spearman's rho tests to identify similarities in proportional representation between orders which might indicate similarities in butchering and/or disposal patterns. Only the Carnivora:Lagomorpha r_s value is statistically significant ($n=5$; $p=0.05$). It is notable, however, that all of the remaining paired orders except Artiodactyla:Rodentia produced fairly high r_s values as well, indicating strong, positive correlations. The small n requires a very strong correlation before it is significant, which suggests that the ranking of proportional representation of body areas is probably not very different.

The Fort Garry data, presented in Figure 4.39, appear to show few similarities in patterning. The Carnivora pattern is one of fairly equal representation, again

Figure 4.38 Proportional body area representation of mammals in the Fort Gibraltar I sample, by order
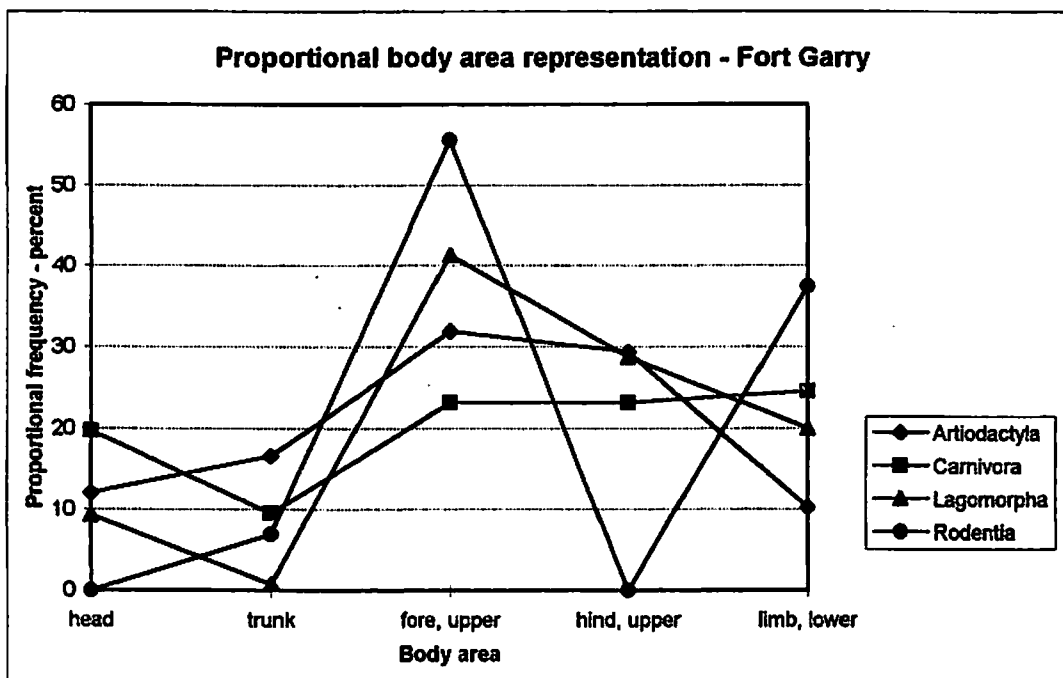
Figure 4.39 Proportional body area representation of mammals in the Fort Garry sample, by order

suggestive of minimal butchery prior to deposition. The Lagomorpha pattern and Rodentia patterns are similar, but for the notable underrepresentation of the upper hind limbs of Rodentia. Interestingly, the Artiodactyla patterning is perhaps closest to that of the Carnivora, with a more even representation of body areas. This may be indicative of the butchery of whole, or nearly whole, animals on site. The Spearman's rho test was again applied to each paired order, ranking the proportional representations of each. None of the r_s values are significant, or even nearly so ($n=5$; $p=0.05$). This lack of evident patterning as compared to the previous samples may indicate very different uses of these taxa or a result of the use of large screen sizes. Although screen mesh size may have less of an effect on mammals than on birds or fish, research by Shaffer and Sanchez (1994) clearly indicates that 1/4" mesh notably reduces recovery even at the body size of Lagomorpha and Carnivora. The effects of large screen size on these latter taxa are felt primarily in the caudal trunk and distal appendicular areas.

The Upper Fort Garry data are presented in Figure 4.40. The Artiodactyla pattern of low head, low trunk, high upper limb bones and low lower limb bone counts suggests, once again, that butchered carcasses were being brought to the post. This pattern is one of discard following butchery and probably following consumption. The Lagomorpha pattern is similar, suggestive of butchery for consumption with discard of lower utility bones. The low lower limb bone counts may also be affected by larger screen size. The Carnivora pattern is an interesting one of extreme overrepresentation of head elements, with an underrepresentation of other body areas. Carnivore heads were apparently discarded in greater numbers than the rest of the carcass. Interestingly, this pattern has
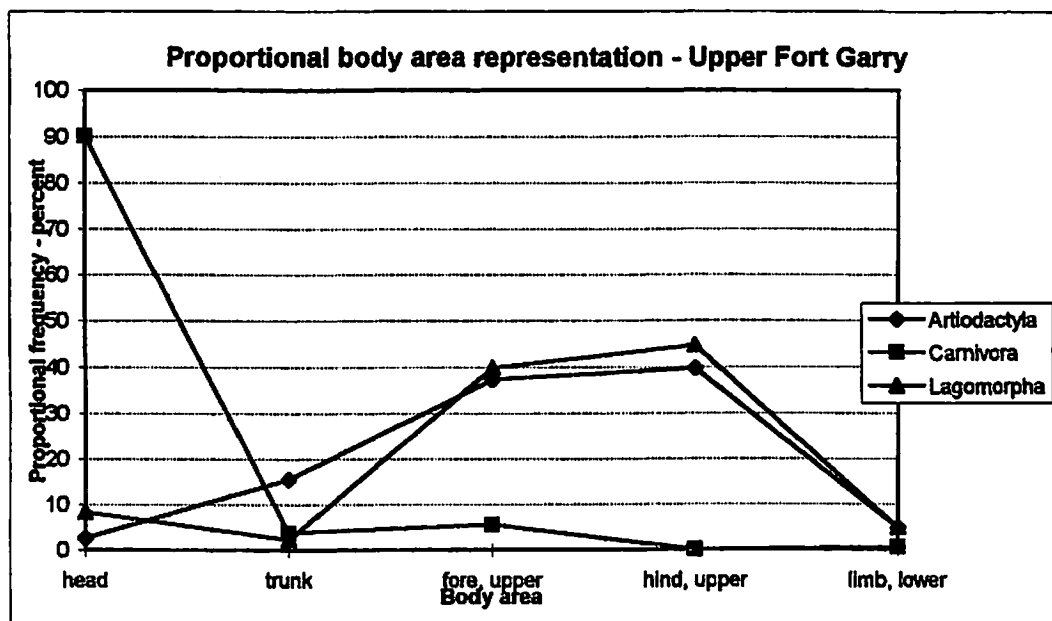
Figure 4.40 Proportional representation of mammals in the Upper Fort Garry sample, by order

been seen also at other Upper Fort Garry excavations (Quaternary Consultants 1998:150). One potential explanation is that large carnivores procured during the winter were only partially skinned out at the kill site or camp site. These animals were further skinned out at the post, removing skulls and mandibles.

The Spearman's rho test was applied to the paired rankings of the orders. None of the resulting r_s values are significant at $n=5$, $p=0.05$. This indicates that the rankings of proportional body areas is quite different between the orders and suggests different butchering and/or disposal. It is notable that the r_s values for Artiodactyla:Carnivora and Carnivora:Lagomorpha are negative values, indicating a negative correlation. This is primarily due to the excessive representation of cranial elements noted above.

Figures 4.41 to 4.44 present the proportional body area representation for each order, facilitating an examination of variation between samples within one taxon. The patterning within Figure 4.41, the Artiodactyla order, shows similarities between Blackduck and Fort Gibraltar, Fort Garry and Upper Fort Garry. The Blackduck and Fort Gibraltar patterns appear to represent carcasses butchered elsewhere, with the high utility, meat-bearing upper limb bones represented on site. The Fort Garry and Upper Fort Garry patterns are somewhat similar to these, but more evenly represented. In all cases, the low utility lower limb bones are underrepresented. The Archaic pattern is quite distinct in its high representation of trunk and upper hind limb bones, suggestive of the inclusion of secondary butchering units.

The raw frequencies were compared using Spearman's rho. The raw frequencies could be used in this instance because the comparisons are within one order. Only the

Proportional body area representation - Artiodactyla
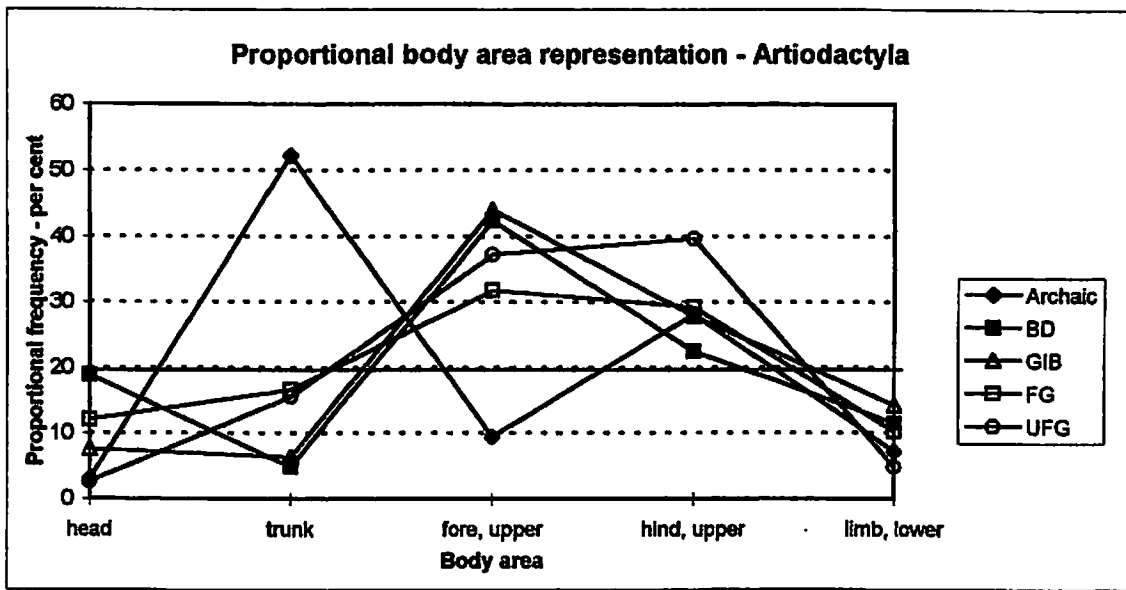
Figure 4.41 Proportional body area representation of Artiodactyla, by sample

Proportional body area representation - Carnivora
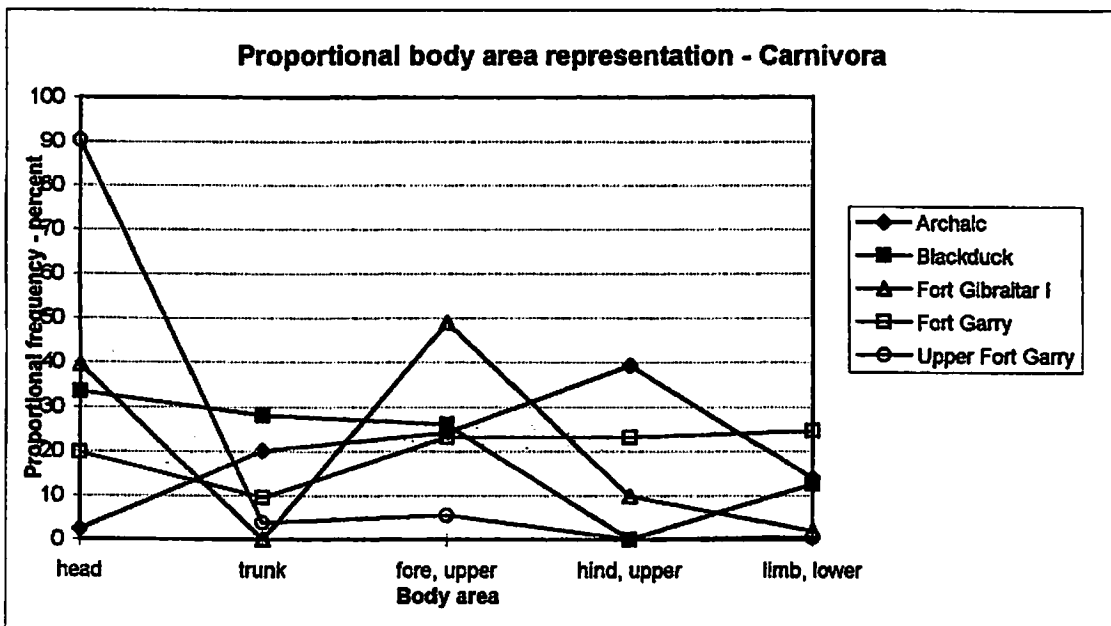
Figure 4.42 Proportional body area representation of Carnivora, by sample

Archaic:Upper Fort Garry test result ($r_s=0.9$; $n=5$; $p=0.05$) is significant, despite the difference between the two samples in the representation of trunk elements.

The Carnivora data are presented in Figure 4.42. Excepting the Upper Fort Garry sample, the body area data express more even representation than the Artiodactyla data. This indicates less butchery and the disposal of more complete carcasses. Fort Gibraltar I is a notable exception, with a much higher upper forelimb representation and an underrepresentation of the lower limb bones. This is more consistent with a pattern of butchery for consumption. It is suggested that the Archaic, Blackduck, and Fort Garry patterns do not indicate consumption of carnivores. The Fort Gibraltar I sample is suggestive of consumption.

The ranking of the body area frequencies were again compared using Spearman's rho. The only significant result ($r_s=-0.9$; $n=5$; $p=0.05$) occurred between Archaic:Fort Gibraltar I, indicating a strong, negative correlation between the body area representations of these two samples. As noted above, the Fort Gibraltar I representation is distinct from the other samples, and this interpretation is supported by the Spearman's rho result. A second r_s value (Blackduck:Upper Fort Garry) was "nearly" significant. This is probably due to the extreme representation of cranial elements in the Upper Fort Garry sample.

Figure 4.43 presents the Lagomorpha data. The Archaic and Blackduck patterns are quite similar, with high head area values. The Fort Garry and Upper Fort Garry samples are also similar, with high representations of upper limb bones, suggestive of a consumption butchery pattern. The Fort Gibraltar I sample is, again, quite distinct with very high upper forelimb representations. This also appears to be a consumption

butchery pattern. The Archaic and Blackduck patterning appears to be the converse of the Fort Garry and Upper Fort Garry patterns. This may indicate the disposal of the results of the initial butchery, although the low trunk and lower limb elements do not really support this.

The Spearman's rho test could only be applied to the three Postcontact samples due to the large number of ties which would have occurred in the use of the two other samples. None of the r_s values are significant at p=0.05 (n=5), although the Fort Gibraltar I:Fort Garry and Fort Garry:Upper Fort Garry tests both resulted in strong positive correlations (r_s=0.7).

The Rodentia data are presented in Figure 4.44. The Archaic taxon is represented only by head elements, suggestive of the discard of some primary butchery - possibly to remove potential raw material (i.e. incisors) for tool manufacture. The Fort Garry sample size is very small, while Rodentia are absent from the Upper Fort Garry sample. The Blackduck and Fort Gibraltar I samples differ primarily in the quantities of upper fore to upper hind limbs. All but the Archaic show a post-butchery, post-consumption pattern of high representation of meat-bearing upper limb bones. The variation between Fort Gibraltar and Fort Garry is in the relative frequencies of these two areas, with the Fort Gibraltar I representation higher in upper hind bones, while the Blackduck is higher in the upper fore bones. Both of these patterns, however, suggest butchery for consumption. The high number of lower limb bones within the Fort Garry sample may indicate the disposal of low utility bones following primary butchery. Spearman's rho was conducted only between the Blackduck and Fort Gibraltar I samples, resulting in an

Proportional body area respresentation - Lagomorpha

Figure 4.43 Proportional body area representation of Lagomorpha, by sample

Proportional body area representation - Rodentia
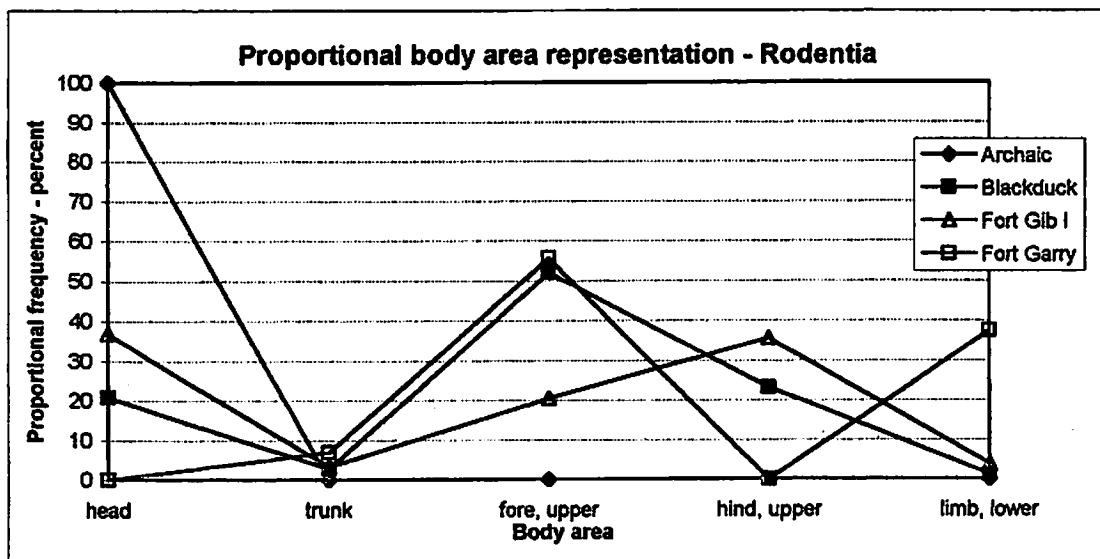
Figure 4.44 Proportional body area representation of Rodentia, by sample

non-significant value of -0.2372.

An investigation for possible pemmican production evidence was attempted due to the importance of this resource during Precontact and early Fur Trade times. The manufacture of bone grease, necessary for pemmican production, produces small fragments of bone, rendered unidentifiable due to the degree of smashing involved in the process (Hurlburt 1977:17-19). Because of the lack of identifying features on these small bone fragments, an examination of these data was carried out at the order level as virtually none of these bone fragments would be identifiable past this taxonomic level. The relative frequencies of identified to unidentifiable bone were examined using chi-square for artiodactyls within the samples. Bone grease manufacture should result in high numbers of unidentifiable bone as compared to identifiable bone and application of the chi-square test should indicate homogeneity, or lack thereof, between the samples. The chi-square values are presented in Table 4.29.

Table 4.29 Results of the chi-square test for identifiable and unidentifiable artiodactyl bone

	Blackduck	Fort Gibraltar I	Fort Garry	Upper Fort Garry
Archaic	0.461322	34.9292*	1.119981	1.325484
Blackduck	----	27.77856*	0.001557*	7.094215
Fort Gibraltar ---	----	----	119.5552*	99.40337*
Fort Garry	----	----	----	10.88658*

These chi-square values show a distinct difference in the relative numbers of identified to unidentifiable specimens for Artiodactyls within the Fort Gibraltar I sample and, to a much lesser extent, within the Fort Garry sample. Examination of the "observed" minus "expected" values within the chi-square calculation shows that the Fort Gibraltar I sample consistently produces a much higher than expected value for the unidentifiable Artiodactyla fragments than the other samples. This is consistent with a pattern of bone grease production, suggesting that Fort Gibraltar I was a site of bone grease production. This may be true, to a lesser extent, of Fort Garry as well.

Family Level

The analysis of element frequencies was then carried out at the taxonomic level of the family. Figures 4.45 to 4.49 present the relative element frequency data as proportional body areas, transformed into percentages, for the families within each sample. Figures 4.50 to 4.57 present the same data arranged by family. Various patterns are apparent in viewing these figures. Some of the information is similar to that observed at the order level, particularly when only one family is considered within one order.

Figure 4.45 presents the Archaic family data. The Leporidae and Castoridae families are represented primarily by head elements, suggestive of discard of the low utility byproducts of primary butchery. The Canidae and Mustelidae families within the Carnivora order, however, present a pattern of quite even representation of body areas, although with lower head and lower limb counts. This argues for the disposal of fairly complete carcasses and minimal butchery, perhaps following skinning. The Ursidae

Proportional Body Area Representation - Archaic
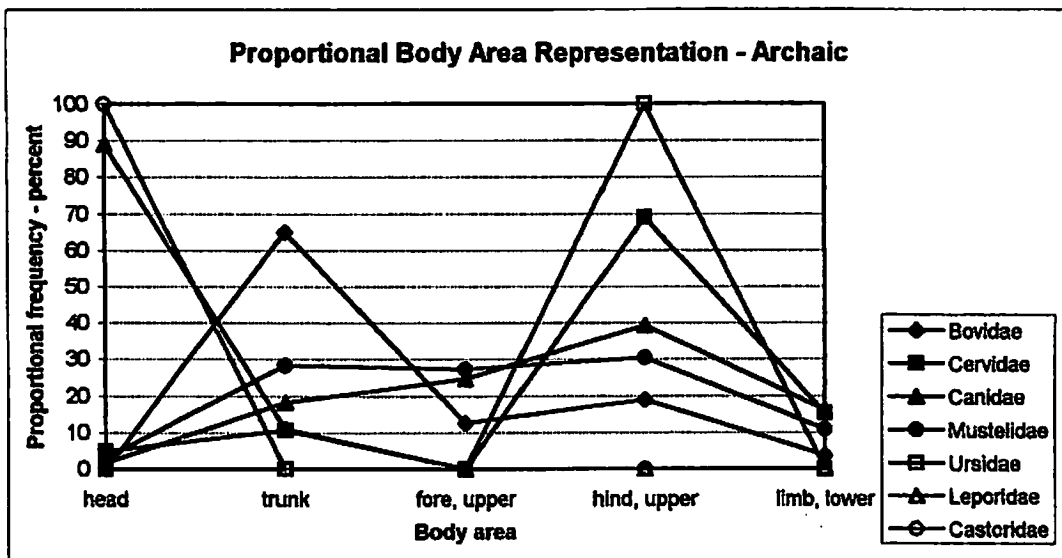
Figure 4.45 Proportional body area representation of mammal families, Archaic sample

Proportional Body Area Representation - Blackduck
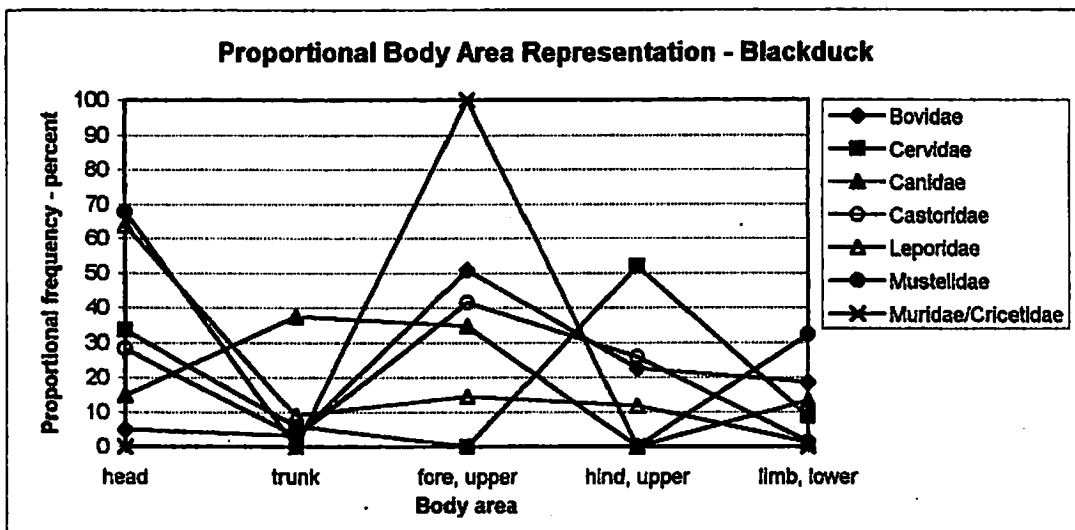
Figure 4.46 Proportional body area representation of mammal families, Blackduck sample

pattern, however, is a representation of only upper hind limbs. This is partially due to the small NISP for bear within this sample, but the absence of other bones argues for the deposition of previously butchered carcass portions. The Cervidae pattern, with low representation of all parts but the upper hind, suggests the deposition and possibly the importation of previously butchered portions. The Bovidae pattern is similar, with a greater representation of trunk elements. This also argues for the presence of already butchered items, possibly a "heavy" butchering pattern.

Spearman's rank order correlation coefficient was used to compare the proportional frequencies of different body areas within the sample. Both the Bovidae:Mustelidae and Canidae:Mustelidae results were significant with an r_s value of 0.9 ($n=5$, $p=0.05$). These values indicate a significant correlation between these groups in terms of representation of body areas. The Canidae:Mustelidae rho value supports the visual relationship within the graph and suggests a similar use and disposal of these two carnivore families. The Bovidae:Mustelidae also shows a strong positive correlation between the proportional representations of these two dissimilar families.

Figure 4.46 presents the Blackduck data and involves a greater number of families. The Bovidae pattern is similar to the Cervidae pattern within the Archaic, with an emphasis on upper limb bones, arguing for the presence of previously butchered portions. The more even representation of lower limb bones suggests that some of the limb portions included the lower limb elements, possibly indicating a "heavy " butchering pattern. The Cervidae pattern is similar with a high representation of upper hind elements, although the higher head elements do not correlate. The carnivore patterns are

quite dissimilar. The Mustelidae exhibit a pattern of high head and lower limb bones. These are the low utility bones as far as meat is concerned and may also be those left in during skinning. The Canidae representation is quite even with a low representation of upper hind bones. This may indicate some form of butchery for consumption. The Castoridae pattern is one of the meat bearing bones - upper fore and upper hind, as well as head elements which may indicate use of raw material for tool manufacture. The Leporidae patterning is fairly even, although with high head and low trunk representation. Spearman's rho test was conducted on the ranked proportional body area values. Only one of the values is significant, that between Castoridae and Leporidae (r_s=0.9; n=5; p=0.05), suggesting a similarity in butchering and use of these families. It is notable that the Cervidae:Canidae result was a strong, negative correlation (r_s=-0.8) and, given the effects of a small n, this should be considered.

The Fort Gibraltar families are represented in Figure 4.47 with an even more confusing spectrum of families. Few of the families show very distinct profiles, however, with most showing a common pattern of representation of low head, trunk and lower limb counts and high upper limb counts. The greatest variability appears to be in the representation of upper hind elements. Bovidae is represented by more or less even counts of upper limb bones (fore and hind) to the exclusion of head, trunk, and lower limb bones. This argues for the presence of already butchered portions and may indicate the presence of quartered meat. The Cervidae pattern is similar, but with a much higher upper fore and lower upper hind count. The earliest presence of the domestic Suidae shows a pattern of low utility parts - head, trunk, and lower limb - suggestive of on site
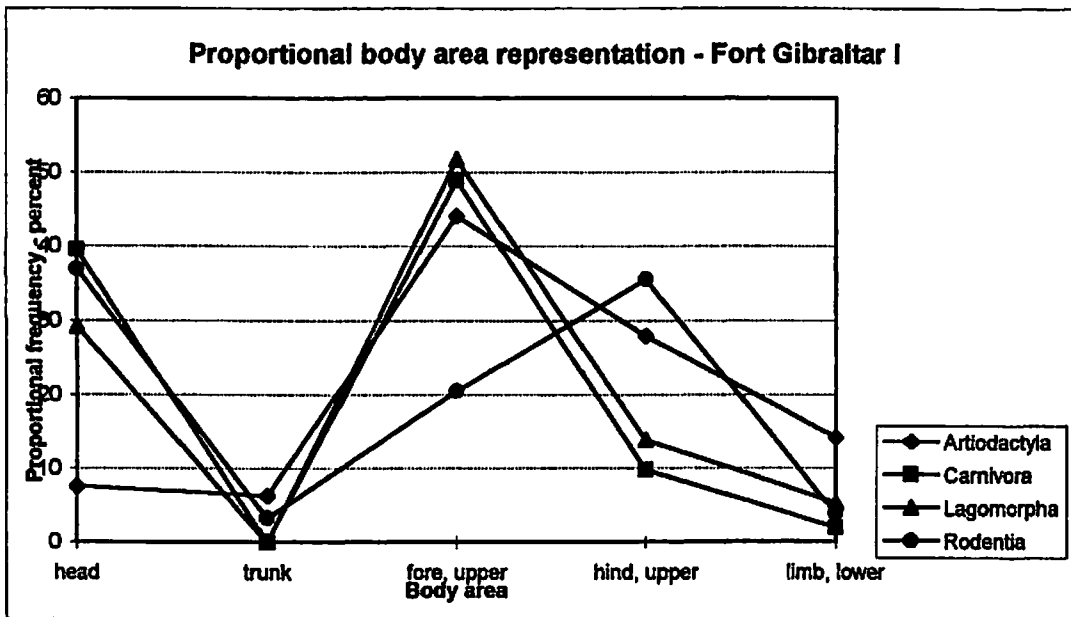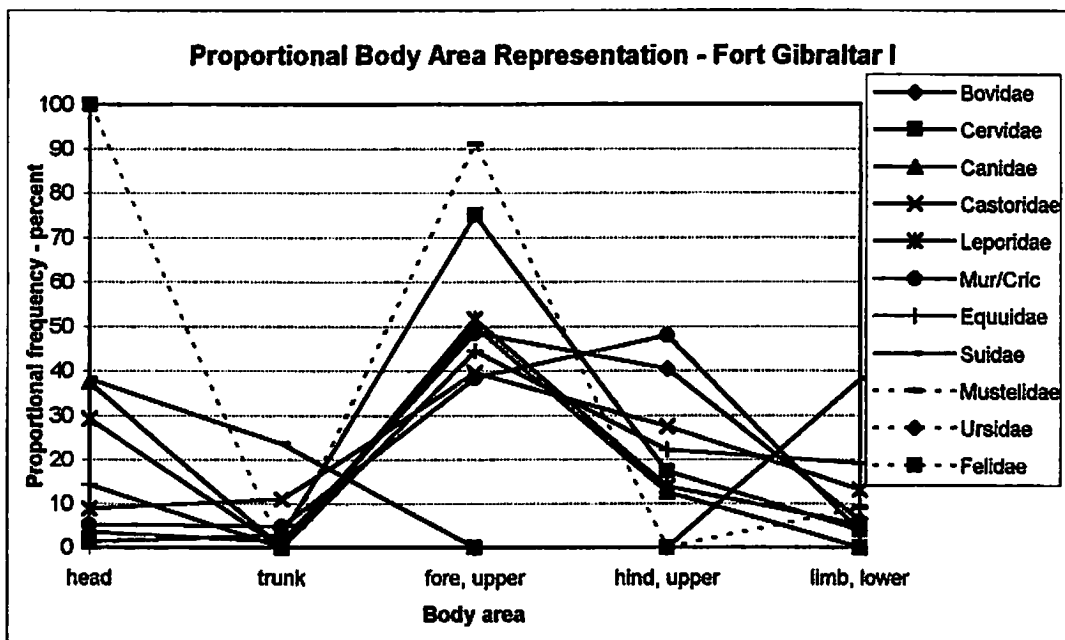
Figure 4.47 Proportional body area representation of mammal families, Fort Gibraltar I sample
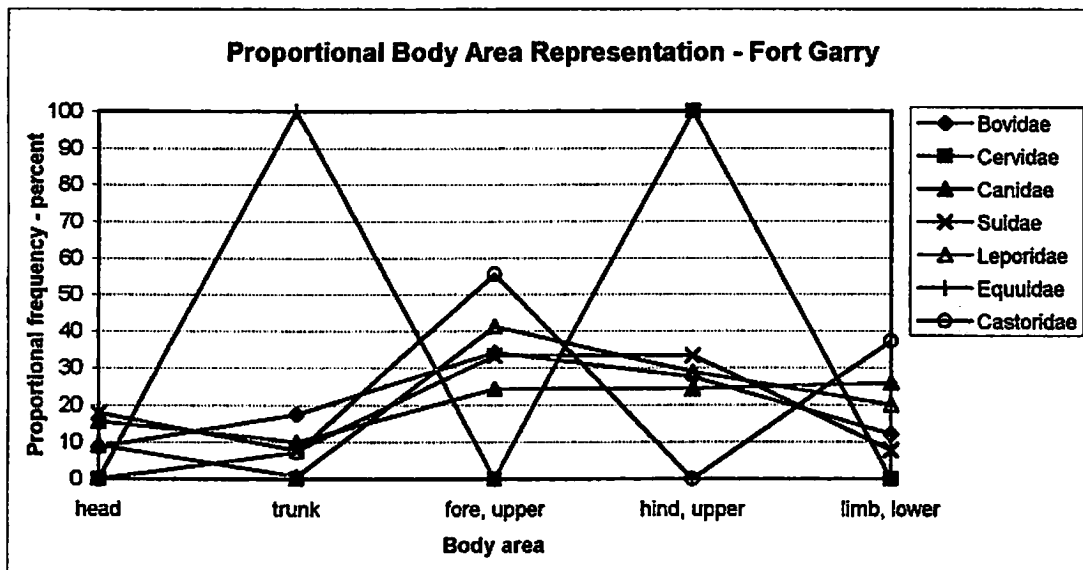
Figure 4.48 Proportional body area representation of mammal families, Fort Garry sample

butchery. Equuidae shows a pattern similar to Bovidae, with high upper limb bone counts. The higher lower limb bone counts, however, are suggestive of either on-site butchery or the disposal of whole legs.

The Canidae pattern shows high upper forelimb elements. This is suggestive of butchery, possibly for consumption. Mustelidae, Ursidae, and Felidae produced small NISP counts, which are apparent on the graph as rather extreme percentages of body areas. The Castoridae pattern is similar to that of the large Artiodactyla, with high counts of upper limb bones. The Leporidae pattern shows high head element counts, low trunk, and high upper limb bone counts. The Cricetidae pattern (i.e. muskrat) is also a post-butchery/consumption pattern with high upper limb bones. The Spearman's rho test was carried out for the Fort Gibraltar I families, resulting in a number of significant positive correlations. These are between Bovidae and Cervidae, Bovidae and Castoridae, Bovidae and Equuidae, Cervidae and Castoridae, Cervidae and Equuidae, Castoridae and Equuidae, and Canidae and Leporidae. Many of these significant correlations exist between the families of large subsistence animals (i.e. Bovidae, Cervidae, possibly Equuidae), suggesting a similar treatment of these animals. The similarities between these large subsistence families and Castoridae may indicate that beavers were also used as subsistence items.

The Fort Garry sample (Figure 4.48) includes more domesticated species and less of the wild species which predominate in the earlier assemblages. The Bovidae pattern of high upper limb bone counts is not as accentuated in this assemblage, suggesting that at least some of the carcasses were butchered and disposed of on site or were brought in

to the post in a relatively unbutchered state. The Suidae pattern is very similar to the Bovidae pattern, with notably high upper limb counts but also a more even representation of head, trunk, and lower limb bones. The Cervidae pattern, on the other hand, is still one of high upper hind limb elements. This is partially due to low NISP counts, but may also suggest that Cervidae meat was still brought into the posts and/or deposited as quarters. The Canidae pattern is one of fairly even representation, suggestive of minimal butchery of these carcasses. The Leporidae pattern is a post-butchery /post-consumption one of higher upper limb bones.

The changes in Bovidae/Suidae patterning to more even body area representation may indicate the overwhelming presence of domesticated genera (*Bos*, *Sus*, and *Ovis/Capra*). These animals were raised and butchered either in the post or nearby, while the wild ungulates were generally killed and partially butchered elsewhere, with only portions of the carcasses entering the post. None of the Fort Garry Spearman's rho values are significant, indicating very little patterning between the taxa in the butchering and/or disposal of body areas.

The Upper Fort Garry assemblage families are presented in Figure 4.49. The Bovidae pattern, once again, consists of high upper limb bone counts, suggestive of post-butchery/post-consumption deposition. The Cervidae pattern is quite different with high head and lower limb bones predominating, suggestive of primary butchery refuse. The Antilocapridae sample, with a small NISP, suggests the inclusion of previously butchered meat. The Suidae patterning is similar to the Bovidae patterning, although with more upper hind than upper fore. The Canidae pattern is one of high head element counts,
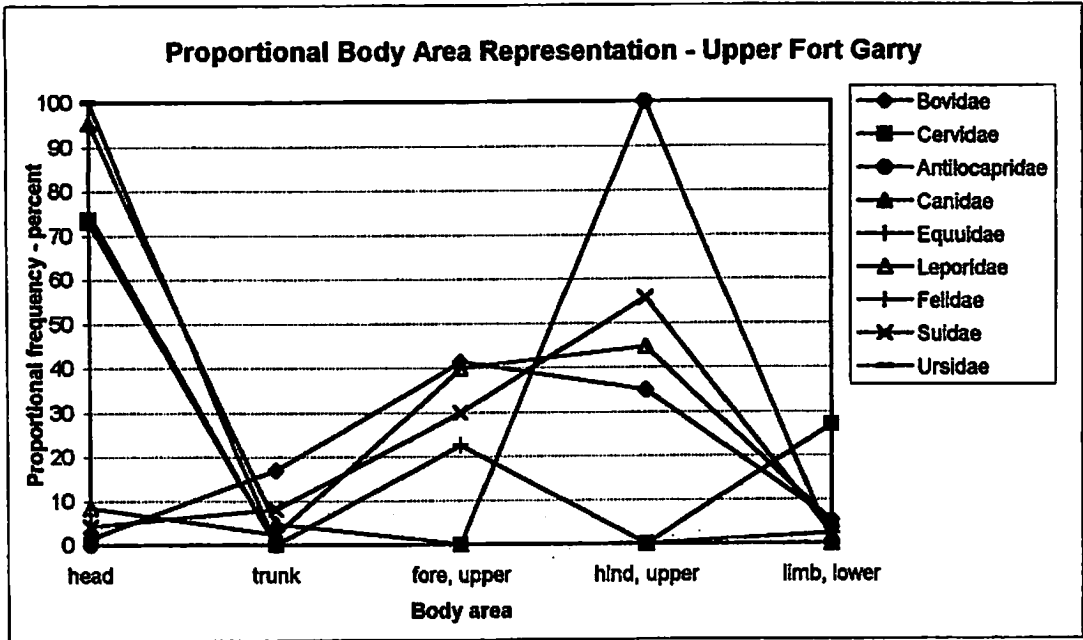
Figure 4.49 Proportional body area representation of mammal families,
           Upper Fort Garry sample

possibly due to the skinning out of pelts. Felidae are also represented by head elements, possibly also from the skinning out of pelts. Leporidae present high upper limb bone counts, again suggestive of a post-butchery/post-consumption pattern. None of the Spearman's rho values are significant, again suggesting little patterning in the treatment of carcasses. Notably, in both Upper Fort Garry and Fort Garry, the strongest correlations are between the large, mostly domestic families (Bovidae and Suidae).

Figures 4.50 to 4.57 present the proportional body area representations by family. Bovidae is presented in Figure 4.50, in which it is evident that the most divergent line is that of the Archaic, in which trunk elements are highly represented. The other assemblages show a general pattern of low head and lower limb elements, with higher upper limb bones. Fort Garry and Upper Fort Garry are quite similar, with a more even representation within the Fort Garry assemblage. The Blackduck and Fort Gibraltar I samples are also similar to each other. Two of the Spearman's rho values indicate a perfect positive correlation of 1.00 ($n=5$; $p=0.05$) - between Blackduck:Fort Gibraltar and Fort Garry:Upper Fort Garry. These values support the visual similarities within Figure 4.50.

Figure 4.51 presents the Cervidae data, in which some consistent patterning is evident but not as clearly as within the Bovidae family. The pattern is one of high upper fore or upper hind limb elements. The Precontact assemblages are similar to each other, with Fort Garry also similar to these two and Fort Gibraltar I similar but with upper fore limbs rather than hind. The Upper Fort Garry sample here is anomalous, with high head and lower limb bones that suggest the refuse of primary butchery. Spearman's rho was

Proportional Body Area Representation - Bovidae
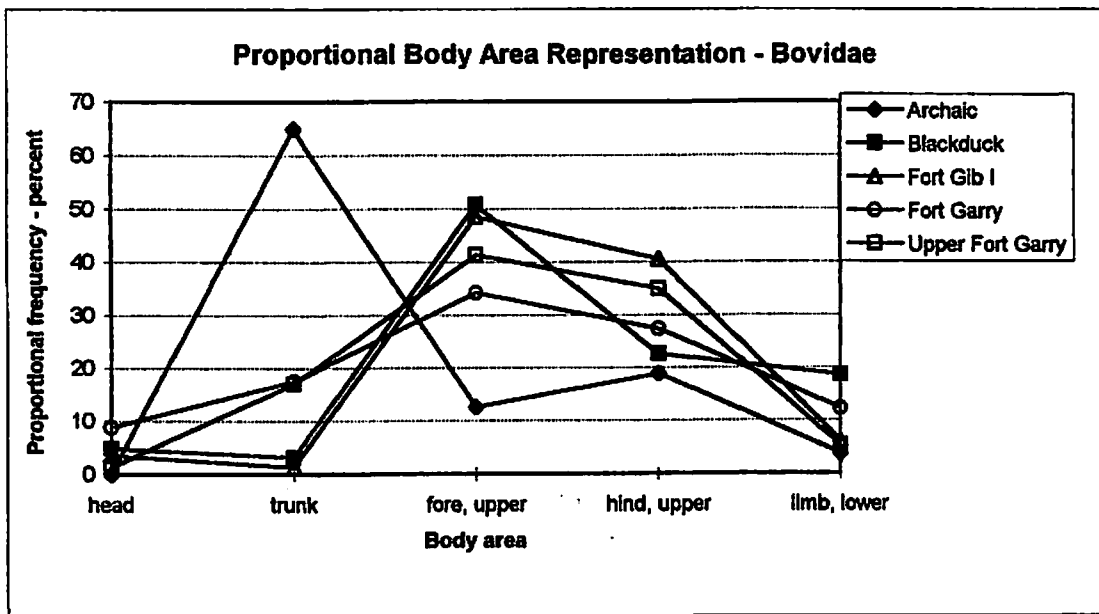
Figure 4.50 Proportional body area representation of Bovidae, by sample

Proportional Body Area Representation - Cervidae
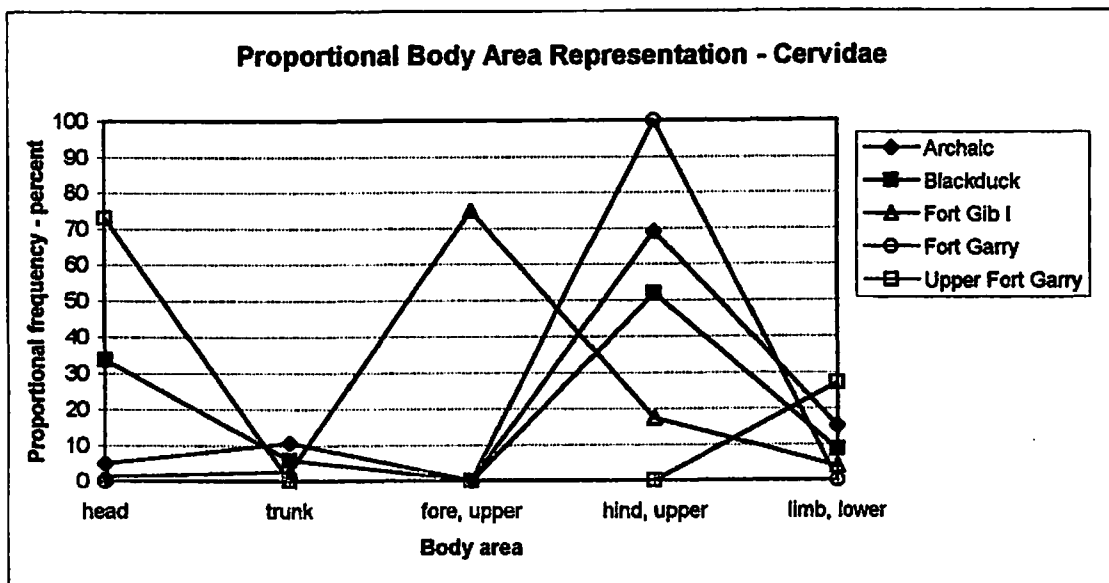
Figure 4.51 Proportional body area representation of Cervidae, by sample

conducted for the Precontact and first Postcontact samples. None of the resultant values are significant, although the Archaic:Blackduck value of 0.7 indicates a strong positive correlation.

The Canidae data are presented in Figure 4.52. This pattern is generally one of more even body area representation, excepting that of Upper Fort Garry and Fort Gibraltar I. The even body area representation is indicative of minimal butchery and probably of the utilization of the carcasses primarily for skinning. The Fort Gibraltar I pattern appears to indicate a consumption pattern, while the Upper Fort Garry pattern appears to suggest a skinning-out process. None of the Spearman's rho values are significant, although the Archaic:Fort Gibraltar I r_s value of 0.8 indicates a strong positive correlation. Upper Fort Garry could not be included due to the large number of zeroes and, therefore, ties.

The Mustelidae data are presented in Figure 4.53, including only the earliest three assemblages. The Archaic pattern is one of fairly even body area representation, excepting the head and extremities. This suggests the use of the carcass for skinning, perhaps with head and extremities left in the skin. The Blackduck pattern of high head and lower limb bones is almost the mirror image of the Archaic pattern. The Fort Gibraltar I pattern of high upper forelimb bones is suggestive of consumption.

Figure 4.54 presents the Leporidae data. Both the Precontact assemblages present high head values. The Postcontact sites present high upper limb bone values, although Fort Garry includes fairly high lower limb bones counts. The Precontact pattern may be one of primary butchery prior to food consumption as one entire carcass, while the
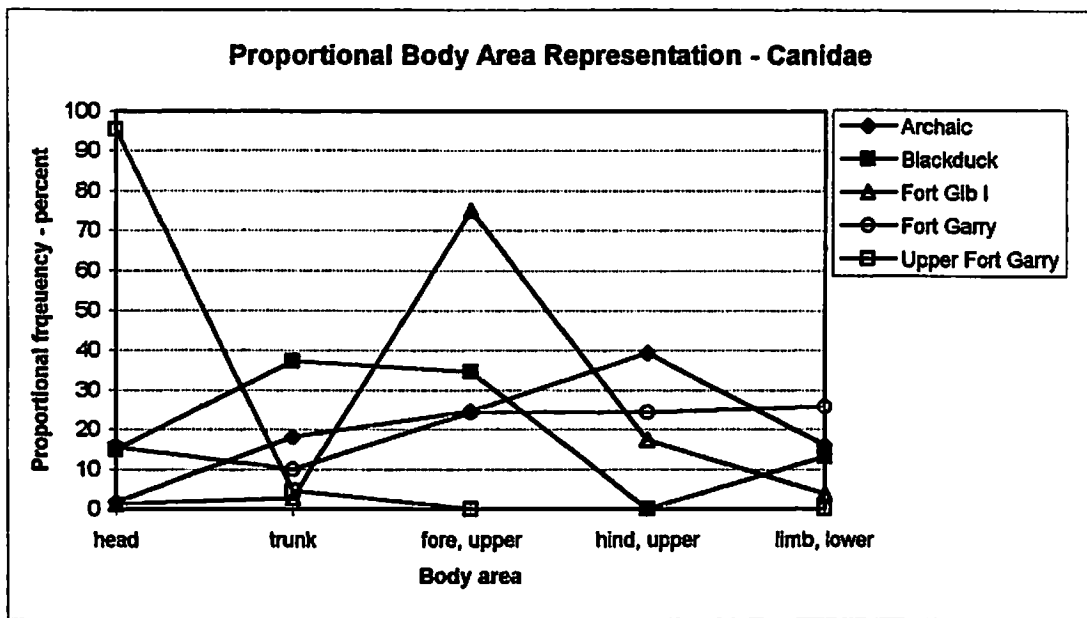
Figure 4.52 Proportional body area representation of Canidae, by sample
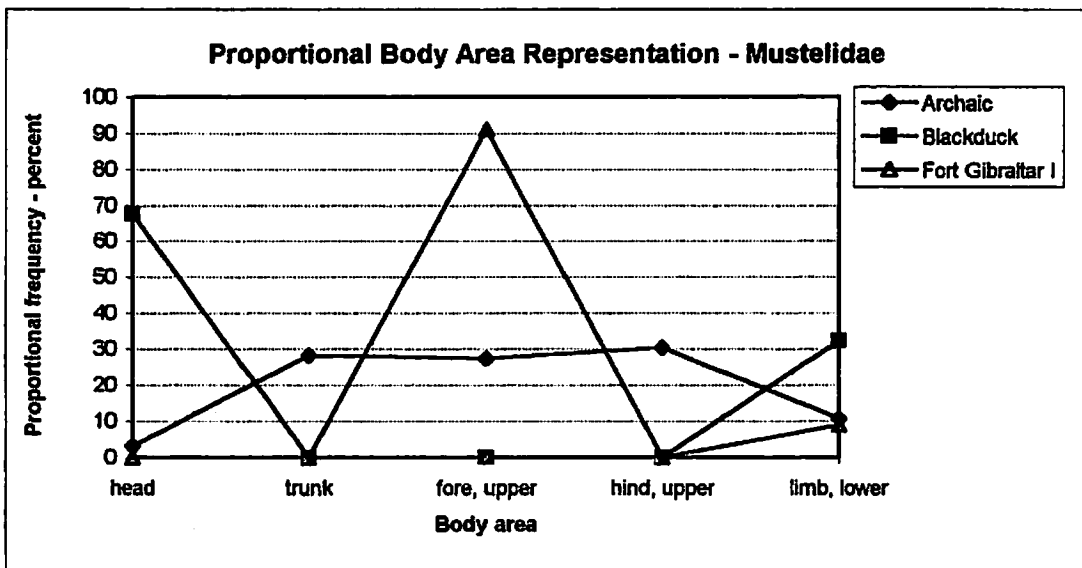
Figure 4.53 Proportional body area representation of Mustelidae, by sample

Proportional Body Area Representation - Leporidae
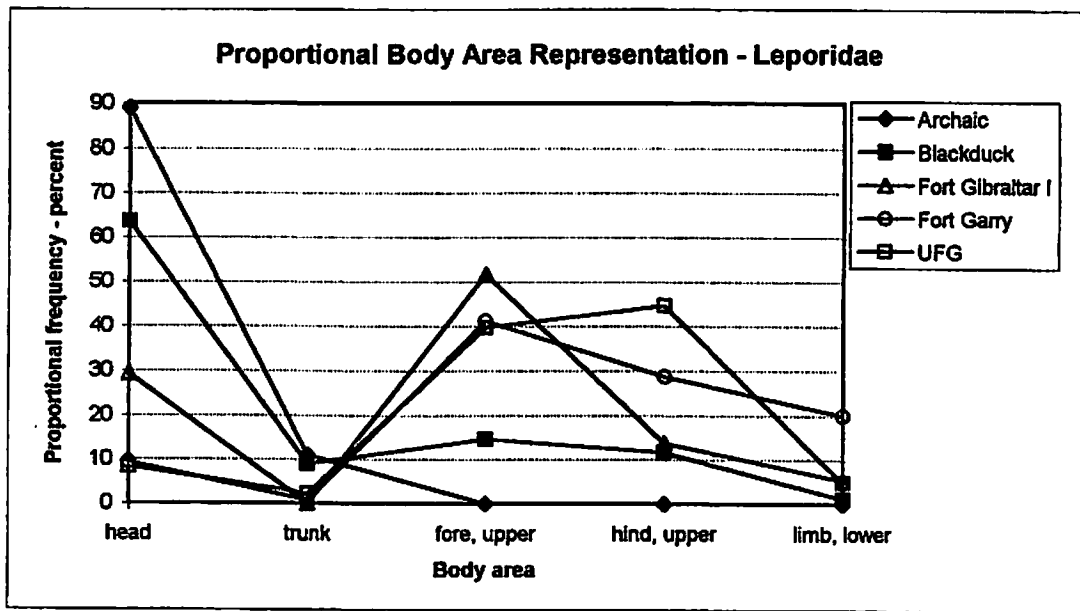
Figure 4.54 Proportional body area representation of Leporidae, by sample

Proportional Body Area Representation - Castoridae
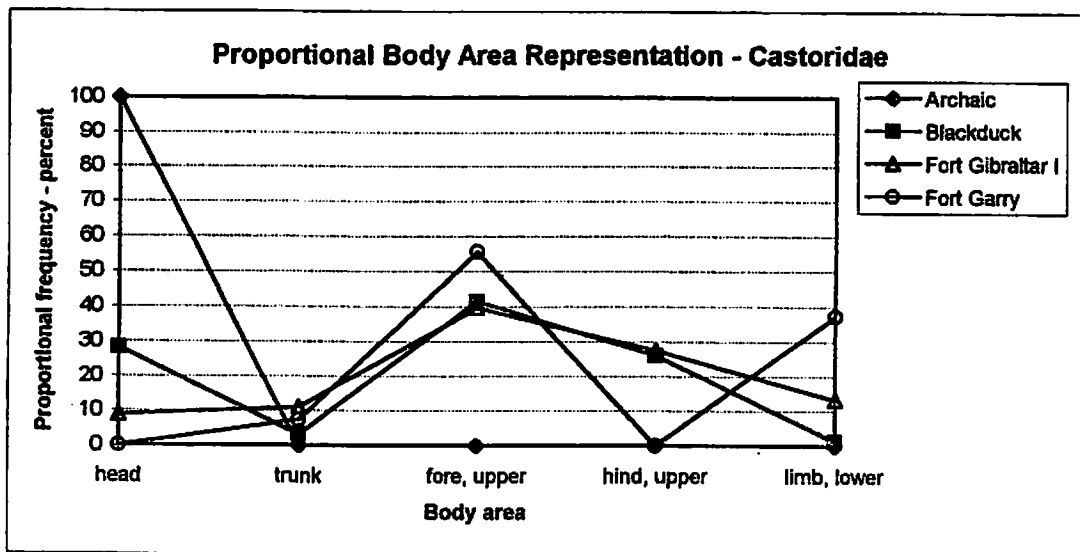
Figure 4.55 Proportional body area representation of Castoridae, by sample

Postcontact pattern suggests further butchery prior to consumption. None of the Spearman's rho values are significant, although the Blackduck:Fort Gibraltar I and Fort Garry:Upper Fort Garry tests both produced strong positive correlations with an r_s value of 0.8.

Figure 4.55 presents the data for Castoridae. The Archaic pattern of high head values is anomalous compared to the other patterning of emphasis on upper limb bones.

Figure 4.56 presents the Equuidae data, all of which suggest some butchery. The NISP counts are small for the Fort Garry and Upper Fort Garry samples, however. The Fort Gibraltar I sample appears to show a definite butchery pattern, similar to the Bovidae pattern.

Figure 4.57 presents the Suidae data. The Fort Gibraltar I sample is one of low utility part discard on site. The Fort Garry and Upper Fort Garry samples are similar to each other, with an emphasis on upper limb bones. The Spearman's rho value of 0.8696 between Fort Garry and Upper Fort Garry is very nearly significant and indicates a strong positive correlation.

4.2.vi Butchering Marks, Thermal Alteration, and Carnivore Damage on Mammalian Bone

As with the bird and fish assemblages, the mammalian assemblage was examined for butchering marks, thermal alteration, and signs of carnivore chewing. Table 4.30 presents the numbers of mammalian bones either butchered, chewed, or burnt within the samples. This table serves to show how variable these quantities and percentages are

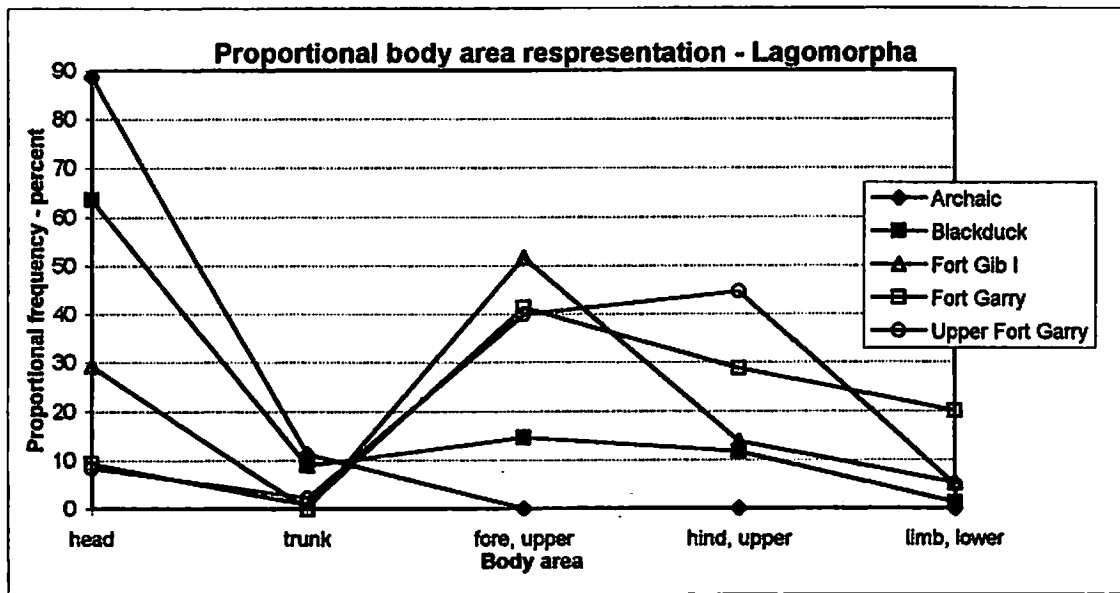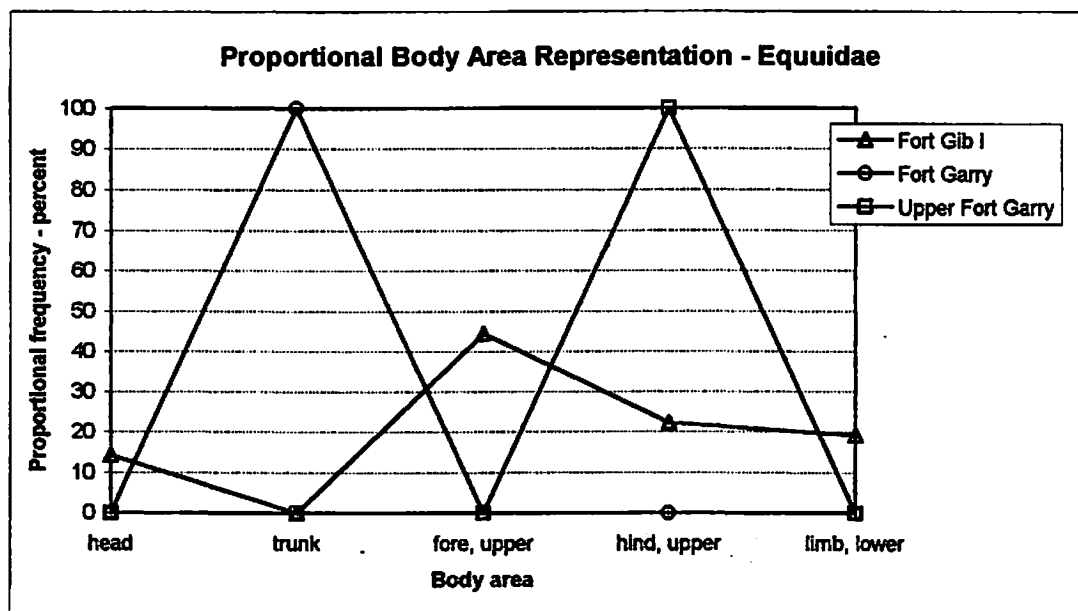Figure 4.56 Proportional body area representation of Equuidae, by sample
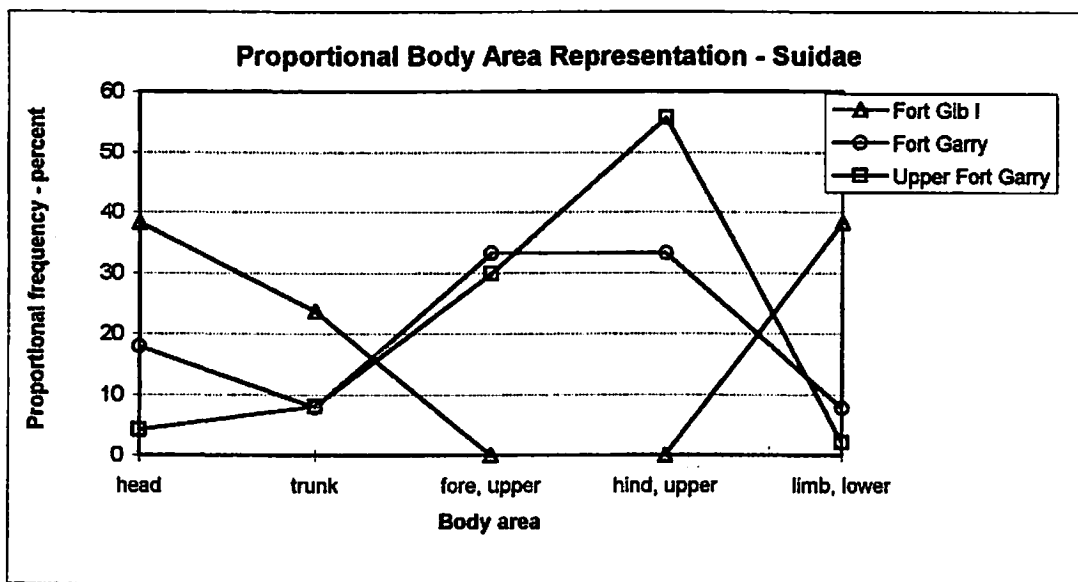
Figure 4.57 Proportional body area representation of Suidae, by sample

from sample to sample - a point which will be returned to in each relevant section below. It is worth pointing out that, in most cases, the percentages of the samples which are affected by one of these three factors are generally very small.

Butchering Marks

Butchering marks are of varied types, generally including cut, chop, and saw marks. The pattern and form of breakage can also aid in reconstructing butchering patterns. This analysis is limited by the way in which the data sets were created. Accurate element portions and breakage patterns were not consistently noted, so that the butchering data is limited to the marks made on the bones and, occasionally, more detailed description of these marks (e.g. orientation, location).

Figure 4.58 provides a graphic presentation of the percentages of each mammalian sample which exhibit butchery marks. The obvious pattern is one of increasing butchering evidence as time progresses. The percentages increase dramatically at the Postcontact boundary, suggesting the effects of new technology (i.e. metal blades). This does not, however, explain the continued increase of percentages of butchered bone within the Fort Garry and, particularly, the Upper Fort Garry samples. The increase may also be due to the greater use of European methods of butchery, resulting in more modern meat cuts.

It is possible that the percentage of butchered bone is correlated with sample size and that one may be viewing the effects of sample size rather than any real change in butchering evidence. In order to determine whether total mammalian sample size was

Percentage of Mammalian Sample with Butchery Marks
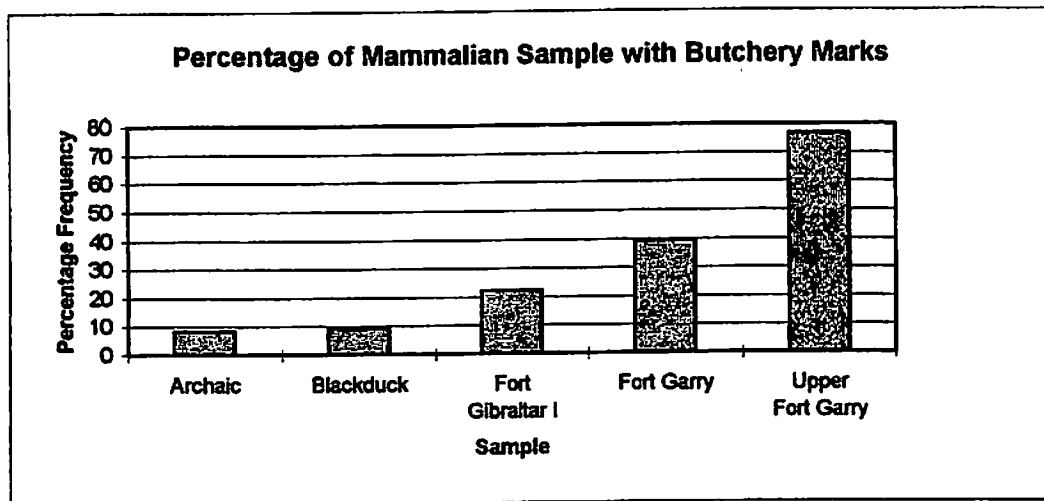
Figure 4.58 Percentages of the mammalian assemblages with butchering marks

affecting percentage of butchered sample, Spearman's rho was calculated between the total mammal frequencies and the corresponding percentages of sample butchered. The resultant r_s value of -0.5 is not significant at $n=5$ and $p=0.05$. This argues that the increase in the percentage of butchered bone through time is not affected by changes in overall mammal bone sample size and is a "real" increase.

The frequencies of butchered bone and the percentages of the sample butchered were calculated for each taxonomic family within each sample. The percentages are presented in simple graphs in Figures 4.59 to 4.63. Several families contained no butchered bone at all and do not appear on the graphs. Hypothetically, the faunal taxa that contain higher percentages of butchered bone should be those which have been most intensively utilized. Meat bearers, for instance, should exhibit higher butchery percentages than fur bearers. The intensity of butchery is also related to the size of the carcass. Small mammals, such as hares, are likely to be less butchered than are cattle, requiring very little butchery prior to consumption.

The pattern which is evident in these graphs is that the common subsistence animals tend to have the greatest frequency of butchered bone, including Bovidae, Cervidae, Equuidae, Suidae, and Castoridae. Taxa with lower percentages of butchered bone include the carnivores (Canidae, Mustelidae) and smaller subsistence animals (Leporidae). Those taxa which are not included in the graphs due to a complete absence of butchering marks tend to be those which are of small body size (Leporidae, Cricetidae) or those with small sample sizes in the assemblages (Ursidae, Felidae). The taxonomic patterning in the percentages of butchering marks follows expected trends. Subsistence

Percentage of Archaic Mammalian Families with Butchery Marks
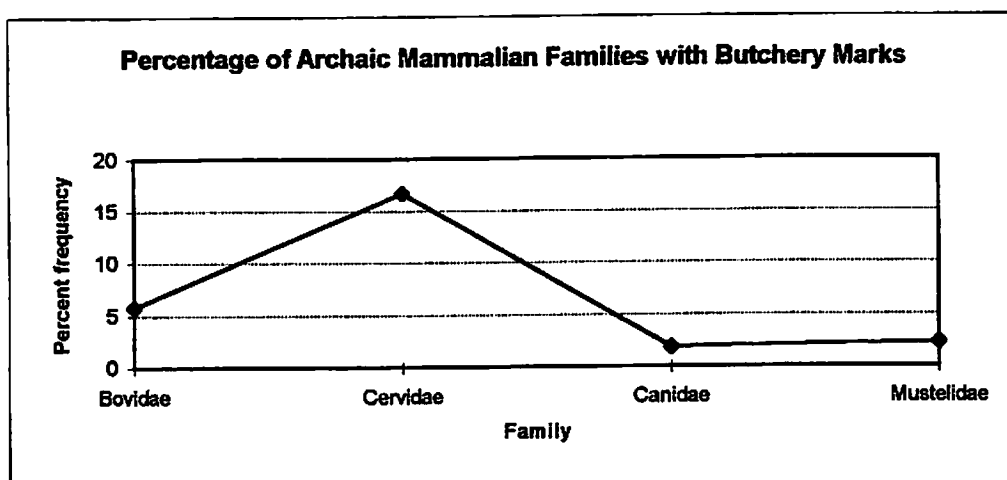
Figure 4.59 Percent frequency of mammal families with butchering marks, Archaic sample

Percentage of Blackduck Mammalian Families with Butchery Marks
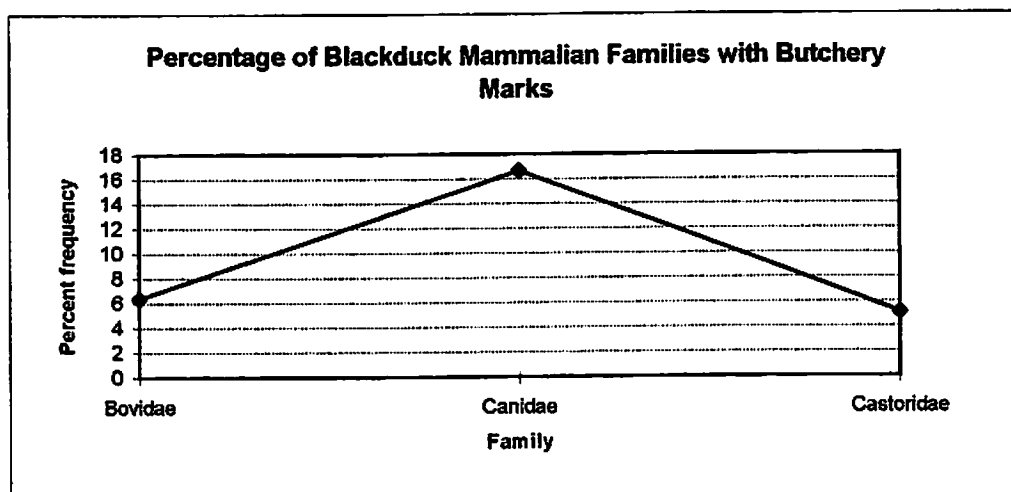
Figure 4.60 Percent frequency of mammal families with butchering marks, Blackduck sample

Percentage of Fort Gibraltar Mammalian Families with Butchery Marks
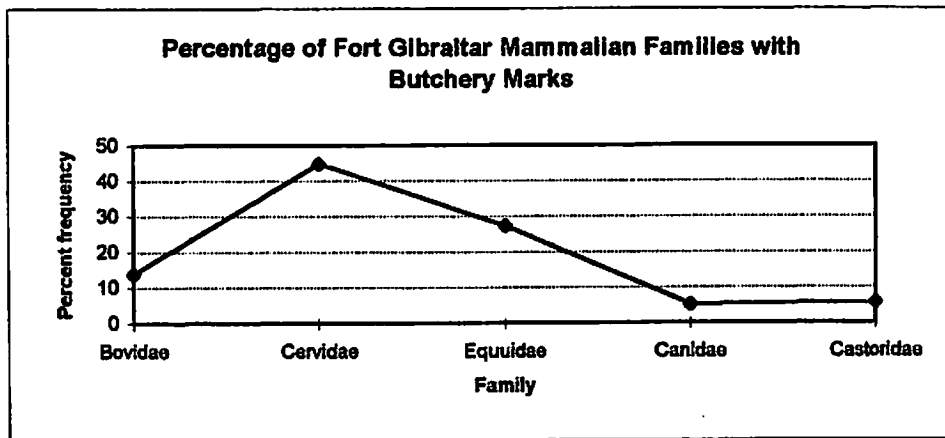
Figure 4.61 Percent frequency of mammal families with butchering marks, Fort Gibraltar I sample

Percentage of Fort Garry Mammalian Families with Butchery Marks
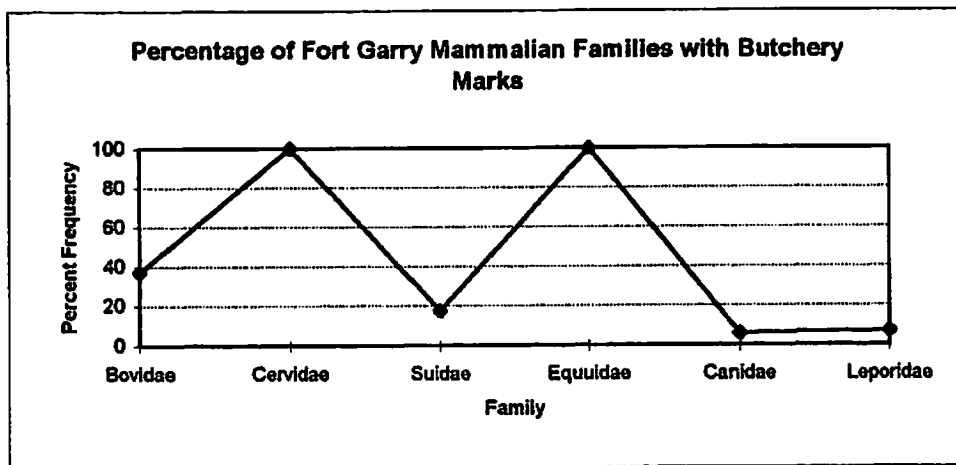
Figure 4.62 Percent frequency of mammal families with butchering marks, Fort Garry sample
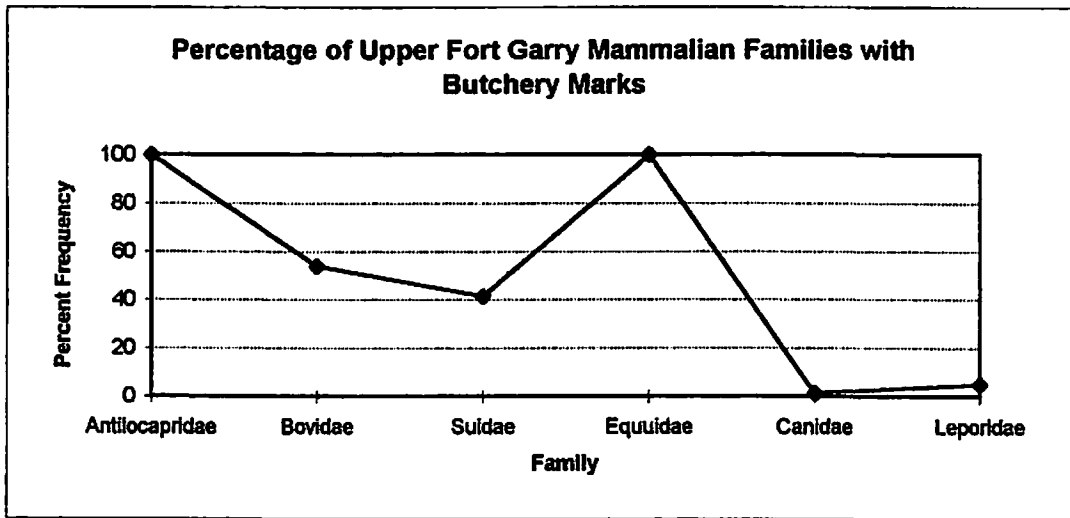
Figure 4.63 Percent frequency of mammal families with butchering marks,
          Upper Fort Garry sample

animals and large animals tend to be more intensively butchered. Carnivores tend to be less intensively butchered due to the likelihood that they furnish primarily furs rather than meat.

Many of those taxa which are not represented by butchered bone are those with small NISP counts and this may bias the view of butchery to a certain extent. In order to determine whether or not sample size played an affect on percentages of butchered bone at the family level, Spearman's rho was calculated for the frequencies of taxonomic families and percentages of butchered bone within those families. The results were not significant except in the case of Fort Garry (r_s=0.9622). However, this calculation should be reconsidered. Those families which rank consistently high in both frequency and butchered frequency may be reflecting the same cultural behaviour: these animals were both deposited in large numbers and butchered intensively because they were desirable food animals. The correlation between sample size and percentage of butchered bone is difficult to isolate from this more basic factor.

The correlation of higher numbers of butchering marks with more intensive exploitation was carried through into an examination of frequencies of body areas butchered within each family. Figures 4.64 to 4.68 present a series of data for each sample, showing the total quantity of each body area and the quantity of each body area butchered for each family which contains butchered bone. The Archaic sample data is presented in Figure 4.64 for Bovidae, Cervidae, Canidae, and Mustelidae. The Mustelidae pattern of head and lower limb butchery, compared to the frequencies of other body areas, is a strong indication of skinning. The Canidae data, however, is not so
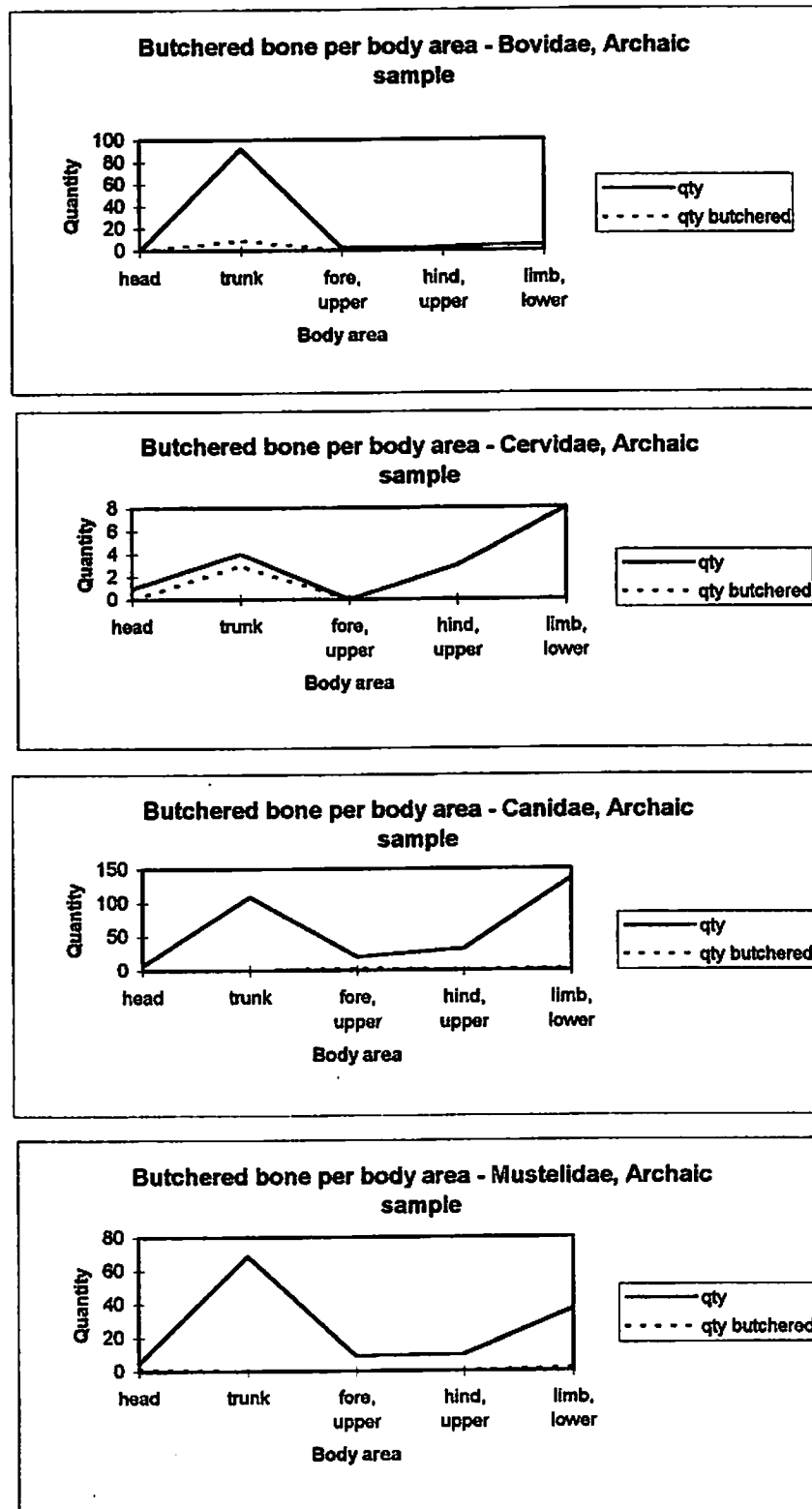
Figure 4.64 Frequencies of butchered bone per family in the Archaic sample

clear. The butchered lower limbs suggest skinning, while the butchered upper fore limb bones are suggestive of consumption. The Bovidae sample exhibits a surprisingly low number of butchering marks while the Cervidae sample is highly butchered on the trunk elements, but less so on the low utility lower limbs.

Figure 4.65 presents the Blackduck data for Bovidae, Canidae, and Castoridae. Relatively few show butchering marks. The bovid pattern exhibits butchery of the heavy meat bearing bones, particularly the upper fore and hind, while the lower limb bones do not. The Canidae pattern of high trunk butchery again appears to suggest some form of consumption. The Castoridae sample suggests both skinning and consumption, with skinning marks around the head and butchery marks on the upper fore limb.

Figure 4.66 presents the Fort Gibraltar I data for Bovidae, Cervidae, Canidae, Equuidae, and Castoridae. The patterns are quite distinct from the Precontact samples, with the butchered bone of Bovidae and Cervidae closely following the overall frequencies of the body areas, although lower limbs are consistently less butchered. This pattern suggests that the carcasses entered the post following primary butchery elsewhere. The Equuidae pattern is strongly suggestive of consumption of this animal, particularly the upper fore area. The butchery at the lower limb indicates skinning. The Canidae pattern shows consistently little butchery but again shows more in the upper hind area, suggestive of consumption.

The Castoridae pattern shows little butchery, possibly due to its relatively small size. The animal still seems consistently "under butchered" and may indicate that the animals were brought in for pelts rather than meat.

Butchered bone per body area - Bovidae, Blackduck sample

Butchered bone per body area - Canidae, Blackduck sample

Butchered bone per body area - Castoridae, Blackduck sample
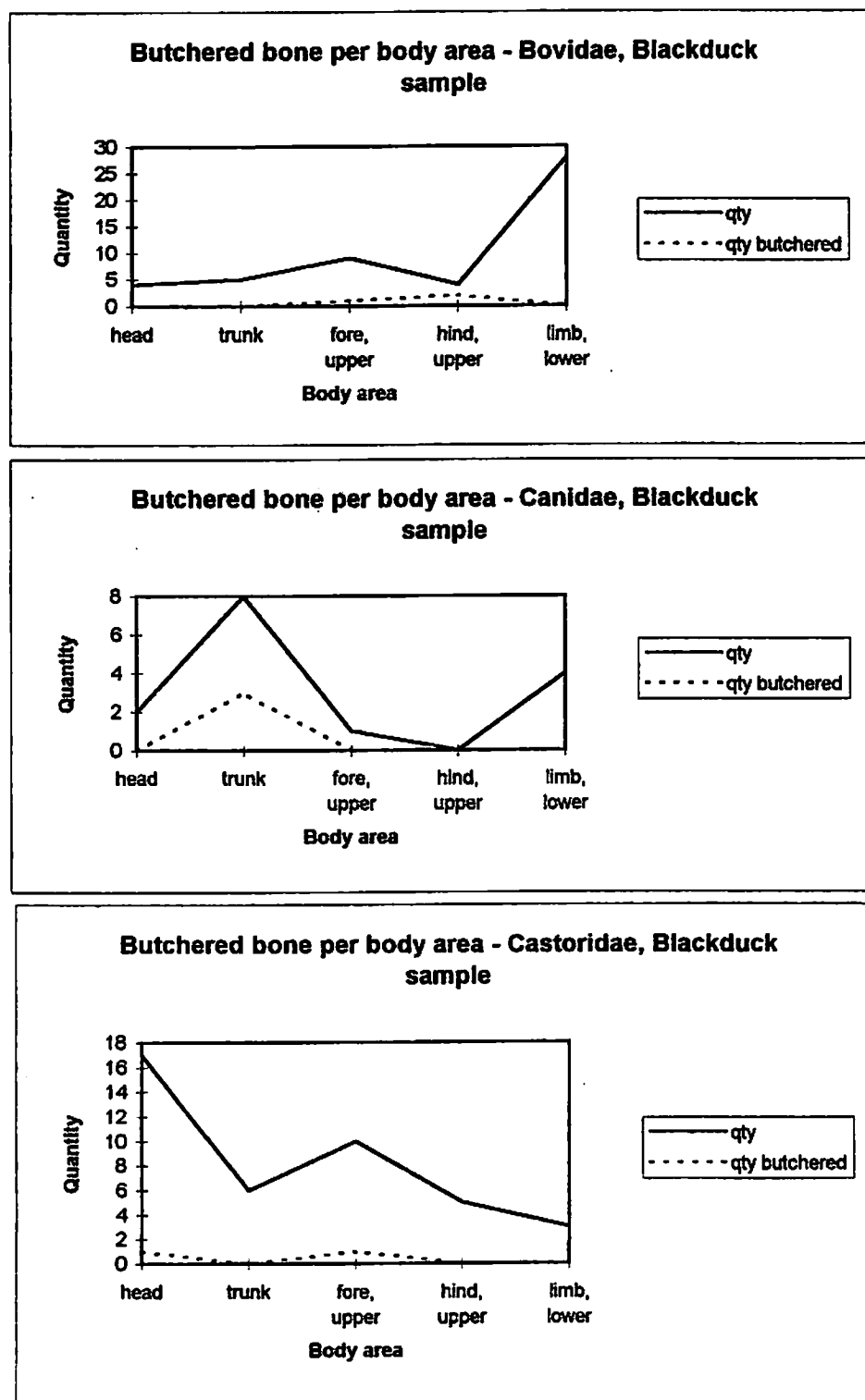
Figure 4.65 Frequencies of butchered bone per family in the Blackduck sample
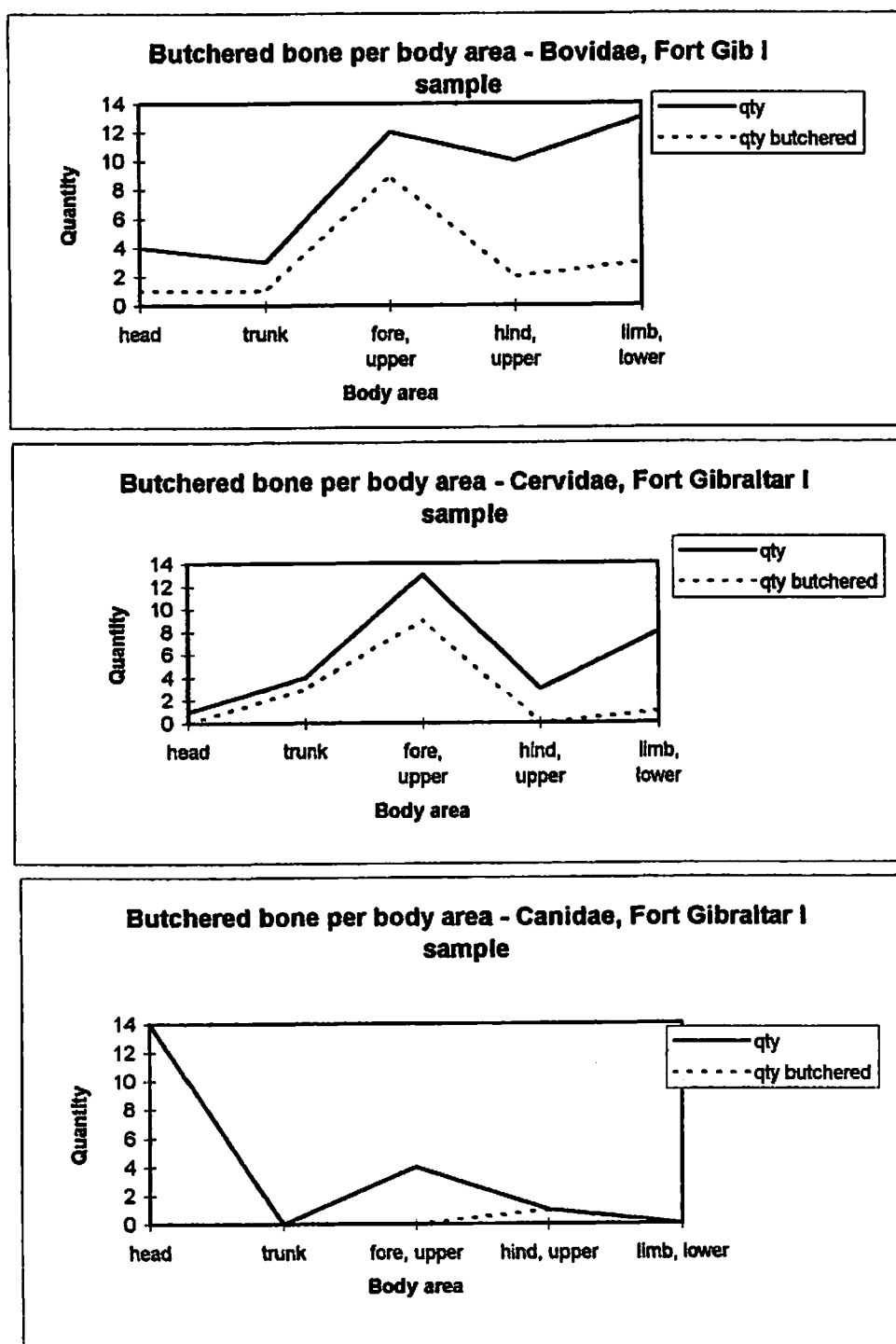
Butchered bone per body area - Bovidae, Fort Gib I sample

Butchered bone per body area - Cervidae, Fort Gibraltar I sample

Butchered bone per body area - Canidae, Fort Gibraltar I sample

Figure 4.66 Frequencies of butchered bone per family in the
Fort Gibraltar I sample

250
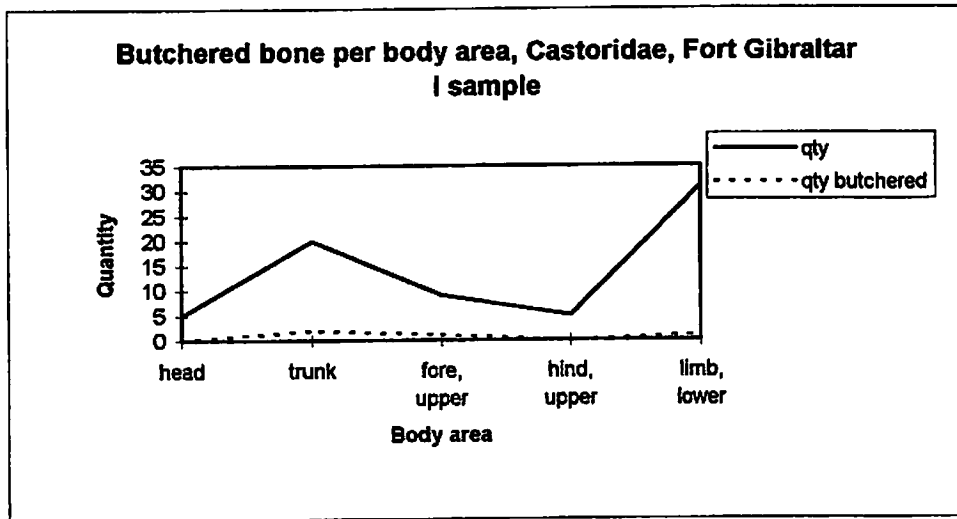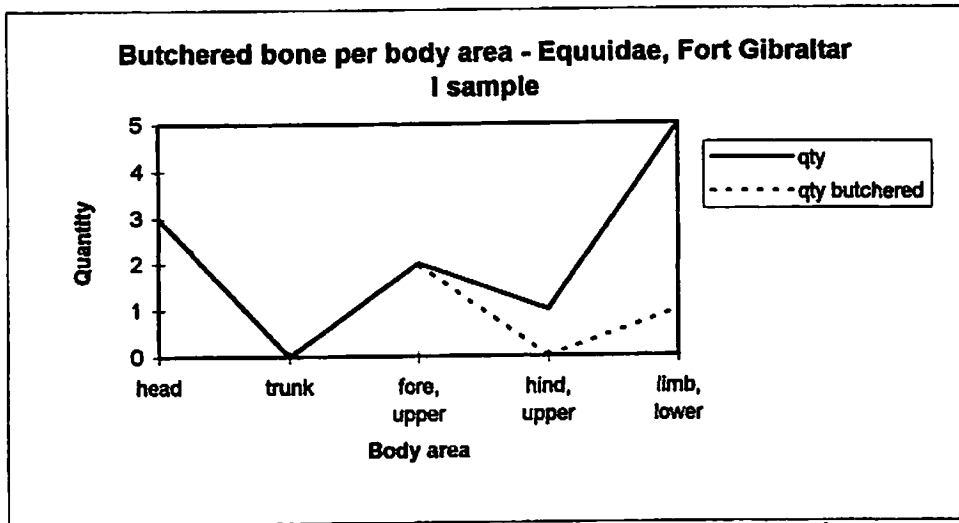
Figure 4.66 Frequencies of butchered bone per family in the
Fort Gibraltar I sample *(cont'd)*

Figure 4.67 presents the Fort Garry data for Bovidae, Suidae, Canidae, and Leporidae. The Bovidae sample again shows the butchery pattern following the representation pattern of body area except for the lower limb bones. This suggests that meat entered or was deposited in some already butchered form, perhaps as quarters with the lower legs still attached. The Suidae data presents a very different pattern. The high representation of unbutchered head and lower limb bones is suggestive of the refuse of primary butchery, with a decreasing body area representation with high butchery representation suggestive of consumption waste. The Canidae data again show high trunk butchery, perhaps indicative of consumption. The Leporidae data show high upper limb bone butchery indicating consumption, although the lack of lower limb butchery is odd considering the cuts required for the casing of the rabbit skin.

Figure 4.68 presents the Upper Fort Garry data for Bovidae, Canidae, Leporidae, and Suidae. The Bovidae data again show a mirroring of the body area representation with the butchered frequency representation. Again, this suggests that the meat was brought into the post - or was deposited - as butchered units. The Suidae data is, again, closer to the Bovidae data with the mirroring of the two patterns - body area representation and butchered body area representation - suggestive of the importation of already butchered portions of meat. The Canidae data show some trunk butchery. The Leporidae data show high upper limb bone butchery suggestive of consumption or post-consumption patterns.

Much of these butchering data could be improved with notations on locations of butchering marks on the elements, but this type of detail was not available for all

Butchered bone per body area - Bovidae, Fort Garry sample

Butchered bone per body area -- Suidae, Fort Garry sample

Butchered bone per body area -- Canidae, Fort Garry sample

Butchered bone per body area -- Leporidae, Fort Garry sample
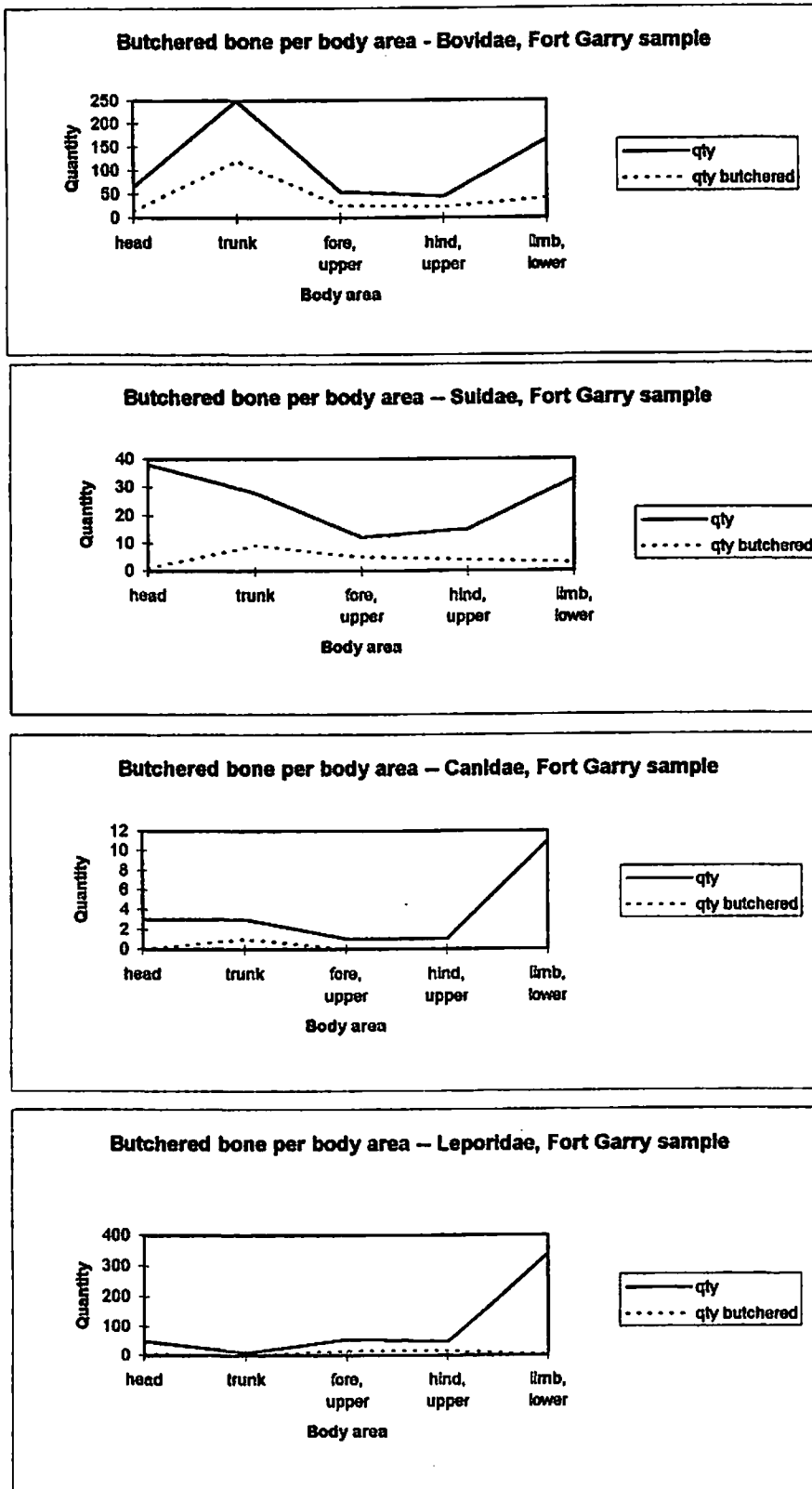
Figure 4.67 Frequencies of butchered bone per family in the Fort Garry sample
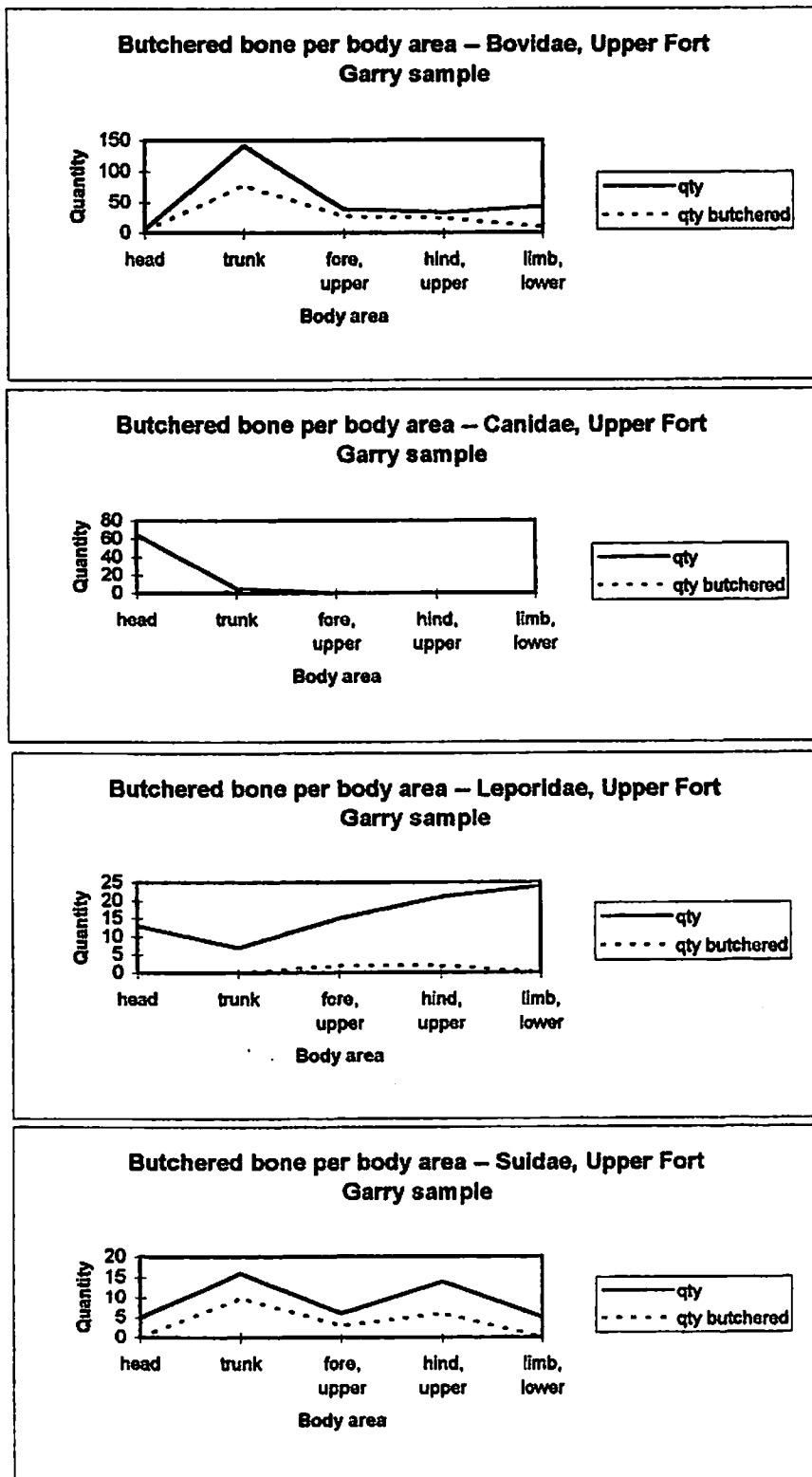
Figure 4.68 Frequencies of butchered bone per family in the Upper Fort
Garry sample

samples. Butchering marks were interpreted based on the information available, with more detailed data providing a firmer basis for interpretation.

Within the Archaic sample, butchery marks exist on Bovidae (*Bison bison*), Canidae (*Canis latrans*, *Canis lupus*, *Vulpes vulpes*) and Mustelidae (*Martes pennanti*). The bison butchery cuts exist on the ribs and thoracic vertebral spines. The dorsal process of the thoracic vertebra was the only portion noted, suggesting that the hump meat was brought to the camp with the thoracic spines intact within but removed from the body of the vertebrae. Both the thoracic spine and rib cut marks suggest the return to the camp of large portions of bison meat, with secondary butchery and meat removal occurring at the camp site. This transport of large meat portions complete with bone suggest a nearby kill. The canid marks appear to be suggestive of consumption for both wolf and coyote. The cut marks on the fox include skinning cut locations (metacarpal, metatarsal) as well as disarticulation marks (distal humerus and femur) which may also indicate consumption. The marten cuts exist only on the anterior mandible, metacarpal and phalanx, which indicate the use of the animal for its pelt. It is possible that the carnivores skinned and/or consumed on site were scavengers in the area during the fish processing and were merely dispatched and utilized in addition to ongoing site subsistence activities.

Within the Blackduck sample, the bison cuts on the femur and tibia are suggestive of meat removal while the cut and chop marks on the proximal ulna suggest disarticulation. This suggests that the legs, at least, were returned from the kill and further processed on site. The canid cut mark is on one vertebra, which suggests

disarticulation. The beaver cut marks suggest both skinning (distal mandible) and consumption (slices at distal limb areas).

The Fort Gibraltar I sample butchery marks are all chop marks, suggesting the use of an axe. Most of the butchered bison bones are limb bones, including many of the lower limb (metapodials and phalanges). The front leg chop marks occur on the scapula, glenoid, humerus, radius, metacarpus, first and third phalanges. The chop mark at the glenoid suggests disarticulation of the front leg at this spot, with further subdivision below. The chopping and utilization of the lower leg portions is an unusually intensive use of low utility parts and suggests either a need to intensively use all portions (i.e. low resources, starvation) and/or the production of bone grease for pemmican production. This correlates with the high number of unidentifiable long bone fragments within this sample, discussed in a previous section. The presence of all the front leg limb elements suggests that the front legs may have entered the post, or been processed, as quarters. One lumbar vertebra is chopped, likely in order to subdivide the backbone. The back leg exhibits butchering marks only on the tibia and ischium.

Canid butchery is represented only by a chopped femur. There does not appear to be any reason to chop the femur except for further disarticulation of the skeleton and, thus, presumably, consumption.

The Fort Garry sample includes chop, cut, and saw marks. This is the earliest instance of the use of a saw in butchery. Chop marks on bison distal radius and phalanges suggest that the legs came into the fort in complete units (i.e. quarters) and that disarticulation of limb bones was carried out by chopping. Bone grease was possibly still

being made within the post as indicated by the chopping of phalanges. Butchering of the trunk is evidenced by chopped lumbar vertebrae and various rib portions. The only lumbar vertebra identified to position is the fourth lumbar, suggesting that the backbone was subdivided about this point. Proximal (i.e. vertebral) rib portions show chop marks, presumably due to the removal of the rib cage from the vertebral column. Central rib portions show chop, cut, and saw marks. The low number of sawn elements suggests that at least the initial butchery - possibly carried out in the field - was executed using the axe. Subdivision of the large portions into smaller cuts of meat may have been accomplished using the saw.

Bos taurus remains exhibit more butchering marks than do the bison bones, probably due to the much larger sample size. Butchering marks on these bones also include chop, saw, and cut marks. Various types of vertebrae exhibit butchering marks. Chopped posterior portions of axis vertebrae indicate the removal of the head at this location. Vertebrae have also been sawn down the centre line, indicating that the saw was used to split the carcasses into two halves. This was probably an initial stage of butchery following head removal. Thoracic vertebrae have also been sawn at the base of the dorsal process. Lumbar vertebrae have been chopped through dorso-ventrally, to subdivide the spine. Rib portions include proximal (chopped or sawn), central or sternal portions (sawn, chopped, cut). This suggests the subdivision of the ribs into at least three portions - that left with the vertebrae, the central and sternal portions.

Front limb bones appear to be chopped to disarticulate the leg potions, with chop marks noted at the semilunar notch of the ulna, the distal radius, the proximal and distal

metacarpus and phalanges. Some of the disarticulation and chopping of the distal limb elements may also indicate continued extraction of bone grease. The carpals are also sawn through, suggesting that disarticulation of the lower limb was also accomplished through sawing straight through the carpals. Using an axe, this portion is disarticulated by chopping on either side of the carpals. The hind leg is also intensively butchered. Saw marks through the innominate suggest disarticulation of the hind leg at this point. The proximal femur exhibits cut marks, possibly for meat removal. The proximal and distal tibia is cut, sawn or chopped, presumably for disarticulation of the lower limb. The astragalus also exhibits chop marks. Cut and chop marks also exist at the proximal and distal ends of the metatarsus.

The remainder of the large Bovidae bones are identified as *Bison/Bos*. A few additional butchery marks are evident here. The first is butchery of the mandible including chopping at the condyloid process, cuts on the angle, and sawing of the distal ends. The first two are suggestive of mandible, and probable tongue, removal. Notably, sawing of the carcass into two halves only shows up on the bones definitely identified to *Bos* rather than *Bison*, which may indicate that bison were still butchered according to the "traditional" pattern and/or in the field. The front leg exhibits sawing of the scapula at the glenoid, as well as along the blade. Sawing is also evident at the proximal, central and distal humerus. The central radius is cut and carpals show both chopping and cutting. The cutting is likely evidence of skinning. Cuts on the calcaneus are probably also skinning marks. Proximal sesamoids and distal phalanges are also chopped and may indicate bone grease extraction. The hind leg is sawn at the femur head, presumably to

disarticulate the legs. The central femur is also sawn.

Ashbrook (1955:137-140) suggests that a "saw rather than an ax or cleaver should be used for cutting bones. This will avoid splintering the bone and causing unnecessary waste of meat." It appears that at the later Postcontact sites, both axe and saw were used for large scale splitting and subdivision of the carcass. The chopping, however, appears to occur during the removal of unwanted or low utility parts (e.g. head, lower limbs) while the saw is used to create the cuts of meat (e.g. central rib portions, thoracic spines, etc). A comparison of the *Bos* and *Bison* patterns do not show many differences, although the bison bone is more likely to be chopped than sawn. This may indicate field butchery for the bison and post or settlement butchery for the cattle. The small size of the bison assemblage makes such comparisons speculative.

The ovicaprid assemblage - most likely over 90% *Ovis aries* - displays a higher frequency of cut marks rather than chopping or sawing. Cut marks on the head and face are possibly due to loosening the skin at these points during the skinning process (see Ashbrook 1955) and the skinning process is the likeliest source of cuts on the metapodia. The head appears to have been removed with a saw, while chop marks on the cervical vertebrae suggest the use of an axe for further subdivision of the neck. Chop marks are also evident on the thoracic, lumbar, and caudal vertebrae. Ashbrook (1955) suggests that sheep be split along the backbone only where necessary to subdivide the shoulders and back legs. This is consistent with the Fort Garry pattern. The neck of the scapula is sawn, subdividing the shoulder and front leg, with cuts also at the distal humerus, central radius/ulna, carpus and metacarpus. Back leg cut marks include the innominate,

distal femur, proximal tibia, distal tibia, tarsus, and metatarsus. Many of these cut marks appear at the joints, suggestive of the cutting of ligaments etc to facilitate disarticulation. Only central and sternal rib portions are present, either sawn, chopped or cut.

The evidence for swine (*Sus scrofa*) butchery is relatively limited. The posterior portion of the head has been chopped, presumably during disarticulation. Very few vertebrae are butchered, excepting sawn thoracics and lumbars. These are subdivided longitudinally to split the carcass. The innominate is also sawn and the pubic symphysis chopped, presumably during the halving of the carcass. The sternum is split and chopped. Few butchered rib fragments are present, only sawn and/or cut central fragments. The scapula shows chop marks, with cuts on the distal humerus, proximal ulna, carpi and phalanges. Similarly, the hind legs exhibit cut marks at the proximal tibia, fibula, and tarsi.

The Canidae butchery evidence consists only of one chopped first thoracic vertebra, possibly due to disarticulation at the head. The Leporidae bone shows only cut marks, as one would expect from such a small animal. Cut marks on the distal maxilla, nasal and zygomatic are consistent with skinning, as are marks on the phalanges, metacarpals, distal radius, distal tibia, and proximal radius and tibia.

The Upper Fort Garry assemblage apparently exhibits only saw and/or cut marks. These are the only categories included within the cataloguing system. It is not clear whether chop marks were not included within the system because they were not present or because they were not separately identified. The bison bones include sawn thoracic spines, consistent with removal of the hump meat. Sawn lumbar vertebrae are also

noted, probably similar to those within the Fort Garry sample, for subdivision of the backbone. The front leg is sawn at the proximal humerus, with cuts on the central radius. The back leg shows sawn proximal femur portions. These butchery marks appear to be similar to the cattle butchery marks. The *Bos taurus* assemblage exhibits many more cuts which is likely due to a larger sample size. The vertebrae are longitudinally split, through to the sacrum. The ribs occur as sawn proximal/central or central portions. Saw marks are also evident on the scapula blade, the proximal humerus, distal humerus, proximal radius, and metacarpus. This is suggestive of disarticulation around the joints. The back leg exhibits saw marks at the distal and central femur, central and distal tibia. These appear to be by-products of meat cut production rather than initial disarticulation. No marks are noted on the carpals, tarsals, or phalanges. This may indicate that meat cuts were imported into the post or the depositional context as already butchered "cuts."

The *Capra hircus* butchery marks are all cut marks, excepting one sawn proximal tibia. Cuts exist on the scapula blade, central humerus, proximal/central ribs, and innominate. These are all suggestive of meat removal. The *Ovis aries* butchery marks include more saw marks than within the Fort Garry sample, including split cervical, thoracic, and lumbar vertebrae suggestive of the halving of the carcass. The ribs are only proximal/central cut sections. The innominate is sawn at the ischium.

The swine butchery marks indicate splitting of the carcass using a saw. The scapula and semilunar notch of the ulna show cut marks, likely due to meat removal in the case of the scapula and disarticulation in the case of the ulna. Cuts are also found

on the proximal and central rib portions, suggestive of meat removal. The back leg is more intensively butchered than the front leg, including a sawn ischium, distal femur, and central tibiae. Cuts are also evident on the femur and distal tibia. This patterning is closer to the *Ovis/Capra* pattern than to that of the large bovidae.

One canid rib has been cut. The *Lepus* sp. bones show cut marks only, on the tibia and pelvis. The tibia cut is likely due to skinning, although the pelvis cut is puzzling and may indicate disarticulation of the hind limb. The cottontail (*Sylvilagus floridanus*) bones exhibit cuts on the scapula, suggesting disarticulation of the front limb at this location.

Summary of Butchering Mark Analysis

Within these later Postcontact assemblages (Fort Garry and Upper Fort Garry), the saw is generally used more frequently on the larger animals such as the cattle, decreasing in frequency on pigs and sheep. Even in these latter cases, it may be that an analysis of estimated individual size would show that the saw was used on the larger specimens of these two species (e.g. large boars). The saw is used both for primary butchery (removal of head and lower limbs and halving of the carcass) as well as subdivision of the remainder into meat cuts.

The Fort Gibraltar I sample is interesting in that it appears to be the most intensively butchered assemblage. In the case of the bison, this may be indicative of pemmican/bone grease production. The intensive butchery of other taxa, coupled with the taxonomic richness of the sample, may indicate that resources were few. The Fort

Garry and Upper Fort Garry assemblages display a much more formalized butchering pattern in the modern sense, producing "market cuts" of meat. Intensive butchering of the distal limb elements of cattle are interesting and is suggestive of the use of cattle bone in the creation of bone grease. All assemblages also include some butchered canid and other carnivore. The mustelids appear to have been skinned only, while the canid bones appear to indicate at least limited butchery for consumption as well as skinning.

The Fort Garry assemblage includes much more butchered bone that does the Upper Fort Garry assemblage, including more large mammal skinning marks. This may indicate more on-site butchery of domestic mammals within the Fort Garry period, while the Upper Fort Garry period is more suggestive of imported, prepared meat cuts. The swine butchery is again more evident within the Fort Garry assemblage, including low utility elements. The argument again can be made that this post butchered and preserved its own meat while Upper Fort Garry was part of a market economy involving the purchase of prepared, butchered meat cuts. It may also indicate, with the swine butchery, that Fort Garry more intensively used the "low utility" bones in the pig, such as the lower limb bones and head.

The marks on the Leporidae consistently indicate skinning and occasional removal of the lower limbs as a step in the initial butchery.

Thermal Alteration and Carnivore Chewed Bone

The existence, but not the degree, of thermal alteration, was noted within all assemblages. Table 4.30 shows the dramatic variation in the percentage of thermally

altered mammalian bone from sample to sample. Fort Gibraltar I (68.81%) and Fort Garry (42.03%) contain the highest percentages of burnt bone, Upper Fort Garry (4.64%) the lowest percentage, and the Precontact assemblages more or less comparable with 8.93% (Archaic) and 10.68% (Blackduck).

Table 4.30 Quantities (NISP) and percentages (% NISP) of butchered, chewed, or burnt mammalian bone

Sample	Butchered	Chewed	Burnt
Archaic	69 (1.26%)	1 (0.02%)	489 (8.93%)
Blackduck	17 (0.44%)	28 (0.73%)	411 (10.68%)
Fort Gibraltar I	149 (1.13%)	19 (0.14%)	9079 (68.81%)
Fort Garry	536 (10.17%)	78 (1.48%)	2215 (42.03%)
Upper Fort Garry	366 (26.11%)	19 (1.36%)	65 (4.64%)

A more detailed study of the thermal alteration of the bones might be helpful but, at this point, it is suggested that the high percentage of burnt/calcined bone within the earlier two Postcontact assemblages may be due to the burning off of garbage within the post. The Archaic and Blackduck inhabitants of the Forks would not need to burn the garbage and probably relatively little would accumulate, given the short occupation periods.

The Fort Gibraltar I assemblage contains evidence of bone grease manufacture. This manufacturing process required large quantities of bones and meat, which would

have created a large amount of refuse. Burning would have been the most efficient way of reducing the odour and bulk of this refuse.

Alternatively, it is possible that the burning of the bone was a final stage in the production of bone grease. Hurlburt (1977:17-18) cites Leechman's 1951 article which suggests that concentrations of "unburnt, burnt, or calcined...bone "no larger than a fingernail"...are commonly interpreted as being the residue of bone grease manufacture". Hurlburt disagrees with this statement, pointing out that little grease can be obtained from calcined bone and that such extreme heating was not necessary for the bone to yield its grease. It is notable, however, that Hurlburt's Northwest Company post also contained large percentages of burnt and calcined bone, similar to Fort Gibraltar I. The prior interpretation of disposing of the waste products of bone grease manufacture through burning appears to best explain the high percentages of burnt bone in the Fort Gibraltar and Fort Garry assemblages. The Upper Fort Garry assemblage was excavated primarily from the privies which were, in themselves, a form of garbage disposal in which burning would not be necessary.

The percentages of chewed bone, on the other hand, are consistently quite low - less than 1.5% of the overall mammalian assemblage. This may indicate that carnivore destruction of bone was not a major taphonomic effect within these assemblages, despite the known presence of dogs within these culture periods.

The frequencies of butchered, burnt, and chewed bone were examined by family. For the Bovidae family, the frequencies of burnt and chewed bone generally mirror - at much lower frequencies - the frequencies of the body areas themselves. The notable

exceptions are within the Blackduck and Fort Gibraltar I samples, in which the chewed bone tends to be lower utility areas of the head and lower limb. In these occupations, scavengers or dogs may have been provided with discarded, unprocessed low utility parts while in the other occupations, burning and carnivore chewing were perhaps the final steps of processing and consumption.

Within the Archaic and Fort Gibraltar I occupations, the lower utility lower limb bones of Cervidae appear to have been burnt, while in the Blackduck occupation these portions were chewed. Both methods appear to have been means of discard of low utility parts which were seldom butchered intensively. Metapodials might also have been heated to access the marrow.

Data for Suidae include only the later three occupations. Within the Fort Gibraltar I occupation, none of the pig bones were butchered, burnt, or chewed despite being primarily "low utility" bones. Within the Fort Garry sample, the butchered frequencies and burnt frequencies are inversely related. Trunk and upper limb bones are butchered, while head and lower limb bones are burnt. The chewed bones follow the actual frequencies, excepting that the head is not chewed. Within the Upper Fort Garry sample, the low utility lower limb bones are burnt but so are the upper fore limbs. Chewed bones are only the upper hind bones.

Within the Archaic assemblage, canid bones show very low frequencies of butchery or burning and there is no evidence of chewing. The Blackduck canid bones have not been burnt although lower limb bones do show signs of chewing. None of the canid bones within the Fort Gibraltar I or Fort Garry samples have been burnt or chewed.

The Fort Garry sample, however, indicates burnt bone, with frequencies paralleling the general frequencies excepting the lower limb. This suggests that the lower limbs were possibly removed at different stages and deposited differently. Very little of the canid bone is chewed, except within the Blackduck sample. It is worth noting that several families exhibit very little or no burning or chewing, including Leporidae, Felidae, and Ursidae. Some of these are very minimally represented but others, such as Castoridae, Leporidae, and Cricetidae (muskrat) are well-represented in at least one sample but show no evidence of burning or chewing.

4.3 Seasonality Estimates

The techniques for determining seasonality of procurement for various taxa were presented in Chapter 3. This section presents the results of the applications of these techniques.

4.3.i Migratory Bird Presence

The presence/absence of migratory bird taxa provide a general indication of seasonality of exploitation of these species given that these birds are absent from southern Manitoba during the winter. Some of these taxa are present within the area throughout their breeding season, while others are available only during their migration through the area in spring and fall. Table 4.31 presents the migratory taxa within each of the samples, providing dates for the spring and fall migrations. Those birds which nest locally are provided only with the earliest spring and latest fall migration dates, estimating the greatest range of possible presence and availability. Those birds which do not nest locally are provided with early and late dates for each migration, estimating date ranges of local availability. The presence of locally nesting birds provides only very general information on seasonality, indicating that the sites may have been occupied at some point from spring to fall. The taxa which are present in the area only during migration provide information of a more defined time period of exploitation.

The Blackduck sample includes possible waterfowl procurement dates ranging from March 25 to November 30 inclusive. The Fort Gibraltar I sample includes waterfowl procurement dates ranging from March 13 to November 30, but possibly

SAMPLE	TAXON	SPRING DATES	FALL DATES	NESTS LOCALLY
Blackduck	Anas crecca/discors[1]	March 25/April 8	November 18/October 25	yes
	Anas rubripes/platyrhynchos[1]	April 11/March 18	November 18/November 30	yes
	Ectopistes migratorius[2]	e. May	l. September	yes
Fort Gibraltar I	Anas sp.[1]	March 22	November 30	yes
	Anserinae[1]	March 13	November 25	yes/no
	Olor buccinator[1]	e. spring	??	yes
	Merginae[1]	April 2	November 25	yes
Fort Garry	Anas platyrhynchos[1]	March 18	November 30	yes
	Aythya americana ?[1]	April 11	November 18	yes
	Branta canadensis[1]	March 13	November 25	yes
	Chen caerulescens[1]	April 9-June 7	September 2-November 18	no
	Olor sp.[1]	April 11-May 26	October 11-November 16	no
	Ectopistes migratorius[2]	e. May	l. September	yes
Upper Fort Garry	Chen caerulescens[1]	April 9-June 7	September 2-November 18	no
	Olor columbianus[1]	April 11-May 26	October 11-November 16	no
	Branta canadensis[1]	March 13	November 25	yes
	Anas platyrhynchos[1]	March 18	November 30	yes
	Mareca americana[1]	March 25	November 16	yes
	Aythya affinis[1]	April 10	November 30	yes
	Grus americana[2]	April 15	l. October ?	yes
	Ectopistes migratorius[2]	e. May	l. September	yes

Table 4.31 Migratory bird taxa present archaeologically ([1] indicates data from Gardner 1981; [2] indicates data from Thompson 1891)

limited to migration periods dependent on the species of swan and goose. The Fort Garry

sample dates range from March 13 to November 30 for exploitation of waterfowl, with

more limited exploitation of the migratory snow goose and swan. Upper Fort Garry dates

also range from March 13 to November 30 for procurement, with limited access to the

migratory snow goose and swan.

4.3.ii Avian Medullary Bone

The analysis of medullary bone provides narrower date ranges for the procurement

of avian taxa. Three elements - femur, tibiotarsus, and ulna - were selected for

examination based on previous research (Rick 1975:184) which found that medullary bone

is most easily viewed in these elements. Specimens noted as containing medullary bone

within the original catalogue records were also included. Table 4.32 presents the number

of specimens selected for examination, those in which the examination could be carried

out, and those with positive identifications of medullary bone. The number of specimens

selected includes all of the relevant avian elements for that sample, many of which could

not be viewed because they were unbroken or were in a poor state of preservation. The

application of radiography or sawing through the bones to expose the medullary cavity

would have resulted in a more complete examination of the available sample. However,

radiographic facilities are difficult to access and sawing through the bones is destructive.

Examining only incomplete elements appeared to be the most sensible, and least

destructive, approach.

Only a small percentage of the avian assemblages included incomplete elements

Table 4.32 Frequencies and percentages of the avian assemblages involved in the study
of medullary bone

Sample	Total Bird	Total Selected	Total Viewed	Total Positive
Blackduck	45	9 (20%)	8 (17.78%)	2 (4.44%)
Fort Gibraltar I	437	26 (5.95%)	22 (5.03%)	1 (0.23%)
Fort Garry	1060	111 (10.47%)	76 (7.17%)	5 (0.47%)
Upper Fort Garry	398	45 (11.31%)	31 (7.79%)	4 (1.01%)

Table 4.33 Positive identifications of medullary bone

Sample	Catalogue Number	Element	Taxon
Blackduck	21K22E27-12x-7273	long bone	Aves
Blackduck	21K22E27-12x-7273	phalanx - alar	Large Aves
Fort Gibraltar I	21K66B11-114031	femur	*Olor* sp.
Fort Garry	DILg-33:88C/09344	tibiotarsus	*Gallus domesticus*
Fort Garry	DILg-33:88C/11880	tibiotarsus	Anatinae/Aythyinae
Fort Garry	DILg-33:88C/12570	tibiotarsus	*Olor* sp.
Fort Garry	DILg-33:88C/09129	ulna	*Anas* sp.
Fort Garry	DILg-33:88C/04156	long bone	Medium/Large bird
Upper Fort Garry	2375	tibiotarsus	*Gallus domesticus*
Upper Fort Garry	2933	tibiotarsus	Phasianidae
Upper Fort Garry	2811	phalanx - foot	*Anas* sp.
Upper Fort Garry	2805	long bone	Large bird

that were suitable for examination and very few contained medullary bone. Table 4.33 lists the elements and taxa of the positively identified medullary bone. It is evident that spring/early summer bird remains were deposited within each of these assemblages and that these occupations most likely included this season.

The Blackduck sample medullary bone cannot be identified to taxon. It is worth noting, however, that neither of these specimens had been selected for examination, neither were identified during cataloguing as containing medullary bone, and were only noted in passing while examining other elements. In other words, the approach as planned would have missed these elements altogether, potentially producing an alternate seasonality estimate.

The Fort Gibraltar I sample element which contains medullary bone is a swan (*Olor* sp.) femur fragment. The whistling swan (*Olor columbianus*) does not breed in southern Manitoba while the trumpeter swan (*Olor buccinator*) included southern Manitoba within its breeding range (Gardner 1981). Thompson (1891:487) does not list either swan as a local breeder. It is probable that this bird was obtained during spring migration. Dates for the spring migration of *Olor columbianus* are given as April 11 to May 26 (Gardner 1981).

The Fort Garry sample contains five positive identifications of medullary bone. These include chicken (*Gallus domesticus*), duck (both Anatinae/Aythyinae and *Anas* sp.), swan (*Olor* sp.), and unidentified medium/large bird.

Modern chickens maintain an elongated laying period and therefore produce medullary bone for long periods. Rick (1975:187) is of the opinion that pre-nineteenth

century chickens experienced shorter laying periods. Henry the Younger (1988:301, 327) brought chickens from Fort William to the Red River area in the fall of 1807. The surviving hen began to lay on March 29, 1808 and continued until April 29. She does not appear to have laid again at least up to July 28, when Henry notes the size of his flock. In following years, Henry (1992:720) states that "[h]ens should never be put to hatch here sooner than the beginning of April." In that year of 1814, chickens were hatching from April 14th to 16th. Given the presence of the medullary bone within the bird a few weeks before laying, this provides an estimated date range of mid-March to late April.

The swan bone again suggests a bird obtained during spring migration, with Gardner's (1981) dates for *Olor columbianus* ranging from April 11 to May 26. The duck nesting dates from Gardner (1981) were combined for a number of Anatinae and Aythyinae species to provide an "average" duck nesting period. The result is a range from May 8 to July 6. This provides a medullary bone presence date range of late April to early July, given approximately two weeks in advance of laying. One of these bones (the unidentified long bone) was examined during cataloguing and would not otherwise have been examined in the scope of this research.

The Upper Fort Garry sample contains four specimens with medullary bone. Two of these would not have been examined as a part of this research and were noted during the original cataloguing and identification of the collection. The Upper Fort Garry sample contains chicken (*Gallus domesticus*) and duck (*Anas* sp.), while the Phasianidae specimen may well be another chicken. The chicken dates approximated for the Fort

Garry sample, mid-March to late April, can probably be used for this sample also. The *Anas* sp. nesting dates within Gardner (1981) provide a range of May 8 to July 6, again providing a late April to early July period for the presence of medullary bone within these birds.

It is difficult to interpret the presence and numbers of the medullary bone specimens. Presence of medullary bone does suggest that these occupations included, but were not necessarily limited to, the spring/early summer period. This assumes that the birds were procured and consumed within the same limited period and that they were not preserved for consumption at a later date. The taxa were also evidently utilized around the laying period. It is, perhaps, as interesting to note which taxa do not contain medullary bone as much as which ones do. Those which were examined but which do not contain medullary bone were, particularly, the passenger pigeon (*Ectopistes migratorius*) and goose (Anserinae). This may suggest that these taxa were hunted during the fall, rather than spring, migration. Timing of the development of medullary bone, however, does vary between taxa. Rick (1979:5) found that snow goose medullary bone had already developed in migrating birds, about a month prior to egg laying. Chickens, however, develop the bone from ten to fourteen days prior to laying and pigeons only seven days prior to laying. The lack of medullary bone in geese from the Forks assemblages may be due to procurement during the fall, but the lack of medullary bone in the passenger pigeons may be a function of the timing of medullary bone development.

Variability in the percentages of positively identified medullary bones is interesting. The Precontact Blackduck sample yielded the highest percentage of

medullary bone relative to the sample size, while the Postcontact samples yielded notably lower percentages. This may be due to the more extended occupation periods represented by the Postcontact samples. The potential effects of sample size and excavation sampling strategy, however, may also have affected the variability in percentages.

4.3.iii Fish Spawning Exploitation

It is often argued that fish taxa were most likely to have been heavily exploited during periods of greatest abundance, which generally coincide with spawning periods. Table 4.34 provides the spawning information for the fish taxa present within the archaeological samples. Three points can be made regarding the spawning exploitation argument. Firstly, not all fish spawning occurs in such a way (i.e. limited time period, congested waters, accessible habitat) as to facilitate capture of the fish, particulary given technological limitations. Both spawning behaviour and spawning season must be considered. Secondly, fish may spawn in habitats distant from the site in which their remains are found, suggesting that their inclusion in local assemblages is more casual.. Preservation (e.g. drying, smoking) and subsequent transport should also be considered possibilities for those taxa which spawn elsewhere. Thirdly, this approach may make sense when considering intensive exploitation of one or a few species within a limited period, but does not make sense given the presence of "casual" fishing. It also assumes that no other more pressing needs existed, requiring a balancing of the spawning fish resources with other needs. Those taxa which were exploited locally primarily during their spawning period are also potentially recognizable in the taxonomic frequencies.

SAMPLE	TAXON	SPAWNING PERIOD	SPAWNING PERIOD
Archaic	*Acipenser fulvescens*	e. May - l. June	rivers
	Aplodinotus grunniens	July-September	bays, lower portions of rivers, over sand and mud
	Catostomidae	mid-April - e. June	small rivers and streams, gravelly bottoms
	Esox lucius	April - e. May	heavily vegetated floodplains and bays
	Hiodon sp.	May - e. July	pools in turbid rivers, backwater lakes and ponds of rivers
	Ictaluridae	l. spring - summer	rivers, moving water
	Lota lota	midwinter (January-March)	usually in lakes
	Stizostedion sp.	e. spring	coarse gravel in streams or shoals in lakes
Blackduck	*Acipenser fulvescens*	e. May - l. June	rivers
	Aplodinotus grunniens	July - September	bays, lower portions of rivers, over sand and mud
	Carpiodes cyprinus	April - May	streams, lakes, rivers
	Catostomus sp.	mid-April - e. June	gravelly streams, shallow areas of lakes
	Esox lucius	April - e. May	heavily vegetated floodplains and bays
	Hiodon alosoides	May - e. July	pools in turbid rivers, backwater lakes and ponds of rivers
	Ictalurus punctatus	l. spring-summer	under rocks, logs, undercut banks in rivers, moving water
	Lota lota	midwinter (January-March)	usually in lakes
	Moxostoma anisurum	spring	swiftly flowing streams
	Moxostoma macrolepidotum	l. May	small rivers, streams
	Stizostedion vitreum	spring - e. summer	rocky area in white water, coarse bottomed lakes
Fort Gibraltar I	*Acipenser fulvescens*	e. May - l. June	rivers
	Aplodinotus grunniens	July - September	bays, lower portions of rivers, over sand and mud
	Catostomidae	mid-April - e. June	small rivers and streams, gravelly bottoms
	Esox lucius	April - e. May	heavily vegetated floodplains and bays
	Hiodon sp.	May - e. July	pools in turbid rivers, backwater lakes and ponds of rivers
	Ictalurus sp.	l. spring-summer	rivers, moving water
	Perca sp.	mid-April - e. May	shallows of lakes, into tributary rivers
	Stizostedion sp.	spring - e. summer	coarse gravel in streams or shoals in lakes

Table 4.34 Spawning periods and areas of various fish taxa within the archaeological samples – data primarily from Scott and Crossman 1973

Table 4.34 cont'd

SAMPLE	TAXON	SPAWNING PERIOD	SPAWNING HABITAT
Fort Garry	*Acipenser fulvescens*	e. May - l. June	rivers
	Aplodinotus grunniens	July - September	bays, lower portions of rivers, over sand and mud
	Catostomus commersoni	e. May - e. June	gravelly streams, lake margins - shallow water
	Coregonus clupeaformis	fall	shallow water with rocky rubble
	Esox lucius	April - e. May	heavily vegetated floodplains and bays
	Hiodon sp.	May - e. July	pools in turbid rivers, backwater lakes and ponds of rivers
	Ictalurus punctatus	l. spring - summer	under rocks, logs, undercut banks in rivers, moving water
	Lota lota	midwinter (January-March)	usually in lakes, gravel bars or rocky shoals
	Stizostedion vitreum	spring - e. summer	rocky area in white water, coarse bottomed lakes
Upper Fort Garry	*Aplodinotus grunniens*	July - September	bays, lower portions of rivers, over sand and mud
	Catostomus catostomus	mid-April - mid-May	streams, shallow areas of lakes
	Catostomus commersoni	e. May - e. June	gravelly streams, lake margins - shallow water
	Coregonus artedii	fall	gravel or stony bottom in about 1-3m of water
	Coregonus clupeaformis	fall	shallow water with rocky rubble
	Cyprinus carpio	spring	shallow, marshy waters
	Hiodon alosoides	May - e. July	pools in rivers or backwater lakes of rivers
	Ictalurus nebulosus	May - June	silty bottoms of streams, under stumps, trees, or rocks
	Ictalurus punctatus	l. spring - summer	under rocks, logs, undercut banks in rivers, moving water
	Perca flavescens	mid-April - e. May	shallows of lakes and tributary rivers
	Stizostedion vitreum	spring - e. summer	rocky area in white water, coarse bottomed lakes

These taxa are most likely those which are overwhelmingly represented within the taxonomic frequencies.

The spawning dates for taxa within the Archaic sample span almost the entire year, but it is plain that the Forks was not continuously inhabited during this period. Given the spawning behaviour and location for the various species, local spawning taxa may have included sturgeon, suckers, possibly goldeye/mooneye, and catfish. The other taxa may be found within the immediate area, but not during the spawn. An examination of the taxonomic frequencies reveals an exaggerated representation of Catostomidae and Ictaluridae, but very few of the other taxa. This suggests that within the given range of local spawners, these two taxa were most likely exploited during the spawn at this location. An examination of all taxa provides possible occupation/exploitation dates of mid-April to June. Limiting this to suckers and catfish does not narrow this range appreciably.

The Blackduck sample also contains various taxa which do not spawn within the immediate area. Taxa which spawn in the area and may have been exploited during this time are sturgeon, quillback, suckers, goldeye, and catfish. This would provide occupation/exploitation dates of April to June. An examination of Table 4.8 shows a high percentage of catfishes, suggesting a narrower range of dates, from May to June.

The Fort Gibraltar I sample includes the local spawners sturgeon, suckers, goldeye/mooneye, and catfish, providing a date range of mid-April to June. Taxonomic frequencies are notably high for sturgeon and catfishes, providing a slightly narrower range of dates from May to June.

The Fort Garry sample includes the local spawners sturgeon, suckers, goldeye/mooneye, and catfish, providing a date range of May to June. Interestingly, the whitefish (*Coregonus clupeaformis*) is a lake dweller, usually exploited now and historically during the fall spawn. This indicates an increase in catchment area for this time period. The taxonomic frequencies are notably higher for mooneye/goldeye and drum. The latter does not spawn within a narrow range of time, while the former spawns from May to early July. Use of the taxonomic frequencies in interpreting the potential exploitation of spawning fishes is of less use with the later Postcontact samples due to the more consistent, year-round occupation of the area.

The Upper Fort Garry local spawners include the suckers, carp, goldeye, and catfishes, providing a date range of mid-April to July. It is notable that whitefish and lake cisco are included in the sample, suggesting an increase in catchment area.

Within the HBC Postcontact occupations, it is more difficult to determine the season of capture of the various fish taxa because the posts were continuously occupied, although fewer men often remained during the summer months. The Fort Gibraltar I assemblage appears to represent a transitional period, with exploitation of spawning catfish and sturgeon during the spring and early summer. The assumption of exploitation during the spawn requires that the people are sufficiently mobile to be able to access resources from various areas and that the subsistence system is a successful one. If the inhabitants are starving, fish will be caught and consumed where possible. Increased study of incremental growth structures would provide a more definite picture of the seasonality of exploitation of the various taxa.

4.3.iv *Ictalurus* sp. Pectoral Spine Incremental Growth Analysis

The majority of the spines selected are from channel catfish (*Ictalurus punctatus*), with a small minority of bullhead (*Ictalurus nebulosus*). As noted in Chapter 3, a large sample of modern channel catfish spines from the Red River was obtained from Natural Resources. These fish were caught within a one-month period during the spring (mid-May to mid-June). One additional modern spine was from a channel catfish killed in August. The Natural Resources spines were already prepared (i.e. thin sectioned and mounted on slides), while the remaining modern spines and the archaeological spines had to be prepared prior to viewing. The mounted and thin sectioned specimens were then photographed onto slide film, the photographs scanned, and printed. The interpretation and measurements were carried out through the examination of the original slides, the photographs, and the printed versions. The measurements made were the distance from the inner face of the last annulus to the outer edge of the spine (measurement A) and the inner face of the second to last annulus to the inner face of the last annulus (measurement B) - or, in other words, the amount of the last year's growth and the last full year's growth. This measurement proved to be an accurate means of estimating growth, as tested by Monks and Johnston (1993).

These two measurements were used to create a growth index by dividing measurement A by measurement B and multiplying the resultant value by 100. In most cases, more than one photograph was taken of each prepared spine and some spines were measured more than once. In combination with the interpretation of growth and other anecdotal notes regarding the clarity of the increments or confidence in the

reading/measurement, measurements and resultant growth indices were selected for the samples. The modern sample yielded twenty-five readable specimens. The specimen numbers and growth indices are presented in Table 1, Appendix III. The dates of death were translated into weeks of the year (1 through 52) and the growth index was graphed against the week of the year, showing distinct clustering as well as some outliers. Because this sample represents only one portion of the annual growth curve of catfish, Morey's 1983 data were incorporated in order to extend the growth curve, facilitating prediction of the dates of death for the archaeological specimens.

There is some concern in using Morey's data due to their more southerly location which could result in a slightly different growth curve and an earlier initiation of warm season growth. It was expected that the Red River modern specimens would show later summer growth initiation as fish growth is thought to be triggered by environmental variables such as water temperature which would, in turn, be affected by the more northerly latitudes of the Red River. In order to examine such variability, Morey's data were graphed with the modern comparative data from the Red River. The Red River data occur more or less where expected, except for five outliers which show higher growth indices than expected for the date. These indices may result from incorrect measurements of the spines due to narrowness and resultant confusion of increments, or the quality (resolution) of the printed versions on which the measurements were made.

Morey (1983) examined the third order polynomial regression line for the growth curve of the channel catfish in his study, using Taylor's power law to correct for the increased probability of error as time progresses. This resulted in the need to transform

the growth indices by the power of .363. This transformation was carried out both for Morey's data and for the Red River data and shows the Red River data more or less in line with Morey's data. The Red River data shows, if anything, a higher growth index than expected for the dates of death indicated. This may be due to variability in environmental conditions in both locations from year to year, to a steeper growth curve in compensation for their more northerly location, or to population differences.

The regression trend line for Morey's data was compared to the trend line for the combined data sets. Use of the combined data sets resulted in "flattening" of the curve, particularly at the point represented by the bulk of the modern Red River comparative specimens. Use of this regression curve would result in earlier prediction dates for archaeological specimens and appears to be due to the inclusion of those "outliers" within the Red River data set which show much larger growth indices than should occur at this date. It is believed that these are probably false readings and were removed, resulting in a final graph (Figure 4.69). It was decided that Morey's growth data could be used to produce rough estimates for the Red River archaeological specimens. Rather than predicting later dates, the inclusion of the Red River specimens in the modern data set tends towards earlier prediction dates.

The archaeological specimens' growth data are presented in Table 2, Appendix III, providing information of archaeological sample/occupation, growth index, growth index.[363], estimate of date of death using Morey's data (1983), and the week of the year within which the date falls. These specimens were examined in order to cull those spines which were unreadable, questionable, or where the measurements did not agree with the
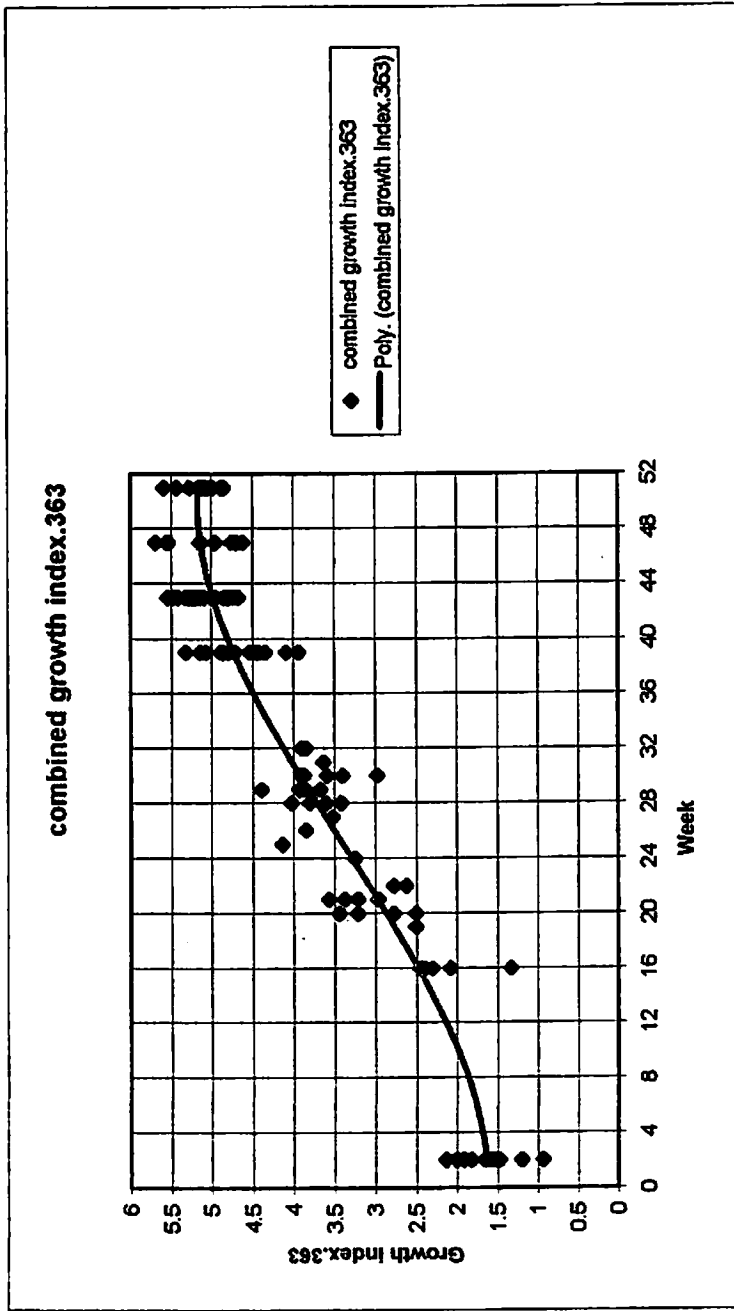
Figure 4.69 Growth index.363 for combined Morey (1983) and modern Red River data

growth interpretation based on visual examination of microslide, photograph, and printout. Figure 4.70 presents the numbers of spines which were originally prepared compared to those which were finally included.

The Archaic and Blackduck samples encountered the greatest number of problems due to the apparent removal of all or some of the growth increments through apparent mineralization. Figure 4.71 shows thin sections of a modern spine and of a poorly preserved spine. The problems of mineralization and poor preservation were greatest within the Archaic sample and were also evident within the Blackduck sample. The spines which were most difficult to read also tended to be those from older individuals, as the increments become progressively narrower with age until it becomes difficult to distinguish one from another and to measure them accurately by hand.

The resultant predicted dates of death are interesting. These are still estimates with a range of error on either side of the predicted date. The Archaic sample was reduced to four readable slides, of which the last is of particularly questionable accuracy due to the noted effects of mineralization and staining. The dates group within the spring/summer period. The Blackduck specimens vary according to the specific feature/occupation. The Blackduck I specimen clearly shows an early fall date. The Blackduck II specimens, on the other hand, group within the late spring/early summer period. The Blackduck III specimens generally also group within the summer period, excepting one clearly late fall/winter spine. Blackduck IV yielded one spine which produced a fall date. These data suggest fishing for catfish within the spring spawning period as well as during the fall. They also suggest that fishing was not focused into a

Total spines versus readable spines
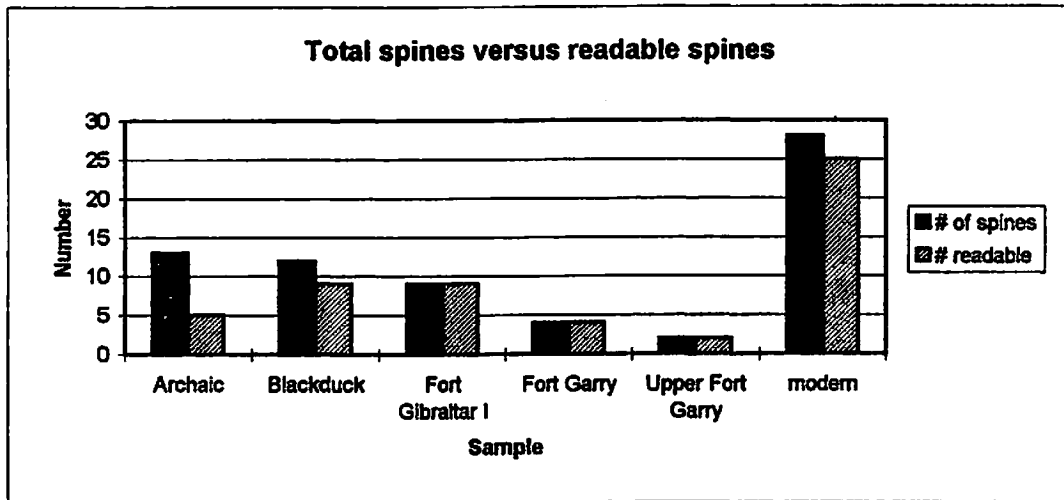
Figure 4.70 Quantity of catfish spines prepared and quantity readable

Figure 4.71 Modern spin thin section (a) showing clear growth increments and archaeological spine thin section (b) showing poor preservation.

narrowly defined period as may have been the case in the Archaic.

The Fort Gibraltar I specimens show three clusters of dates - late spring/early summer (similar to the Blackduck and Archaic), summer, and early to mid-fall. The Fort Garry specimens include the early summer date, as well as a range of dates from the late summer to mid-fall, showing very little clustering. The Upper Fort Garry specimens both fall within the late fall/winter period. The variability in these seasonality patterns is interesting. Not only do the dates vary from sample to sample - although with a definite spring and fall pattern - but the degree of clustering of dates also varies. Some of the samples appear to suggest fairly defined fishing periods, while others present a less focused fishing exploitation pattern. Although various periods are indicated, there is still clustering of dates within these specific periods. Only the Fort Garry sample seems to show no clustering of dates at all, suggesting consistent ongoing fishing. The patterning evident in the seasonality estimates cannot be considered to be definitive, however, given the small sample sizes involved. An increase in sample size, as well as selection of spines from a variety of locations within each site, would help to assess the validity of these patterns.

4.3.v Mammalian Epiphyseal Fusion and Tooth Eruption

A complete listing of unfused elements, erupting or unerupted teeth, as well as previous notations on animal age during original cataloguing was compiled. These items were aged using readily available reference materials. The vast majority of these specimens did not assist in creating seasonality estimates due to the broad age categories

resultant from the bones, but did often support interpretations from other seasonality estimate techniques. An epiphysis which fuses to the diaphysis of a certain element by three years of age, for instance, provides only an age range of "less than three years", providing little to no indication of seasonality. An examination of each specimen, attempting to link scattered bones of individuals, might produce an assemblage of bones from one individual allowing a more precise age estimate yielding, in turn, a more precise seasonality estimate. The time required for such an exercise would be far too great and the results far too equivocal. Some of the specimens from the five samples here did, however, yield some seasonality information as presented in Table 4.35.

Within the Archaic sample, only one specimen yielded any type of seasonality information. The diaphysis of a deer (*Odocoileus* sp.) metacarpal was noted as "foetal" within the original catalogue. The average fawning period of late May to mid-June (Banfield 1977) and the fact that this specimen must have been fairly well-developed in order to be easily identified to element, provide a seasonality estimate of early spring.

Three specimens provide limited information on seasonality and ageing within the Blackduck sample. One wapiti (*Cervus canadensis*) maxillary molar shows very slight wear. Quimby and Gaab (1957) provide ages of eruption for mandibular teeth of wapiti. Wapiti of 1.5 years showed M2 advanced in eruption but "seldom, if ever, completely erupted" (1957:441). Given a calving time of late May to early June (Banfield 1977), this suggests a season of death of late fall.

Two deciduous dog (*Canis familiaris*) teeth suggest an age of 5 weeks to 5 months (Silver 1969:299). Wolf puppies are born in early May (Banfield 1977) and assuming

Table 4.35 Information used in seasonality estimates based on mammalian epiphyseal
fusion and tooth eruption and wear

Sample	Taxon	Element	Age Data
Archaic	*Odocoileus* sp.	metacarpal	foetal
Blackduck	*Canis familiaris*	lower canine	deciduous
Blackduck	*Canis familiaris*	lower P3	deciduous
Fort Garry	*Bison/Bos*	lower PM3	deciduous, unworn
Fort Garry	*Ovis/Capra*	humerus	distally unfused
Fort Garry	*Ovis/Capra*	phalanx 3	proximally unfused
Fort Garry	*Sus scrofa*	upper PM4	unworn

that this analogy can be applied to domestic dogs during this period, this provides a season of spring to late summer.

Additional notes within the original catalogue also provide some useful seasonality information. One *Bison bison* calcaneus is noted as "juvenile/foetal" which suggests either a late foetal or early newborn age. The bison calving period stretches from mid-April to early June, with a peak period in the first half of May (Banfield 1977), producing a seasonal estimate of spring. This element and a central and fourth fused tarsal are noted as similar to a newborn calf. A femur and metatarsal (*Bison bison/Bos taurus*) are noted as "same size as 2 mo calf", suggesting a somewhat later summer date. A bison skull with teeth is noted as "same state of eruption as newborn *Bos* calf".

The Fort Garry sample provides a number of potentially informative specimens. An unworn, deciduous mandibular premolar (*Bison/Bos*) suggests an age between three weeks and 0.5 year, suggesting a death season of spring/summer. Ovicaprid specimens include a distally unfused humerus, an unfused third phalanx, and a proximally unfused radius. The first and third elements here suggest an age of less than 10 months, while the unfused third phalanx suggests an early, newborn death. A *Sus scrofa* unworn mandibular premolar suggests an age of 12 to 16 months, suggesting a death date of spring/summer.

The Fort Gibraltar I and Upper Fort Garry samples did not include any useful mammalian ageing data.

4.3.vi Summary

The seasonality estimates produced through the various techniques were combined for each sample. Seasonality estimates for the Archaic assemblage indicate procurement and probable site occupation from early spring (April) to early summer (June). The Blackduck assemblage seasonality estimates indicate date ranges from early spring (late March, April), through summer, to late fall. These date ranges suggest at least intermittent use of the Forks throughout the spring to fall seasons. The Fort Gibraltar I estimates based on waterfowl and spawning fish indicate early spring to early summer procurement, while the catfish spine estimates include dates ranging from late spring/early summer through the early to mid-fall. Fort Garry seasonality estimates generally indicate procurement of waterfowl from spring to fall, slaughter of mammals during the spring and early summer, and procurement of catfish from early summer to mid-fall. Upper Fort Garry estimates include the possibility of procurement of birds from spring to fall and the procurement of bullheads during the late fall/winter period.

The Archaic sample data suggest a temporally limited site occupation and the Blackduck data suggest intermittent occupation from spring to fall. The bulk of the Postcontact indicators suggest spring to fall procurement, with some late fall/winter fishing.

CHAPTER 5:DOCUMENTARY INFORMATION

Information on subsistence and faunal exploitation patterns for the Forks area was extracted from ethnographic, ethnohistoric, and historic documentation. Ethnographic, ethnohistoric and secondary sources were used to reconstruct general patterns of faunal resource exploitation for the Precontact period. Relevant documents from the Forks area provided similar information for each Postcontact occupation. The Postcontact information and reconstructed patterns are focused specifically on the Forks posts themselves and rarely on other groups or settlements within the area during the same period.

As stated in Chapter 3, the two sources of information - archaeological and documentary - are played off against one another. Given the biases peculiar to each body of data, the agreements and/or disagreements between these two sources of data should serve to enlighten and clarify as well as identify areas for further study. For this reason, archaeological evidence from other sites in the region or of similar culture groups/periods was generally excluded from consideration at this stage. These data would be more likely to exhibit biases similar to the archaeological data from the Forks and would fail to clarify the data sets in any useful way. The discussion below includes, where possible, a description of the subsistence round, resources utilized or not utilized, procurement method, butchering, end product/purpose of resource exploitation, and disposal of remains, as well as the social aspects of procurement and processing.

into deeper waters. Skinner (1911) mentions the Cree fishing for sturgeon and pike and the Northern Saulteaux fished for whitefish, suckers, sturgeon, and "other fish".

Based on ethnohistoric evidence, Syms (1977:39-42) identifies two subsistence cycles for the Algonquian groups of the Boreal Forest during the Ceramic period - one in which the groups practised a "diffuse economy ... adapted to year-round activities within the Boreal Forest" and a second which involved shifts from the Aspen Parkland to the Boreal Forest. In the first cycle, the people tended to remain in small groups for most of the year, dependent upon diffuse and variable resources. Major food sources included caribou, moose, bear, beaver, and fish, with numerous small and medium-sized animals as occasional resources. Summer was the period of aggregation during which "bands of 50-150 individuals gathered on the lakes where they relied on moose, fish, and waterfowl."

The second cycle, shifting from the Parkland to the Boreal Forest, appears to have been the most common throughout the Historic period. The Saulteaux (Plains Ojibwa) are described as following a Boreal Forest/Parkland subsistence round during transitional stages to Plains life (Syms 1977:41-42). The people moved from the Parkland, where winter camps were located in sheltered areas and bison hunting was possible, to the fish spawning areas by the Parkland rivers in the spring. By the late spring, the people moved into the Boreal Forest where fish were more numerous.

Peers (1994) expands on the historic Saulteaux subsistence round for the period following their relocation to the Red River/Interlake region towards the end of the 18th century. These people exploited both Parkland and Plains biomes during this period,

with a "well-balanced seasonal harvesting round that emphasized wild rice and fish" (Peers 1994:6). During the early spring, family groups moved to the sugar bush, using supplementary subsistence resources of small game, meat caches, and the previous year's wild rice. The people then moved to sturgeon fishing sites, particularly in the Boundary Waters region. This was the season of large social gatherings, including Midéwiwin ceremonies. Family groups fished, picked berries, and hunted large game to the end of the summer, when wild rice was harvested and migratory waterfowl hunted. People also took advantage of the fall whitefish spawning season. Extended families then left and moved into forested areas, hunting deer, moose, and bear to provide stored meat. The caches of stored foods and continuous hunting of smaller game supported the people through the winter. At the end of the winter/early spring, an intensive period of trapping preceded the return to the sugar bush (Peers 1994:22-25). As time progressed, the Saulteaux moved increasingly towards a Parkland/Plains adaptation, gradually abandoning the Boreal Forest area.

Syms' (1977:43) description of the subsistence round for the Ottawa during the historic period is most similar to Peers' description for the late 18th century Saulteaux. While the women were making maple sugar during the spring, groups of men hunted beaver along the tributaries of the Red River. Syms (91977:43) relates that the Red River valley was "noted for large numbers of elk and bison to the west and bear, beaver, moose, and deer to the east." A study on beaver fat content (Soprovich 1994:23-25) determined that beavers maintain a high fat content throughout the year, even up to the end of April, but by mid-May to mid-June had depleted the majority of their remaining

body fat. This annual depletion of body fat probably signalled the end of beaver hunting during the late spring. Fishing and the hunting of "diffuse resources" are noted for the summer months. The harvesting of garden resources, as well as group hunting of bison, differ from Peers' late 18th century Saulteaux description, but agrees with her reconstruction of early 19th century Saulteaux subsistence.

The historic Assiniboine provide one potential "analogue" for a primarily Parkland adaptation, increasingly using the Plains/Grassland biome. Henry (1988) describes their territory during the late 1790s as stretching from immediately west of the Red River valley, into Saskatchewan, to the Missouri River. Lowie (1909) emphasizes their dependence upon the bison which were hunted communally in pounds as well as by small groups or single hunters. Porcupine and fish were also noted faunal subsistence resources. Syms (1977:48) cites Ray's subsistence pattern reconstruction for the early Assiniboine. Winter months were spent in the Parkland or wooded river valleys, hunting bison and wolves. Fish weirs were set on the major rivers during the spring, while the summer was spent hunting bison in the Plains. Fall included both bison hunting and a trading trip for corn to the Mandan villages on the Missouri River. Rodnick's (1978) description of the Assiniboine from the Fort Belknap Reservation of Montana portrays a Plains-adapted people heavily dependent on bison. The diversity of potential subsistence resources, however, suggests Parkland adaptation. No seasonal round is described, but it is clear that bison were the primary resource, with secondary resources including other large game (antelope, deer, wapiti), medium and small mammals, berries and wild vegetables, and a number of fish species.

The Plains Cree were also Parkland adapted people during the historic period. Although originally a Boreal Forest adapted group, by the early 1770s they were sufficiently Plains/Parkland adapted to be communally hunting bison in pounds (Mandelbaum 1979:33). Mandelbaum (1979) stresses the dependence upon the bison, stating that the migrations of the herds determined tribal movements, with the bison accessible at all seasons of the year. Bison were pounded during the autumn and winter when the bison were in the Parkland; during the spring and summer the bison were hunted communally on the Plains, by foot or on horseback. Bison meat was stored in the form of pemmican. Waterfowl were hunted during the summer moulting period. During the autumn, wapiti and deer were hunted by single hunters or small parties. Bison pounding was carried out during the fall and winter. January and February were the lean months, during which the people depended on limited fishing and small numbers of wapiti, deer, and bison. Fish weirs were built and used in the spring after which the people moved onto the Plains to hunt the bison and hold the Sun Dance during the late spring and early summer.

Ray (1974) hypothesizes the following Precontact Parkland cycle. Fish, particularly the sturgeon, were most plentiful during the spring, with fish and waterfowl continuing to be used into the summer months. Limited fall fishing was also carried out. Bison were scarce in the Parkland during the summer, although limited large game was still present - presumably wapiti and deer. As the bison moved into the Parklands in the late fall/winter, these small groups were exploited providing more than sufficient resources.

Malainey's (1997:88 ff) summary of the Forest adaptive strategy for the Ceramic period is grouped with a Parkland adaptive strategy. Based on the ethnohistoric record, she suggests that the "proximity of bison attracted both parkland- and forest-dwellers to the grassland-parkland transition zone where camps were formed on the northern edge of the grassland and in the sheltered aspen groves along the southern edge of the parkland." These people followed a more diffuse, "mixed-strategy" due to the unpredictable presence of the bison within the Parkland. Rather than moving to different locations to access the bison, the strategy involved a shift to alternate resources such as fish, other large game animals, small/medium sized animals, and waterfowl. These peoples "exploited a wider variety of animals and plant, and formed small winter camps in the area" (Malainey 1997:90).

Smith (1991:37) cites Meyer (1983) in noting that "prehistoric cultures exploited the parklands as an extension of the grasslands. The cultural boundary between woodland dwellers and grasslands dwellers occurred at the parkland/woodland edge, not the grassland/parkland edge...[but] ... the prehistoric cultural dynamics of the parklands have yet to be resolved." Malainey (1997), as noted above, has grouped the parkland and forest adaptive strategies. She argues (1997:23) that, based on historic records, "the majority of bison did not winter in the sheltered parkland....herds approached sheltered areas if there was a severe storm or extended periods of cold weather...." It was necessary for groups remaining in the parklands during the winter to follow a "true mixed strategy" (Malainey 1997:91), including deer, wapiti, moose, fish, as well as drying and storing foods particularly for late winter/early spring use.

Malainey's (1997:85-88) Plains adaptive strategy demonstrates that Precontact groups remained in the Northern Plains and did not move into the Parkland. Bison populations were largest and most stable in this area during the winter and were present year-round. This consistent supply of bison, occasionally bolstered by hunting of other large game, reduced the need to produce large amounts of pemmican in the fall or exploit seasonally abundant sources (like fish) in the spring and fall. Foetal bison were preferred during the spring when adult bison were low in fat content. This type of strategy involved limited migration for the human groups, limited need for food preservation and storage, and reduced need for a diffuse economy based on a large variety of resources. Malainey (1997:6-12) argues that the prevailing perspective that the grasslands were uninhabitable during the winter and that bison moved into the sheltered riverine valleys and Parkland areas to survive is not supported by historic records.

Wright (1995) uses the more "traditional" hypothesis in his synthesis of the subsistence round for the archaeological McKean complex. Sites of this complex include Plains, Parkland, and Boreal Forest locations. The major resource within plains and parkland sites appears to have been bison, followed by smaller amounts of other large game (wapiti, antelope) and smaller mammals, birds, and fish. Evidence of pemmican and bone grease manufacture is present. Boreal forest sites obviously tend to contain forest species rather than bison. Wright (1995:315) notes that the "historically documented settlement patterns of bands wintering in the Parklands, moving onto the Grasslands in the summer, and then shifting back to the Parklands in fall/winter, would appear to have been practised by Middle Plains culture hunters....The many multi-

component campsites in the Grasslands/Parklands clearly reflect the successful anticipation of bison availability at different seasons of the year."

Wright (1995:318) agrees with Meyer (cited in Smith 1991) that the Parkland ecotone was used primarily by Grassland adapted groups to access the bison, presumably during the fall and winter, rather than by Boreal Forest adapted groups. Malainey (1997:88), as noted above, argues against this view, suggesting that the use of Parkland resources (particularly fish) reflects the "behavior of parkland- and forest-adapted groups wintering in the transition zone". In addition to the supposedly Grassland-oriented McKean complex cultures, it is possible that the Forks area would have been within the Middle Shield culture area, with a diffuse subsistence pattern (Wright 1995:278) and a seasonal focus on fish resources as well as beaver, muskrat, bear, large game animals such as wapiti and moose, smaller mammals, birds, and turtle.

These subsistence patterns seem to have continued into the Woodland period, with perhaps an increased stress on pemmican production in the Plains/Grasslands and of wild rice exploitation within the southeastern Manitoba/northwestern Ontario areas.

A southern Boreal Forest/Parkland adaptation is suggested by Nicholson (1987:250) for the Blackduck archaeological culture. Nicholson considers this adaptation a "Type B" subsistence strategy, utilizing the resources of two biomes. As the Blackduck culture expanded over time from the Boreal Forest into the Parkland, the subsistence strategy shifted from "a broad based strategy utilizing fish, beaver, moose, woodland caribou, bear, and migratory waterfowl...as well as wild rice...to mass kills of bison excavated at such sites such as Stott..., Gompf..., Brockinton..., and Stendall"

(Nicholson 1987:201). In discussing this shift from a more eastern Boreal Forest to western Parkland, however, Nicholson fails to note the extensive Blackduck occupations in intermediate areas such as the Red River valley.

The Forks site is located within the Parkland ecotone and within a riverine environment. This location would have been rich in resources, including both plant and animal species, and provided access to both Grassland and Forest species. The details on different subsistence rounds for forest, parkland, and grassland adapted groups provide some idea of the season of the year during which the Forks area would have been inhabited, as well as what type of culture might have utilized the area. Cultural groups do not appear to have been solely "Parkland-adapted" but, instead, the Parkland area is utilized by Grassland and Forest adapted groups on a seasonal basis.

It is apparent that Forest adapted groups (such as the historic Plains Ojibwa and archaeological Blackduck) would have been located within the Parkland during the winter and spring. During the winter, the Forks location within a riverine valley close to the plains would have provided shelter, firewood, and access to the bison herds. The Forks is also ideal for the location of spring fishing camps, taking advantage of the spring spawning runs on the Red, Assiniboine, and Seine Rivers. The winter camps would likely have been of smaller size than the larger social groups made possible by the abundance of spawning fish.

Cultural groups adapted to a Grassland biome (e.g. historic Assiniboine, Plains Cree) also may have used the Parkland, riverine location of the Forks on a seasonal basis. It appears that, similar to the above, grassland adapted groups might have inhabited the

area during the winter, while hunting bison, as well as during the spring, when fish weirs/traps would have been set up on these rivers. Malainey (1997:69), however, argues that "there is little indication that plains-adapted people exploited fish, even during spring spawning season when they were abundant and bison were fat-depleted." She (1997:84) suggests that negative effects (diarrhoea and loss of strength) of fat malabsorption would have occurred following the consumption of fish, due to their primary dependence on red meat. While the Forest adapted peoples would have moved into the forest during the summer and fall, the Grassland adapted peoples would have moved onto the plains. This argues that the Forks would have been occupied most consistently during the winter and spring. Malainey's (1997) argument seems to suggest that Parkland people would have followed a more diffuse economy during the winter, subsisting on large game species other than bison as well as on fish. The preservation and storage of subsistence resources was necessary among Parkland/Forest adapted groups due to greater variability in resources. The consistent presence of bison in the plains reduced the need for food preservation and storage among Grassland adapted groups.

The major disagreement among previous researchers regards the seasonal movements of bison which affect, in turn, interpretations of the seasonal movements and resultant subsistence rounds of the human populations. Further research focused on inferring seasonality through the analysis of incremental growth structures in both mammals and fishes is the clearest solution. Malainey's assertion that bison were not generally located within the Parkland during the winter should result in fewer bison remains within such sites, as well as a much greater range of mammalian and possibly

winter fish resources due to the more diffuse economy practised by non-Grassland-adapted groups.

Range of Faunal Resources Used, Butchering and Disposal, and Social Aspects

The ethnographic and ethnohistoric records provide some indication of the range of species that were exploited as well as those that were not considered to be acceptable food items. These records also provide some idea of how the species were procured, how they were processed, and how the remains were discarded. It must be remembered, however, that the ethnographic and ethnohistoric information was gathered after the introduction of European technology and the fur trade market economy.

These data contain biases which relate to the details of data collection - who was interviewed/observed and who carried out the interview/observations. Conkey and Spector (1984:3) warn against the uncritical use of gender-biased ethnographic and ethnohistoric information which stress male perspectives and activities. Although these data are useful in this situation, they cannot be unquestioningly applied to archaeological cultures. Preferences in food items, means of disposal, and gender roles are, to a large extent, flexible and bounded in the world view of each culture. In other words, these data provide possible patterns which, juxtaposed against the archaeological data, may be enlightening regarding archaeological cultures as well as the biases in both sets of records.

Boreal Forest

Within the boreal forest cultures, the subsistence economy was diffuse. People took advantage of various seasonally abundant resources with several sources consistently exploited when available. Much of the subsistence round and settlement pattern, however, appears to have been focused around riverine and lacustrine environments. It should continually be remembered that both plant and animal resources provide subsistence, although only the animal resources are being considered as part of this research.

According to Skinner (1911) and Ray (1971), the following resources were accessed year round: "game birds" such as grouse and ptarmigan; pike, sturgeon, and other fishes; moose, caribou, white-tailed deer, black bear, lynx, beaver, woodchuck, muskrat, skunk, and turtles. Winter resources included hare, beaver, caribou, moose and other large game, bear, lynx, and fish. During the spring, fishes and waterfowl were most commonly exploited. During the summer months, people were supported by bear, lynx, fish, waterfowl and other large game, while the fall saw a return to reliance on fishes and waterfowl.

Smaller animals were generally snared or trapped while beaver and muskrat could be chiselled out of lodges during the winter or early spring. Chiselling the animals from their lodges was probably made possible by the introduction of European technology, while the fur trade may have provided the impetus to procure large numbers of these animals. During the winter, bears were hunted in their dens when these could be found. Fish were hooked through the ice during the winter, trapped at the base of rapids or falls,

or hunted by spear or leister. These techniques were determined partially by the size and habitat of the fish species. Nets are generally considered to have been introduced by Europeans. Waterfowl could be snared, hunted with bow and arrow, or caught during the moult, while game birds were usually snared.

Both large game and fish were dried and/or smoked as well as eaten fresh. Fish were cleaned, split, and scaled prior to being smoked. For most species, the head was also removed prior to smoking, except in the case of whitefish and sucker.

Few details are available regarding butchering or refuse disposal habits. Moose were drawn, skinned, and quartered. The neck was severed, the head removed, and the ribs separated from the spine. Other large game was presumably dealt with in a similar manner. Marrow was extracted and bone grease manufactured through the smashing and boiling of long bones. Skinner (1911) notes that hare legs were removed at the elbow and hock and the paws used in alternate ways. Beaver bones, as well as those of other aquatic mammals and birds, were thrown back into the water after use. No details were noted regarding the social groups which carried out these various tasks, although it appears from other work on the boreal forest groups as well as historical records, that men hunted large and medium sized mammals as well as large fish, while women did the secondary butchering of large animals and likely all of the butchery of smaller animals. Women also hunted small game and most of the fish, particularly when the hook and line technique was used. Men were generally involved in fishing only when spears/harpoons were used on large species, such as sturgeon.

Parkland

Sources used to provide information on Parkland adapted groups are: Lowie (1919; Assiniboine), Wallis (1947; Canadian Dakota), Pond (1986; Minnesota Dakota), and Mandelbaum (1979; Plains Cree), as well as Ray's (1974) synthesis of various groups and previous researchers and Tanner's late 18th century/early 19th century record of Saulteaux life in southern Manitoba. All of these resources state that bison was the most important resource and was hunted throughout the year. Bison were pounded, particulary during the fall/winter months, and hunted by single hunters and small parties. During the spring and summer months, large bison hunts were carried out on a communal basis, both by horseback and on foot. The bison might also be guided into marshes where they would become bogged down and could be more easily dispatched. During the fall and winter months, bison were pounded in wooded areas until January/February and were also forced into deep snow.

Samuel Pond (1986) stressed the importance of the annual October to January deer hunt in the transitional Woodland area in Minnesota as well as for the bison hunters further west, who travelled east into the transitional Woodland area to hunt the deer at this time. Wapiti and bison were both noted winter resources, while bears were hunted opportunistically in their dens when they were discovered. Fidler (cited in Stock 1992:87) notes the seasonal changes in nutritional status of moose, as the cows were fat all winter while the bulls were fat only from June to Christmas.

During the winter, fish were hooked or speared through the ice as well as scooped up at springs where they would gather in large numbers. During the spring, spawning

fish, especially sturgeon and suckers, were caught in weirs and fish traps. Sauger is also mentioned by Tanner in the Rainy River area. Many of these fish were split open, cleaned, and dried, while others were made into fish pemmican. During the summer, fish were caught intermittently and opportunistically, either by hook or spear. In some areas, the spawning whitefish (October/November) were also heavily exploited during the fall. Bullheads are noted as a resource in the larger rivers.

Waterfowl and passenger pigeon were also important spring resources. Muskrat and beaver were hunted during the early spring (March to May) and were speared in their lodges, trapped, and shot. The meat was best, however, only during the early spring. It was noted that muskrat and hare were important resources when people were starving due to a scarcity of bison.

Young birds were eaten in the spring. Passenger pigeons and other birds were shot when available. Geese and ducks were hunted during the moult when they were killed by men and women using only digging sticks. Eggs were also collected.

During the autumn, ducks and geese again provided an abundant resource. Muskrats and beaver were hunted, partially for furs. The deer hunt began again in October in the more easterly, wooded regions. Raccoon were also hunted, as well as rabbits/hares and other small game. Moose, wapiti, and bear are noted as fall/early winter resources.

Additional resources noted but not limited to any particular season include: porcupine, squirrel, grouse, otters, wolves, foxes, badgers, cranes, hawks, owls. Pond (1986) lists the following species in order of importance to the Minnesota Dakota (1834):

deer, ducks, geese, wapiti, bear, bison towards the west, smaller animals, dogs, horses, muskrats, fish, and turtles. This list seems to suggest meat preferences rather than percentage importance in the diet, at least by following Pond's seasonal round description for the Dakota. A list of birds considered suitable for food includes: ducks, swan, goose, turkey, partridge, prairie chicken, grouse, magpie, hawk, and owl. Mammals include: badger, bear, beaver, bison, chipmunk, coyote, dog, wapiti, fisher, fox, gopher, groundhog, horse, kitfox, lynx, prairie dog, marten, mink, muskrat, otter, porcupine, rabbit, skunk, squirrel, wolf, wolverine. Fish species include: goldeye, pike, sturgeon, perch, longnose sucker, white sucker, catfish and various other unidentified fishes.

Horses were generally consumed only when the horse died naturally or accidentally. Dogs were only eaten ceremonially.

Bison were frequently butchered by women in the field. The carcass was first skinned, the sinews of the back removed, the limbs disarticulated (dislocated and cut off), the ribs were chopped off along the backbone, and the meat and marrow bones returned to camp. Large bones were split open and pounded in the manufacture of bone grease. Primary butchering was carried out by the men when the kill was far afield, while the women continued the butchery after the carcass portions had been transported to camp. Raccoons were, notably, frequently singed rather than skinned and cooked. Suckers caught during the spawn were dried over fires for later use. Howard (1977) notes that fish pemmican was made by the Plains Ojibwa/Bungi, but that the bones were pounded up with the flesh.

Small animals and birds were generally snared by women or young boys.

5.2 Fur Trade Subsistence -- Fort Gibraltar I Sample (1810-1816)

The information in this section is based primarily on Alexander Henry the Younger's (1988) NWC fur trade journal for the years 1800 to 1808, when he was situated in various locations on the upper Red River and was travelling in the Red River valley. Peter Fidler's (1814-1815) journal (HBC Archives B.235/a/3) also provides detail regarding subsistence at the Forks for this period. Although he worked for the HBC rather than the NWC, he was located at the Forks during this year, often looking after the recently arrived Selkirk settlers.

Alexander Henry's journal provides the following information. The traders returned to the interior from Fort William/Lake Superior during the late summer (mid-August/mid-September). At this time, they did not have any stored provisions and lived on what they could obtain themselves or through trade with Native people. Provisions acquired through barter during the trip to the Forks included: sturgeon, catfish, "piccanan" (?), "malachigan" (freshwater drum), "brim", "pois d'oilel", "lacaishe" (mooneye/goldeye), pike, pois donce, and dried meat. Henry also shot ducks and pelican at the south end of Lake Winnipeg. These resources appear to have been consumed fresh. At the Forks itself, Henry's men remained several days and fished by hook and line, catching "lackaishe" (mooneye/goldeye) and catfish in the hundreds. As Henry and his men travelled up the Red River, they continued the pattern of supporting themselves by fishing, shooting wild fowl, and trading with the Indians for available meat (beaver, bison, wapiti). The preferred meat was evidently bison, as Henry notes that no more fishing was carried out when red meat was available. This may also be a note on

efficiency. Fishing takes time when travelling and one bison can feed far more people than a few fish. Bear, bison, otter, beaver, and raccoon are noted as meat resources on the way up the Red River to the Park River Post. Fish, including sturgeon, catfish, and "bream", remained a "fall-back" resource.

When Henry and his men were settled at the post (mid-September), nets were set for the night and caught sturgeon, catfish, suckers, bream, "aschegan" (bass), "doree" (walleye), pike, and "lackaishe" (mooneye/goldeye). Whitefish netting was carried out by the NWC at Lake Manitoba during February. Net fishing appears to have continued throughout the winter. Henry and his men continued to support themselves during the fall, shooting bison, wapiti, moose, bears, beavers, raccoons, geese, ducks, grouse, geese, swans, and grizzly bear. During the late fall (after late October), carnivores such as foxes, fishers, and wolves were also shot. It is not noted whether or not these were consumed, although raccoons were definitely considered "good eating". Animals were generally assessed by the amount of fat they contained. By mid-January to mid-February, the push to hunt bison ended as the meat stocks were complete.

The spring began with the hunting of raccoons, swans and geese, and sturgeon. Native people procured sturgeon using fish barriers during late April, while the fur traders used sturgeon nets and a night line of hooks. During early April, hundreds of drowned bison provided a subsistence resource and were butchered and processed by Native women. Bison calves were also hunted during the spring and selectively butchered for choice parts. Beaver were also hunted both for food and furs during mid-April. By early May, Henry and his men were preparing pemmican prior to their departure for the

east. The trip downriver again forced them to hunt, fish, and trade as they proceeded. Resources included bison adults and calves, sturgeon, duck eggs, bears, pigeon, moose, catfish, and "lackaishe" (mooneye/goldeye).

Henry provides a list of the numbers of animals - particulary fish - which were caught for post provisions. During the spring, up to twenty sturgeon a day were being aught in nets in the Red River, some of which weighed over 100 pounds. On May 10, 1808, Henry remarks that 120 sturgeon were caught within a 24 hour period, each weighing 60 to 80 pounds. Catfish were numerous in the fall and spring. Over forty were often caught in one day, each weighing close to twenty pounds. Henry depended on the Native hunters largely when travelling but, when settled at the post, seemed to use his own engagés for hunting, particularly bison. Henry frequently remarks that only small, preferred portions of bison, such as the tongue and dépouille, were taken during hunts for fresh meat. Cow meat was considered inferior during the summer (July). Catfish were caught in August, September, October, April, and May, although Henry was not usually in the Red River valley from late May to mid-August.

Henry (1988:317) provides a list of the numbers of animals procured during one trading season by the post inhabitants (17 men, 10 women, 14 children, 45 dogs), including 112 bison cows, 35 bulls, 3 wapiti, 3 black bears, 4 beavers, 3 swans, 1 crane, 12 outards, 36 ducks, 1150 fish (lackaishe/goldeye, doree/sauger, suckers, pike), and 775 sturgeon, a great part of which was given to the Indians. There appears to be little seasonal patterning in the exploitation of fish species apart from the procurement of spawning sturgeon during the early spring.

Fidler's journal (B.235/a/3) was written from July, 1814 to June, 1815, when he was at the Forks providing for the newly arrived Selkirk settlers. Much of the large game meat (moose, bison, bear) was purchased or traded in a dried form from the Indians, Métis, and Canadian freemen, mostly during July, August, and October. The later historic pattern of the fall bison hunt appears to have existed at this early date, as Fidler writes that the freemen had left to hunt bison during late October. Moose meat and young black bear meat was purchased throughout the summer.

Fidler hired a Canadian to fish for catfish, paying one dollar for twenty catfish. Few - and poor quality - are noted for August 13, although by August 18, catfish were "plenty and excellent". Fish were scarce by early September and Fidler writes that the catfish and sturgeon were "gone to the lake" by mid-October. Fishing was often impossible during the early spring when the water was too high, but nets were set for sucker, catfish, and perch in the Seine River by late May. Sucker and perch were available earlier than catfish. Burbot were also fished by hook and line in early June. Hind (1860:491) notes that wall-eyed pike (presumably walleye, *Stizostedion vitreum*) were called "perch" by the "half-breeds," so that perch in some of the historical documents may refer to walleye rather than perch (*Perca* sp.). Due to the Selkirk settlers' arrival, domestic animals (cattle and sheep) were already being imported.

5.3 Fur Trade Subsistence -- Fort Garry Sample (1821-1835)

The information for this section was extracted from a number of Fort Garry daily journals (trading seasons 1820/21 (B.235/a/4), 1822/23 (B.235/a/5), 1824/25

(B.235/a/6)), John West's (1966) journal based in the Red River Settlement (1820-1823), as well as excerpts from the Hargrave correspondence (1968) concerning the Red River area (1820-1839). The journals vary in the amount of detail, but do provide a basic outline of the seasonal activities and subsistence during the fall to spring trading seasons. A limited number of men were generally left at the inland posts during the summer, rather than abandoning the posts altogether during the summer as commonly occurred during the earlier NWC period.

Fishing is the earliest subsistence activity noted in the 1820/21 journal (October 23-June 14). Unfortunately, the clerk included very little detail regarding fish species. Fishing was carried out during the fall (October/November) until freeze-up, at which time nets were placed under the ice. Overhauling nets appears to have been an almost daily task throughout the fall, winter, and spring. A fisherman was also hired to fish during the summer.

During this early post-amalgamation period, Fort Garry is the centre of a network of smaller outposts. The Netley Creek establishment focused on fishing for subsistence and, perhaps, for dog food. The favoured fish - and the only species noted within the journal - is sturgeon, which were transported periodically to Fort Garry from Netley Creek from December 8 to March 23. The second outpost, Pembina, focused on the procurement of large amounts of bison meat, transported to Fort Garry continuously from early December to late March. The meat was placed in an ice house during late February/early March. The only other subsistence activity recorded in the journal is the occasional pig slaughter. One adult hog was slaughtered in early November, six "small

ones" in mid-November, followed by six other "small ones" and one large boar a few days later. Presumably the pigs were fed during the summer and fall to be slaughtered and stored for the winter. Occasionally the men were sent to retrieve meat from "Indian tents", using horses or dogs. Dogs were used throughout the winter to travel and haul meat from Netley Creek and Pembina and much of the fish procured may have been intended for the dogs.

The September 10, 1822 to June 11, 1823 journal (B.235/a/5) indicates a greater variety of subsistence resources, particularly during the early fall. The network again included the central Fort Garry location, with "satellite" posts at Netley Creek and Pembina, focusing on fish and bison, respectively. Fish continued to be an early subsistence priority and nets had been set in the river by September 18th. Eighty-nine fish were netted within one week although there are no further details regarding species. Fresh meat was also traded from the Indians, including moose, deer, bear, swans, ducks, muskrat, and sturgeon, as well as other meat, dried provisions and pemmican. One "half moose" is recorded as being traded in one instance, indicating that meat came into the post in a butchered state.

Notations of provision trade with the Indians cease by late November, while a hunter was engaged to kill 50 bison cows and 20 bulls, presumably for later pemmican production as well as immediate subsistence. The Netley Creek post provided ducks during the fall (October), sturgeon and pike during the winter (November, December, January) and again during the spring (April-May). Fishing was also carried out at Fort Garry throughout the winter by a Canadian and his wife who tended the nets, catching

goldeyes, carp, pickerel and other unnamed species. Carp were not introduced to Manitoba until 1889 (Scott and Crossman 1973:409), so the fish in this case may have been catfish or sucker. Hind (1860:491) uses the term "sucking carp" for a type of sucker, which may serve to clarify this apparent discrepancy. A total of 1529 fish were caught during this season at Fort Garry. This does not include counts of "a few fish daily" for example, or "catching only 1 or 2 sturgeon a day". The bulk of the records relating to fish are from September, October, January, February, April, May and June. The missing months (November, December, March) may be due to changing ice conditions at freeze-up and break-up, as well as to the availability of other fresh meat.

Fresh bison meat began to arrive from Pembina ("the plains") by December 21st and continued until late March. The ice house was prepared and filled during mid-February. Choice cuts such as tongues and bosses were brought in from Pembina during February and March, while pemmican and other provisions were finally boated up from Pembina during late April. Provisions also came in intermittently during the winter from the Indians in the Portage la Prairie area. Domestic cattle are also noted as being within the Fort and subsequently sent to Netley for the winter, but no slaughter or butchery of domestic animals is recorded within this journal.

The June 1, 1824 to May 31, 1825 journal (B.235/a/6) provides the first glimpse of summer activities at the Fort. Forty-two sturgeon were netted at Fort Garry during the first two weeks of June. Cattle appear to have been the most important animals in the area during the summer in terms of care. Freemen and Indians began to bring in fresh bison meat from the plains during the fall (September/October). Meat again arrived

from the Pembina plains during the winter and spring, as well as from any settlers who spent the winter on the plains. No mention is made of Netley Creek post or the fishery.

The Hargrave correspondence adds little regarding fur trade subsistence at the Forks. The whitefish fishery is noted during the fall, with an overall count of 22, 000 whitefish from Bas de la Rivière. Plains provisions (i.e. bison) are noted as plentiful during the 1830s, while complaints of soft catfish in August echo Fidler's 1814/15 comment on poor catfish from the late summer period.

John West's account provides some additional detail regarding the settlement. "Ptarmigans" - presumably grouse/prairie chicken - were shot while travelling between the Forks and Brandon House. The settlers are recorded as using sturgeon during May/June followed by catfish, which were taken throughout the summer. The settlers also set nets under the ice during the winter (February) for pike, perch, and goldeyes, while whitefish are noted from Bas de la Rivière. Passenger pigeons, considered excellent food, were shot during the spring (May).

5.4 Fur Trade Subsistence -- Upper Fort Garry Sample (1835-1883)

Notes for this section were extracted from the Upper Fort Garry Post journals (1852-1853; 1858/1860), the Nor'Wester (1859-1861), Paul Kane's narrative account (1846-1847), and Alexander Ross' account of the RRS (1856). The Upper Fort Garry journals tend to contain less subsistence detail than those from earlier Fur Trade periods. This may be due to the increased number of domesticates and decreased populations of wild taxa, the establishment of a farming economy, the purchase of provisions in the

market from the settlement, and less stress concerning the adequacy of provisions due to the increase in domesticates and other agricultural products.

The 1852/1853 journal (B.235/a/15) seems to indicate that the plains provisions were no longer procured through the Pembina outpost or contracted to a post employee. They were, instead, purchased directly from hunters, including the Métis from White Horse Plains and other freemen. The provisions bought from the hunters during late August/September were primarily dried meat and pemmican. Fresh meat is noted as coming into the post during mid-November, also from the White Horse Plains hunters. During mid-November, meat from settlement domesticates (beef and pork) were purchased and salted for export via Norway House during the spring. The ice house was cleaned up and filled with ice by mid-February. The central post at this period is Lower Fort Garry and provisions were moved constantly between Lower and Upper Fort Garry.

The 1858-1860 journal (B.235/a/16) provides more detail than the 1852/53 journal. Many of the subsistence related activities relate to pork and beef, rather than bison. Little information regarding post subsistence is included, as much of what passes through the post seems to be intended for the market rather than consumption within the post. The journal begins on May 1, with pemmican brought in from White Horse Plains. Three oxen were killed and presumably butchered during May, while hams were being made up for export via Norway House. Individual oxen were also killed during July and October. As in the previous journal, the post was "taking in and cutting up" beef and pork, as well as salting the pork during November. December was spent in packing the salt pork and pickling other pork. Fish were requested from Fort Alexander during

December, possibly whitefish, and four ox sledges of fish were sent to Upper Fort Garry. Beef was placed into the icehouse during early March, rather than the usual bison meat. In spring, hams and tongues were smoked, pork salted, and these items packaged and prepared for export. Pemmican was sent to Lower Fort Garry. The following fall followed a similar pattern with a few oxen killed, beef and pork prepared and packaged. One horse was skinned following a natural death and was presumably also butchered. Fish were sent up from Lower Fort Garry during the winter - possibly from Fort Alexander, as in the previous year. Beef was placed in the ice house during the late winter/early spring and hams were smoked and baled. The role of Lower Fort Garry as a central depot tends to obscure the origins of some of the subsistence items that come into Upper Fort Garry.

Articles from the *Nor'Wester* (1859-1861) state that there were two primary bison hunts. The purpose of the summer hunt was to manufacture pemmican, while the fall bison were preserved fresh by freezing throughout the winter. The fall fishery on Lake Winnipeg is also mentioned in the newspaper, located where the Winnipeg River enters Lake Winnipeg (Bas de la Rivière). The catch for one month was approximately 80,000 to 100,000 whitefish, as well as some pike, perch, and others. The whitefish were dried where they were caught and transported into the settlement during early winter.

Livermore (1976:129) adds some detail regarding subsistence items for this period in a list of rations provided to the servants and officers at Lower Fort Garry for the 1861-1862 trading season. The servants were issued fresh beef, pemmican, salt beef, salt pork, dried meat, sturgeon, and ham (listed in decreasing order). Officers, on the other

hand, were provided with a much greater range of meat, including fresh beef, mutton, ham, whole fish, ducks, eggs, fowls, geese, and sturgeon. The range of foodstuffs and the differences in the diet between the labourers and officers would probably have been quite similar at Upper Fort Garry.

5.5 Fur Trade Subsistence — Resources Used, Butchery and Disposal Patterns, and Social Aspects

The foregoing description of the seasonal rounds of subsistence activities at the fur trade posts during the nineteenth century also summarizes the resources used, according to the documentary evidence. The journals provide very little detail regarding butchery or disposal patterns. The description of bison butchery is briefly described in a number of historic documents. Alexander Henry the Younger (1988:318) provides the following list of "cuts": "1 Petit Boss, 2 Depouilles, 2 Shoulders, 2 Lourd Epoulets, 2 Fillaits, 2 Thighs, 1 Belley, 1 Heart, 1 Gross Boss, 1 Rump, 1 Brisket, 2 Sides, 1 Backbone, 1 Neck." Henry adds that the tongue is generally given to the hunter. Hurlburt (1977:35-37) provides some identification of these portions. The "petite bosse" and the "grosse bosse" are the hump and little hump on the bison; dépouilles are "storage depositions of fat over the rump and into the saddle of the animal", i.e. backfat; shoulders and lourdes épaulettes are forequarters and forequarter cuts; "fillets" were the "sinewy muscles which connect the shoulder blades to the haunches". The remaining cuts are self-explanatory.

The basic steps of butchery for other large game animals were to disembowel,

quarter, remove the ribs from the vertebrae, and remove the head at the neck. There is no readily available detail regarding the butchery of smaller mammals during the fur trade. As domestic animals became regular fare, these were presumably butchered in a basically "modern" manner, using saws to subdivide the carcass into meat cuts. Modern beef cuts have been used successfully in archaeological studies of status and economic position (Schulz and Gust 1983; Seyers 1986; Brenner 1998) for the later nineteenth century. These studies indicate that butchering of cattle was carried out in a manner similar to modern methods.

The little detail regarding social aspects of animal procurement and processing are summarized below. Throughout the journals considered here, fishing and hunting of smaller mammals appears to have been carried out by the Canadian engagés or labourers. Bison hunting and sturgeon fishery were initially contracted out to company employees but, by the mid-19th century, "plains provisions" were generally purchased directly from the hunters, most frequently the Métis. These provisions entered the post already butchered or processed into dried meat or pemmican. Domestic animals, although they were often bought from the settlers, were slaughtered within the post by the post employees.

Alexander Henry the Younger's journal provides information on what he hunted personally, including large game, particularly bison, and migratory waterfowl. He did not apparently hunt often for the subsistence of the post.

Women within the post are rarely mentioned, although the Fort Garry journal does note that the fisherman and his wife tended the nets throughout the fall, winter, and

spring. During the later Fur Trade period, male employees of the post carried out the butchery and preparation of domestic animal meat. Henry (1988:317), however, includes ten women and fourteen children within his list of post inhabitants during 1808. It is probable that these women processed much of the meat that entered the post at that time.

CHAPTER 6:DISCUSSION AND INTERPRETATION

This chapter includes the summary and interpretation of the archaeological and documentary data, observations concerning change through time in faunal exploitation patterns, and discussion of the factors influencing the observed variability.

6.1   Summary of Archaeological and Documentary Data by Sample

This section summarizes the archaeological and documentary information of faunal exploitation patterns which is presented in detail in Chapters 4 and 5. The databases provide information on taxonomic composition, taxonomic richness, taxonomic diversity, butchering and processing patterns, and seasonality of procurement. Areas of agreement and disagreement between the databases are noted and discussed.

6.1.i   Archaic Sample

Taxonomic frequencies for the Archaic sample are presented in Table 6.1. It is evident from this table and from the data presented in Chapter 4 that fish is the most important class, yielding 94.98% of the total NISP. These frequencies reflect an intensive exploitation of spawning suckers (Catostomidae) and catfishes (Ictaluridae) during the spring and early summer. The seasonality of procurement is somewhat supported by the incremental growth analysis of the catfish pectoral spines and by the recovery of foetal deer bone. The focused exploitation on two major fish taxa suggests that the occupation itself was seasonally limited and intended for the preservation of fish for future consumption or for the support of a large population over a short period of

TAXON	NISP	CLASS
Catostomidae	7246	fish
Ictaluridae	5673	fish
Vulpes vulpes	314	mammal
Esox lucius	250	fish
Stizostedion sp.	225	fish
Aplodinotus grunniens	126	fish
Bison bison	104	mammal
Martes pennanti	92	mammal
Castor canadensis	32	mammal
Mustelidae	20	mammal
Mustela vison	18	mammal
Odocoileus sp.	10	mammal
Canidae	8	mammal
Acipenser fulvescens	8	fish
Leporidae	7	mammal
Lota lota	5	fish
Hiodon sp.	4	fish
Canis lupus	4	mammal
Cervidae	4	mammal
Alces alces	4	mammal
Passeriformes	4	bird
Canis latrans	3	mammal
Lutra canadensis	2	mammal
Ursus americanus	1	mammal
Unidentified Fish	90078	
Unidentified Mammal	4846	

Table 6.1 Archaic sample taxon representation (in order of decreasing magnitude)

time. These interpretations suggest a seasonal period of social aggregation, made possible by the abundant resource of spawning fish and providing the necessary labour force for the processing of the resource.

The presence of additional fish taxa suggests that the fish were procured in a weir or trap, or that hook and line fishing was also carried out. High numbers of stream spawning suckers may provide corroborative evidence regarding the nature of the Assiniboine River bed. If the present Assiniboine River channel was occupied by a smaller stream during this period, this would have provided a better spawning habitat for suckers. Suckers currently move up the Assiniboine River to spawn in smaller tributary streams (e.g. Sturgeon Creek, Catfish Creek). Spawning suckers could have been more efficiently exploited at the Forks if fish traps were constructed across a narrower stream bed.

The interpreted focus on sucker and catfish is supported by the presence of butchering marks only on the remains of these taxa. A small number of specimens indicate a butchering pattern of head removal, but this pattern may not be consistent throughout. Skinner (1911) notes that heads were often removed in preparation for smoking the fish and the drying and/or smoking of large numbers of spawning fish is noted within the ethnographies.

Very few fish bones have been thermally altered or chewed by carnivores. The greatest number of burnt bones are cranial bones of pike (*Esox lucius*), which may indicate that these fish were consumed fresh with the low utility head removed and burnt. The complete lack of chewed fish bone is interesting as dogs would most likely have been

present at any Precontact occupation. Wheeler and Jones (1989:69-74) discovered that consumption of fish bones by dogs results in little damage other than slight erosion by digestive acids. It may therefore be impossible to recognize fish bone which has been consumed and redeposited by dogs.

The presence of mammalian taxa indicates a background subsistence pattern of fresh meat. Bison and cervids are not well-represented, suggesting that these animals were scarce or of poor quality at that season. This could be partially offset, as suggested by Malainey (1997), by the consumption of foetal animals. The remains of foetal deer and of high utility body areas (e.g. bison hump meat) suggests that the poor quality of the animals during the spring was offset through the utilization of selected choice meats. Bovids and cervids are represented by high utility elements, the results of primary butchering. The pattern is one of "heavy butchering," suggesting that these animals were procured fairly close by.

The high numbers of smaller carnivores are also remarkable and suggest either procurement of furs as a secondary activity or as a possible by-product of the fishing through the opportunistic exploitation of scavenging carnivores. The capture of mustelids for furs is borne out by the locations of cut marks on the remains of these taxa. The butchering pattern for canid indicates procurement for both furs and meat. The mammalian pattern seems to be one of even, perhaps opportunistic, exploitation of various taxa.

The overrepresentation of beaver cranial elements may be due to the use of incisors as tools. Leporids, however, also show excessive head representation and this

may indicate the refuse of primary butchery, with consumption and subsequent discard occurring elsewhere.

The almost complete absence of birds is striking given that the interpreted season of occupation coincides with the arrival of migratory waterfowl. Ethnographic information includes descriptions of waterfowl being intensively exploited during the moulting period, when the birds were easier to kill in large quantities. An intensive exploitation of waterfowl could also be more efficiently carried out in a marsh, rather than a riverine, environment. Ethnographers also remark that the remains of aquatic animals were disposed off in the water. This disposal trait might account for the lack of waterfowl remains as well as underrepresentation of non-cranial bones of beaver.

The archaeological database provides an interpretation of the Archaic occupation as temporally limited and focused on the seasonal exploitation of spawning riverine fish taxa. Subsistence was supplemented by opportunistic exploitation of other fish taxa and a variety of mammals. Procurement of fur bearers appears to have been a secondary focus. The labour requirements of processing and preserving large numbers of fish suggest a seasonally limited period of social aggregation.

The general Precontact Parkland subsistence round (e.g. Syms 1977; Ray 1974) for such historically known groups as the Saulteaux, Assiniboine, and Plains Cree includes the use of spawning fish in Parkland rivers during the spring. According to Malainey's (1997) hypothesis of bison movement and corresponding human settlement patterns, the Forks site corresponds to a spring occupation within a Forest/Parkland subsistence round, with an emphasis on a mixed strategy, food storage, and the use of

fish as a seasonal resource.

Such an occupation would correlate better with Wright's (1995) Middle Shield culture description than with his McKean complex description, but both of these are quite general in nature, and depend on the more "traditional" argument regarding bison winter movements. Wright notes that the Middle Shield cultures followed a diffuse subsistence pattern, with a seasonal focus on fish as well as beaver, muskrat, bear, large game (moose, wapiti), smaller mammals, birds, and turtle. The inclusion of bison, deer, moose, bear, beaver, and fur bearers suggests a familiarity with woodland taxa.

The focused nature of the Archaic sample is due to its seasonally limited nature and does not directly reflect the annual subsistence round. The pattern of intensive exploitation of spawning fishes and its co-occurrence with a period of social aggregation supports an interpretation of occupation by Parkland and/or Woodland adapted groups.

6.1.ii Blackduck Sample

The Blackduck sample presents a diversified subsistence economy, with seasonality indicators suggesting spring, summer, and fall procurement and site occupation. Table 6.2 presents the taxonomic frequencies for the Blackduck sample. This occupation was also focused on fish procurement but includes a greater representation of mammals than the Archaic assemblage. The range of mammalian taxa is narrow, but the taxa are evenly represented, indicating a lack of specific focus. The representation by class is most similar to that of the Upper Fort Garry sample but, instead of indicating a longer occupation, supports an interpretation of a series of shorter revisits at various seasons.

TAXON	NISP	CLASS
Ictalurus punctatus	727	fish
Acipenser fulvescens	247	fish
Ictaluridae	102	fish
Artiodactyla	64	mammal
Aplodinotus grunniens	63	fish
Castor canadensis	39	mammal
Lepus americanus	32	mammal
Bison bison/Bos taurus	27	mammal
Bison bison	26	mammal
Stizostedion vitreum	24	fish
Hiodon alosoides	21	fish
Catostomidae	21	fish
Ictalurus sp.	15	fish
Stizostedion canadense/S. vitreum	14	fish
Hiodon sp.	12	fish
Stizostedion sp.	12	fish
Perciformes	11	fish
Moxostoma macrolepidotum	9	fish
Esox sp.	8	fish
Ectopistes migratorius	7	bird
Ictalurus nebulosus/I. punctatus	7	fish
Anas rubripes/platyrhynchos	6	bird
Canis sp.	6	mammal
Lota lota	5	fish
Ondatra zibethicus	4	mammal
Canis familiaris/C. latrans	4	mammal
Esox lucius	3	fish
Catostomus sp./*Moxostoma* sp.	3	fish
Alces alces	3	mammal
Cervus canadensis	2	mammal
Passeriformes	2	bird
Carpiodes cyprinus	2	fish
Moxostoma anisurum	2	fish
Canis familiaris	2	mammal
Canis latrans	2	mammal
Cervus canadensis/Alces alces	2	mammal
Anas crecca/discors	1	bird
Accipiter gentilis	1	bird
Anatinae	1	bird
Esox masquinongy	1	fish
Cypriniformes	1	fish
Moxostoma sp.	1	fish
Catostomus sp.	1	fish

cont'd

TAXON	NISP	CLASS
Canis familiaris/ C. lupus	1	mammal
Canis lupus	1	mammal
Vulpes vulpes	1	mammal
Urocyon cinereoaregenteus	1	mammal
Lutra canadensis	1	
Procyon lotor	1	

Unidentified Bird 27
Unidentified Fish 3019
Unidentified Mammal 3620

Table 6.2 Blackduck sample taxon representation (in order of decreasing magnitude)

High numbers of channel catfish and sucker suggest procurement during the spawn, indicating an occupation season of late May/June. Other seasonality indicators, however, suggest intermittent use of the area from spring through fall.

The focus on catfish (*Ictalurus* sp.) evident within the archaeological sample is not noted in any ethnographies, although the exploitation of spring spawning taxa (e.g. sucker, sturgeon) is often noted. The lack of catfish may be due to the slightly later spawning period of catfish (May-June), at which time other resources are often suitable for exploitation. In a subsistence economy centred around bison, in which fish are viewed as a seasonal "stopgap" measure, later spawners may not have been utilized. If, however, fish are viewed as an integral part of the subsistence round, later spawners would perhaps be as likely to be used as the earlier spring spawners.

The bulk of the fish taxa show higher representation of cranial and appendicular body areas, with low representation of trunk bones. The low representation of trunk elements is not due to the lack of identification in this case. The pattern suggests that the assemblage includes the discarded refuse of primary butchery, with the flesh eaten elsewhere or dried/smoked following decapitation. Only *Hiodon* sp. (goldeye/mooneye) yields fairly even representations of body areas, probably due to their small size. The location of butchering marks indicates that catfish were decapitated and cleaned prior to further processing.

The bison remains appear to be the result of heavy butchery, with an emphasis on high utility, meat bearing bones of the upper limbs. Inclusion of some lower limb bones suggests that the bison meat may have entered the site as quarters. Cut and chop marks

indicate meat removal on the large upper limb bones and disarticulation of lower limb. The few cervid bones included in the sample indicate a greater representation of upper hind limbs and cranial elements, again suggestive of a heavy butchering pattern.

Beaver remains include high utility meat bearing bones of the upper limbs, as well as head remains. The high representation of cranial elements may be due to the documented use of beaver incisors as gravers. The greater relative frequencies of meat bearing upper limbs bones indicates that these bones represent the refuse of consumption. Cut marks on the head indicate that the animals were also skinned.

High percentages of butchering marks on canid remains indicate at least selective consumption, although the even representation of body areas suggests disposal of whole carcasses. Mustelids are represented only by unbutchered low utility parts (head and lower limb), possibly indicating consumption and the discard of these low utility parts or the last stages of skinning out the animal. The snowshoe hare is well-represented, with slightly higher head and lower trunk counts but a fairly even distribution of body areas. This body area representation may indicate discard from primary butchering.

Ducks, passenger pigeon, and peregrine falcon comprise the avian assemblage. While none of these taxa are very well represented, the first two groups were evidently subsistence items. Element frequencies indicate a dominance of upper wing and upper leg, suggesting post-consumption waste.

The presence of avian medullary bone suggests a spring/early summer exploitation, while the presence of migratory birds indicates occupation anywhere from spring to fall. The catfish pectoral spine analysis, however, suggests a number of

seasonal clusters which are dependent on the stratum/feature and include late spring/early summer, summer and fall/winter. Mammalian seasonal indicators present a similar range of possibilities, including late fall, spring/late summer, spring and summer. Scott and Crossman (1973:608) note that catfish move downstream during the fall, and Fidler (HBC Archives B.235/a/3) also remarked on the fall movement of catfish down to "the lakes". This fall movement might explain the fall clusters of catfish seasonality indicators.

These seasonality indicators, as well as the diversified resource base, suggest that Blackduck use of the Forks did not follow the same intensive seasonally limited pattern of the Archaic, but was part of a more diffuse subsistence round. The occupation pattern appears to be one of revisits across a number of seasons, accessing a variety of resources. The pattern includes the intensive exploitation of a limited number of fish taxa, possibly for preservation/storage, as well as a diffuse subsistence round utilizing resources in a more opportunistic way. The aggregation of five occupations into one faunal assemblage may have resulted in exaggerated taxonomic richness and diversity values. However, the pattern of intermittent revisits during several seasons suggests distinct differences from the previous Archaic occupation. The Forks locality is used in a different manner, accessing a greater range of resources, with a less intensive focus on certain taxa. The effects of aggregation do not mask the overall shifts in resource use patterns at the Forks. The use of seasonal indicators permits the interpretation of intermittent, short-term occupations and avoids the potential pitfalls of viewing the assemblage as the product of undifferentiated occupations.

The Forks Blackduck pattern agrees, in general, with Nicholson's (1987) boreal

forest subsistence reconstruction but not, of course, with the bison hunting pattern at, for instance, the Stott site. Given the hypothesis that the people of the Blackduck culture moved from the boreal forest into the parkland and plains over time, the Forks represents an "intermediate" site area with a subsistence adaptation transitional between the forest and grassland. It would be useful to carry out a seasonality study on the bison remains at the Stott site in order to determine how continuous was the bison hunting; perhaps the Stott site bison exploitation was just another seasonally utilized resource in the Blackduck diffuse subsistence base.

6.1.iii Fort Gibraltar I Sample

Table 6.3 presents the taxonomic frequencies for the Fort Gibraltar I sample. This assemblage contains a remarkable amount of mammal bone, primarily bison, with the remainder mostly medium and small rodents and carnivores. Domestic taxa (pig and horse) are present in small amounts, but beaver is the second most abundant resource. The greater richness of this sample in terms of mammalian taxa is notable and is due to two factors: 1) As a "transitional" sample between the Precontact and later Postcontact samples, both wild and domestic taxa are included; and 2) A less seasonally delimited occupation period facilitates the exploitation of a greater range of mammals.

The richness of the mammalian assemblage is offset by the extremely low diversity index which indicates an intensive focus on bison. The high degree of fragmentation within the Artiodactyla/bovid assemblage is indicative of the manufacture of bone grease, presumably for pemmican production. The need for large amounts of

TAXON	NISP	CLASS
Bison bison	349	mammal
Acipenser fulvescens	155	fish
Ictalurus sp.	118	fish
Artiodactyla	95	mammal
Castor canadensis	70	mammal
Bovidae	70	mammal
Ictaluridae	56	fish
Catostomidae	52	fish
Rodentia	40	mammal
Anatidae	31	bird
Stizostedion sp.	24	fish
Cervus canadensis	21	mammal
Anas sp.	15	bird
Ondatra zibethicus	13	mammal
Canidae	12	mammal
Cypriniformes	11	fish
Leporidae	11	mammal
Equus caballus	11	mammal
Anserinae	8	bird
Aplodinotus grunniens	7	fish
Cervidae	7	mammal
Anseriformes	6	bird
Canis sp.	6	mammal
Cygninae	5	bird
Olor sp.	5	bird
Passeriformes	4	bird
Sus scrofa	4	mammal
Olor buccinator	3	bird
Galliformes	3	bird
Esox lucius	3	fish
Hiodon sp.	3	fish
Lepus sp.	3	mammal
Carnivora	3	mammal
Merginae	2	bird
Charadriiformes	2	bird
Lynx lynx	2	mammal
Ovis aries	2	mammal
Clupeiformes	1	fish
Perciformes	1	fish
Perca sp.	1	fish
Sylvilagus floridanus	1	mammal
Vulpes vulpes	1	mammal
Ursus americanus	1	mammal
Mephitis mephitis	1	mammal
Taxidea taxus	1	mammal
Alces alces	1	mammal

cont'd

TAXON	NISP
Unidentified Bird	353
Unidentified Fish	3567
Unidentified Mammal	12470

Table 6.3 Fort Gibraltar I sample taxon representation (in order of decreasing magnitude)

bison meat and pemmican necessitated the exploitation of a larger catchment area. This is consistent with the role of Fort Gibraltar I as one of the *forts des prairies*, intended to produce large amounts of provisions - mostly pemmican - to facilitate the fur trade expansion into the northwest.

Element frequencies suggest that bison were brought into the post following primary butchering on the plains. The high utility bones (meat bearing upper limb bones) were most intensively and consistently utilized. The element frequencies for moose and wapiti indicate a similar pattern, but with a greater representation of upper fore rather than upper hind limbs. Hurlburt (1977:27), based on fur trade journals, considers the forequarters of wapiti to be less favoured meat, both in terms of species and body area. A few, low utility pig bones are included in the assemblage, suggestive of the results of on-site, primary butchery. The horse remains, possibly from one individual, indicate skinning, butchery and presumably consumption of fore- and hindquarters. Low utility large mammal bones (head, lower limb) exhibit chewing marks indicating that dogs were probably provided with the discarded, unused bones.

Small and medium-sized mammals such as beaver, canids, hare, and muskrat are all represented by the higher utility, meat bearing upper limb bones. Butchering marks rather than element frequencies indicate intensive butchery of large subsistence animals (bovids, cervids, and equids), less intensive butchery of the medium-sized animals (beaver, canid), and no butchery of the smaller species (hare, muskrat) or those represented by few elements (bear, lynx, mustelids, pig). This variability in the intensity of butchering appears to be a function of carcass size. Smaller mammals require less

subdivision of the carcass prior to processing and consumption and are also easily transported without primary butchery. Additionally, many small and medium-sized mammals are exploited primarily for furs rather than flesh. This use results in lower frequencies of butchering marks as carcasses are merely skinned and discarded.

The greatest discrepancies between archaeological and documentary databases relate to the taxonomic richness of the mammalian assemblage. The documentary data note eleven taxa while fifteen are present archaeologically. The taxonomic composition is also different. Domesticates (sheep, pig, horse) are present in the archaeological record but not in the documentary record. The incoming settlers brought domesticates with them to the Red River, while additional cattle and sheep were driven up from the United States to develop stock for the settlers. The discrepancies between the databases may be due to the location of the archaeological sample near the Red River Settlement and the location of Alexander Henry south of Pembina.

Variations also exist in the use of small to medium-sized mammals, such as otter, raccoon, fisher, muskrat, hare, skunk, and badger. While the specific taxa vary, the use of small and medium-sized mammals occurs both in the documents and within the archaeological data. The documents note that the use of some of these taxa are characteristic of "the men" and might have been particular to the engagés.

The small and medium-sized mammals noted as subsistence items within Henry's daily journal are *not* noted within his list of subsistence items for the post. The use of these smaller mammals (e.g. raccoons) may have been generally limited to "the men" and presumably their families, but were not considered part of the post's subsistence roster.

This suggests that procurement was carried out by the men, for the men (and their families) and was presumably not of interest to the company. Such items cannot be expected to be mentioned within the fur trade journals or account books, but were personal supplements to the post provisions.

Butchering marks across the mammalian faunal assemblage include the use of the axe, particularly for the initial disarticulation/quartering of large animals. Although bison are most generally represented by high utility upper limb bones, there is also evidence of the exploitation of lower utility lower limb bones. This may be due to a shortage of immediate subsistence resources or to a shortage of bone grease for pemmican production. It is important to remember that most of the bison resources entering the post were intended not for immediate consumption but for storage and processing for eventual export.

The Fort Gibraltar I sample also contains a high percentage (68.81%) of burnt mammal bone. As Hurlburt (1977) argues, the production of bone grease does not require the extreme burning of bone and therefore the large percentage of burnt/calcined bone is probably due to the intermittent burning of garbage. Both Fort White Earth (Hurlburt 1977) and Fort Gibraltar I, similar in purpose and date, yielded extraordinarily high percentages of burnt and calcined mammal bone. The processing of bison resources for meat and fat may have produced a larger amount of food refuse, necessitating more frequent burning of the garbage.

Fish are again a fairly important resource. Fewer fish taxa are utilized than in other samples, with a slight dominance of sturgeon and catfish. The archaeological and

documentary data generally agree in terms of the range of species utilized, although some variations exist. Unfortunately, three to four of Henry's terms could not be translated into fish species. Burbot, noted in the documentary data, was not noted in the archaeological data but is a little-used, generally lake-dwelling fish, so the absence is not surprising. Henry's "brim", assumed to be "bream", could indicate bass, which is also absent archaeologically. The use of nets, noted within the documents, agrees with the variety of fish taxa noted archaeologically.

The analysis of element frequency was hampered by the fact that few vertebrae were identified to taxon. Analysis of the fish assemblage at the class level resulted in a pattern of dominance of trunk elements, low representation of cranial elements, and an "average" representation of appendicular elements. This patterning of elements indicates that primary butchery of the fish (decapitation, cleaning) occurred elsewhere, probably at the location of the catch, and that the remains within the assemblage are the end result of butchery and consumption. The lack of vertebral identification resulted in high cranial representation at the family level of analysis. Catfish are notably well-represented by pectoral elements, probably due to the highly identifiable nature of these bones. Carnivore chewing is evident only on low utility elements of catfish, which would have been immediately discarded. Almost 10% of the fish assemblage has been affected by heat, focusing on low utility areas (cranial, pectoral) of catfishes, suckers, and walleye/sauger. This suggests the burning of discarded portions.

A variety of waterfowl was slightly utilized, with a high diversity index indicating a lack of focused exploitation of any one taxon. Various chroniclers describe the

passenger pigeon being shot in the hundreds at the Forks, but these birds are absent from the archaeological assemblage. Scheduling conflicts may have resulted in the failure to make use of this resource at Fort Gibraltar. The birds migrated through the area in May, by which time preparations were in place for all, or most, of the post inhabitants to leave for the summer.

The avian assemblage presents a dominance of upper wing and upper leg bones, with a low representation of lower limb bones. Given the small screen size used in this project, this pattern is a likely representation of the bones originally deposited. The pattern of upper limb dominance is probably due to discard following consumption, as these are the higher utility, meat bearing bones. Butchering marks on avian bones indicate wing and leg removal.

The presence of medullary bone in migratory swan indicates the exploitation of these birds during the spring migration (mid-April to late May), while other migratory, locally nesting birds could have been hunted from early spring (mid-March) to late fall (late November). The high percentages of sturgeon and catfish suggest exploitation of these fishes while spawning, during May and June. The incremental analysis of channel catfish pectoral spines, however, provides three clusters of dates - late spring/early summer, summer, and early to mid-fall. Only the first of these (late spring/early summer) agrees with the spawning period of catfishes. The procurement of catfish during June and July does not agree a pattern of post abandonment during the summer as noted in the NWC documents. Fort Gibraltar was evidently not abandoned during the summer but was maintained by a reduced staff. This may have been due to the hostilities between

the two companies and the settlers or merely a function of post size and importance.

Fort Gibraltar I produced a sample transitional between the Precontact and later Postcontact samples. While certain Postcontact trends were immediately noticeable within the Fort Gibraltar I sample, these were only minimally present. In many ways, the Fort Gibraltar I sample was more similar to the Blackduck sample than to the later Postcontact samples. This may be due to the generally "Indian" nature of the subsistence patterns/processing methods, due to the incorporation of Native/Métis workers (both male and female) within the posts, subsistence trade with Native and Métis people, and the necessity of incorporating Native subsistence patterns into a successful fur trade adaptation. The mere introduction of Europeans into the landscape did not immediately result in dramatic differences within the subsistence patterns associated with this landscape. Rather, the new inhabitants altered their cultural subsistence patterns to suit the new landscape, particularly within the NWC.

6.1.iv Fort Garry Sample

Table 6.4 presents the taxonomic frequencies for the Fort Garry sample. Notable trends in this sample are the dramatic increase in avian species and the increase in the number and frequency of domestic taxa (*Bos taurus, Sus scrofa, Ovis aries, Gallus gallus, Meleagris gallopavo, Capra hircus*).

This sample is the richest and most diverse in terms of avian taxa and also exhibits the greatest richness of fish taxa. The fish taxa also produce a high diversity index. The mammal data, on the other hand, produce a middle range richness and diversity index.

TAXON	NISP	CLASS
Aplodinotus grunniens	478	fish
Lepus americanus	444	mammal
Hiodon sp.	294	fish
Bison bison/Bos taurus	197	mammal
Stizostedion sp.	180	fish
Ovis aries/Capra hircus	160	mammal
Artiodactyla	130	mammal
Sus scrofa	126	mammal
Anatinae/Aythyinae	122	bird
Gallus gallus	112	bird
Bos taurus	108	mammal
Ovis aries	103	mammal
Ectopistes migratorius	81	bird
Ictalurus sp.	55	fish
Ictalurus punctatus	50	fish
Leporidae	49	mammal
Acipenser fulvescens	46	fish
Bovidae	34	mammal
Anas sp.	31	bird
Anas platyrhynchos	24	bird
Anserinae	22	bird
Anatinae	19	bird
Passeriformes	14	bird
Catostomus sp.	13	fish
Aythyinae	10	bird
Catostomidae	10	fish
Ursus americanus	10	mammal
Meleagris gallopavo	9	bird
Castor canadensis	9	mammal
Vulpes vulpes	9	mammal
Cygninae	8	bird
Galliformes	8	bird
Lepus sp.	8	mammal
Canis sp.	8	mammal
Bison bison	8	mammal
Anseriformes	6	bird
Ictaluridae	6	fish
Olor sp.	5	bird
Branta canadensis	5	bird
Stizostedion vitreum	5	fish
Chen caerulescens	4	bird
Coregonus sp.	3	fish
Catostomus commersoni	3	fish

cont'd

TAXON	NISP	CLASS
Carnivora	3	mammal
Aythya sp.	2	bird
Esox lucius	2	fish
Chen hyperborea	1	bird
Aythya americana	1	bird
Haliaeetus leucocephalus	1	bird
Tetraonidae	1	bird
Columbidae	1	bird
Coregonus clupeaformis	1	fish
Lota lota	1	fish
Rodentia	1	mammal
Cervidae	1	mammal
Capra hircus	1	mammal
Equus caballus	1	mammal

Unidentified Mammal	3860
Unidentified Fish	1382
Unidentified Bird	573

Table 6.4 Fort Garry sample taxon representation (in order of decreasing magnitude)

These figures indicate that the Fort Garry sample represents a more extensive use of the available subsistence resources in the area, but less intensive and less focused. This may be due to the year-long occupation period, to the availability of leisure time to hunt for sport, or to the dramatic reduction in local bison populations in the area due to overhunting. The archaeological record consistently shows greater taxonomic richness than is expressed within the documents. For the mammal assemblages, this amounts to twice as many taxa within the archaeological record as within the documentary record.

Fish taxon frequencies indicate a complete switch away from sturgeon, catfish, and sucker and towards drum, goldeye/mooneye, and walleye/sauger. This may be due to changes in technology as the journals indicate the almost continuous use of nets set across the river. The use of nets would decrease the ability to selectively fish for certain taxa, while the practice of fishing all year would reduce the dominance of any seasonally abundant taxon. It may also indicate cultural preferences away from bottom feeding fish. The inclusion of whitefish (*Coregonus* sp.) indicates a larger catchment area, including Lakes Winnipeg or Manitoba. The documents stress the exploitation of sturgeon, which are not well-represented within the archaeological record, probably due to the largely cartilaginous nature of the sturgeon skeleton. Drum and sucker are very well-represented in the archaeological record but are not mentioned at all within the documents, while perch is noted within the documents but not represented archaeologically. Burbot are poorly represented within the archaeological record but not noted at all within the documents.

Sturgeon seem to be mentioned frequently in the journals because they relate to

movements of goods between the posts. Because the sturgeon were being imported from Netley Creek post, the comings and goings of the post employees around this activity are noted in the journals. Other fishing activities are noted in passing and in general terms. Although fish catches are consistently large and represent an important source of meat, the taxa are not distinguished one from another within the journals.

Fish element frequencies generally indicate high percentages of trunk elements, suggestive of a post-processing and possibly post-consumption pattern. Initial butchery would have occurred, and refuse discarded, elsewhere. At the family level, this pattern of high trunk elements and low representation of cranial elements is true for sucker and freshwater drum. Goldeye/mooneye are, however, represented by higher cranial and pectoral element counts and lower trunk representation. Given the small size of these fish, the low trunk counts may be due to the small size of the vertebrae, spines, and fin rays passing through the screen. The high appendicular representation of the catfish may be related to the greater identifiability of these elements. Percidae, on the other hand, were fairly evenly represented, possibly indicative of consumption whole.

The faunal assemblage is distinctive in the high percentage of butchered bone. The greater percentage of butchering marks is not linked, however, to a well-defined pattern. Within the fish assemblage, the bulk of the cuts occur in the trunk area, primarily the vertebrae, indicating both filleting (longitudinal cuts) and subdivision of the fish into steaks (transverse cuts). Cut marks on catfish remains indicate decapitation and halving, sometimes by saw. Freshwater drum were beheaded, tails removed, and halved/filleted. Walleye/sauger butchering marks indicate only filleting.

The intensity of butchering, as measured by percentage of butchering marks, is not directly related to fish length or weight. Those taxa most intensively butchered are whitefish, sucker, and catfish. The latter two may have been more intensively butchered in order to make them more acceptable in appearance, while the whitefish butchery may be due to processing for smoking/drying.

Mammalian taxonomic composition of the assemblage reflects an expected shift towards domestic taxa and a decreased reliance on wild taxa. This is due to the increased availability of domestic taxa, to cultural preferences, and to the decrease in available wild taxa due to habitat destruction and overhunting. The assemblage also includes a surprisingly large amount of snowshoe hare. The high percentage of fragmented, unidentifiable bovid remains suggests that bone grease extraction may have occurred, although to a lesser extent than at Fort Gibraltar I.

The degree of discordance between archaeological and documentary records is most evident in terms of the taxonomic richness of the mammalian assemblage. Twelve archaeological taxa are represented in comparison to six documentary taxa. Horse and goat are not well-represented in the archaeological record and therefore their lack of mention in the journal is not surprising. On the other hand, snowshoe hare, cow, and sheep *are* very well-represented archaeologically but are not noted in the journals. There is a documentary bias against what is not traded but is produced or hunted locally. The journals focus on bison, as the procurement, storage, and distribution of bison/pemmican was a major focus of the post. Little bison exists in the archaeological record, however, probably because the meat came in as prepared portions or pemmican and was also traded

back out again. Decline in bison population size and accessibility may have led to an increase in specific uses of the highly valued meat. Pemmican was a valuable fur trade resource for the brigades, and bison may have been discouraged as a post subsistence item.

The small size of various taxa in the archaeological record - especially hare - may have contributed to their absence in the journals. It is also possible, as noted above, that some of these smaller mammals (hare, beaver, fox, canid) were hunted by the "men" for themselves and/or their families.

Bovid and suid remains are fairly evenly represented in terms of body area, indicating that these animals were likely butchered on site and that most of the animal parts were utilized. Cervid remains and equid remains are too sparsely represented to determine patterning. Butchering marks indicate that swine heads were removed with an axe, and the carcass split into halves. Low utility bones, such as the head and lower limb, were also burned. Cow is more intensively butchered than bison, possibly due to the larger sample size of the former. Cattle remains exhibit more sawing and less axe chopping than do the bison remains. This may be a factor of butchering location and ethnicity of the butcher. The bison remain were likely roughly butchered in the field by the hunters, while cattle remains were butchered by post employees at the post.

The intensity of butchering may be a function of the intended "final product." Bison were procured for pemmican production while cattle were butchered to supply fresh or salted meat. The cattle would have been more likely to be butchered in a "European" manner, into a number of smaller meat cuts. Butchering marks on cattle remains indicate

that the head was removed using an axe and the carcass split using a saw; low utility areas (e.g. lower legs) were chopped off while the saw was used to create further meat cuts. Sheep remains were more often cut than chopped or sawn, probably due to their smaller size. These animals were skinned, their heads removed, but were not split into halves.

Canid remains indicate a fairly even representation of body areas, with most butchery focused on the trunk, with evidence of head removal. Snowshoe hare (*Lepus americanus*) remains present a high frequency of upper limb bones, suggestive of consumption waste, while butchering marks are also focused on this area and include skinning marks on the lower limbs.

A high percentage (42.03%) of the mammalian assemblage shows evidence of heating, likely due to intermittent burning of midden deposits.

The avian assemblage reveals an expected increase in domestic taxa (primarily *Gallus gallus*), but an unexpected reliance on a wide range of wild taxa (duck, passenger pigeon, goose, and swan). Seven archaeological avian taxa compare to four documentary taxa. The missing taxa are, interestingly, the domestic chicken and turkey as well as goose. Chicken and turkey are well-represented within the archaeological assemblage. The absence of remarks within the journal again appears to relate to internal versus external sources of subsistence items. Swan and duck were traded and therefore the transaction was recorded. This suggests that chicken and possibly turkey were raised within the post for post consumption and therefore not worthy of remarked.

Element frequencies indicate a fairly complete representation of body areas, with

a slight dominance of upper wing and upper leg elements. The passenger pigeon (*Ectopistes migratorius*) is fairly completely represented and, after taking into account the potential bias of large screen size, may indicate the discard of fairly complete individuals. The small size of these birds may have encouraged stripping of breast meat and discard of the rest of the carcass. Butchering marks on duck, goose, pigeon, and swan remains are focused on the breast/upper wing area and, to a lesser extent, the upper leg. These are the areas of greatest meat content and most of the cut marks are suggestive of meat removal rather than initial butchery. Chicken (*Gallus gallus*) remains are dominated by sternum, upper wing, cervical vertebrae, and rib counts. Butchering marks suggest the initial removal of head and neck and disarticulation of the wings. Cut marks due to meat removal occur on upper wing and leg elements. The evidence suggests that the remains are "post-consumption" waste. The incidence of carnivore chewing marks on previously cut elements indicates that dogs (or other scavengers) were given the remains of human meals.

Medullary bone was noted in chicken (*Gallus gallus*), ducks, and swan (*Olor* sp.). Given a limited laying period for nineteenth century chickens, this provides estimates from late April to early July for these taxa. Swan would have been procured during their spring migration, while duck and chicken provide a broader date range. Snow goose and swan may also have been shot during the fall migration, while ducks and Canada geese could have been procured locally from spring through to fall. The pectoral spine analysis exhibits very little seasonal clustering and suggests early summer and late summer to mid-fall dates. Bovid ages indicate that *Bison/Bos* and *Ovis aries* were utilized as newborns

or young animals, providing dates of spring through summer. Pig remains indicate the use of yearling animals during the spring and summer. The documentary use of fish does not appear to have been seasonally limited and this may be due to the continuous use of nets and night lines throughout the year. Swan and ducks were traded in late September, during the fall migration.

6.1.v Upper Fort Garry Sample

Table 6.5 presents the taxon representation for the Upper Fort Garry sample. The assemblage is characterized by an increased dependence on domesticates and a fairly even class representation (48.01% fish, 40.5% mammal, 11.5% bird).

The avian assemblage is dominated by domestic chicken, producing a low diversity index. The assemblage includes a broad range of other taxa including species not generally considered subsistence items, such as crow, wading birds, whooping crane, and cuculiformes (cuckoos). Most of these are present in very small amounts and may not indicate subsistence items.

The relative importance of avian taxa in the archaeological record is not consistent with their absence within the journals. Various taxa represented archaeologically, including chicken, ducks, passenger pigeon, and crow, are absent from the documentary record. This absence appears to be due to the fact that they were not procured through a business transaction or, alternatively, they may have been regarded as contributing little to the diet.

The element frequency patterns of chicken and passenger pigeon are indicative

TAXON	NISP	CLASS
Bovidae	168	mammal
Gallus gallus	86	bird
Stizostedion vitreum	78	fish
Vulpes vulpes	69	mammal
Lepus americanus	57	mammal
Sus scrofa	46	mammal
Hiodon alosoides	38	fish
Bos taurus	35	mammal
Ovis aries	34	mammal
Coregonus clupeaformis	30	fish
Tetraonidae	26	bird
Catostomus commersoni	22	fish
Anatidae	20	bird
Anas platyrhynchos	19	bird
Coregonus sp.	17	fish
Corvidae	16	bird
Corvus branchyrhynchos	16	bird
Catostomus catostomus	16	fish
Capra hircus	16	mammal
Lynx lynx	15	mammal
Artiodactyla	15	mammal
Leporidae	12	mammal
Ectopistes migratorius	11	bird
Ictalurus nebulosus	11	fish
Pedioecetes phasianellus	10	bird
Scolopacidae	10	bird
Passeriformes	9	bird
Bison bison	9	mammal
Stizostedion sp.	8	fish
Lepus sp.	8	mammal
Perca flavescens	6	fish
Branta canadensis	5	bird
Chen caerulescens	5	bird
Anatinae	5	bird
Anas sp.	5	bird
Aythya affinis	5	bird
Coregonus artedii	5	fish
Catostomus sp.	5	fish
Anseriformes	4	bird
Anserinae	4	bird
Cyprinus carpio	4	fish
Grus sp.	3	bird
Cuculiformes	3	bird
Percidae	3	fish

cont'd

TAXON	NISP	CLASS
Sylvilagus floridanus	3	mammal
Galliformes	2	bird
Ictalurus sp.	2	fish
Aplodinotus grunniens	2	fish
Ciconiiformes	1	bird
Olor columbianus	1	bird
Mareca americana	1	bird
Phasianidae	1	bird
Meleagris gallopavo	1	bird
Grus americana	1	bird
Corvus sp.	1	bird
Hiodon sp.	1	fish
Catostomidae	1	fish
Ictaluridae	1	fish
Ictalurus punctatus	1	fish
Perciformes	1	fish
Canis sp.	1	mammal
Ursus americanus	1	mammal
Cervidae	1	mammal
Cervus canadensis	1	mammal
Capra sp.	1	mammal
Ovis sp.	1	mammal
Antilocapra americana	1	mammal
Equus caballus	1	mammal

	NISP	
Unidentified Fish	1410	
Unidentified Mammal	907	
Unidentified Bird	127	

Table 6.5 Upper Fort Garry sample taxon representation (in order of decreasing magnitude)

of post-consumption waste disposal. The crow is the most completely represented, suggesting that this species may have been discarded whole and not consumed. The few butchering marks noted on bird elements appear to be the result of meat removal rather than disarticulation. Butchering marks are not evident on ducks, swan, turkey, wading birds, pigeons, or crows, although it is evident from element frequency patterns that some of these taxa were subsistence items. The lack of thermal alteration and carnivore chewing is due to the nature of the deposit - a privy - which served to protect the deposits from further taphonomic effects.

The fish assemblage includes a few, evenly represented taxa. The major taxa are walleye/sauger, goldeye/mooneye, whitefish, and sucker. These shifts in taxonomic importance are probably due to changes in technology of capture (nets rather than weirs/angling), cultural preferences (against bottom feeders), exploitation of a larger catchment area (whitefish), and perhaps local population decline of certain species, such as channel catfish. Bullheads prefer "shallower, more turbid, vegetated areas" rather than the "cool, clear, deeper water with sand, gravel, or rubble bottoms" preferred by channel catfish (Scott and Crossman 1973:608). The shift in frequency towards bullheads rather than channel catfish may indicate environmental change, due to devegetation of the area and a consequently higher silt content. Alternatively, the shift may indicate a selection of different fishing locations.

The discrepancies between the documentary and archaeological records in the range of taxa utilized are again quite dramatic. Only three fish taxa are noted within the documents, all from Lake Winnipeg. Nine taxa are represented archaeologically, only

one of which is non-local.

Combined fish element frequencies indicate that heads were removed elsewhere, either at the fishing site or prior to cooking, producing a post-consumption pattern. Unfortunately, few vertebrae were identified past the class level. The high representation of Ictaluridae pectoral elements is notable and is probably due to the easy identification of these elements. Percidae, Salmonidae, and Hiodontidae are represented by higher cranial and pectoral element frequencies, probably due to the lack of identification of vertebrae. This is borne out by the higher trunk representation of drum, which has very distinctive, easily identifiable vertebrae. Only a small percentage of the fish assemblage (0.12%) exhibits butchering marks, all located in the pectoral area of Percidae and indicative of filleting. This lack of burning/calcination or chewing is probably due to the nature of the deposits.

The mammalian assemblage is fairly rich in terms of taxa, with a heavy reliance on domesticated species (*Bos taurus*, *Sus scrofa*, *Ovis aries*, *Capra hircus*), the utilization of fur bearers (*Vulpes vulpes*, *Lynx lynx*), and snowshoe hare (*Lepus americanus*).

Within the mammalian assemblages, fourteen archaeological taxa compare to four documentary taxa. The declining importance of bison is evident within both the archaeological and documentary records. Pork and beef were both purchased for processing (salting, pickling) for export. Oxen and horse are also noted as being processed within the post.

The Upper Fort Garry sample exhibits a more even body area representation for Artiodactyla than the earliest three samples, but the overall pattern is still one of high

upper limb representation. Leporids (hare/rabbit) are patterned similarly to the bovids and suids, with high upper limb counts suggestive of a post-consumption pattern. Cut marks indicate skinning as well as disarticulation of front and hind limbs.

Carnivores (canids, felids) at Upper Fort Garry are extremely overrepresented by cranial elements. This pattern was evident in fauna from a more recent Upper Fort Garry excavation project (Kroker 1998) and is difficult to explain. It is possible that winter killed carnivores were only partially skinned out on the plains and were completely skinned out later within the post. The Upper Fort Garry mammal assemblage contains a fairly high percentage of butchered bone, including bovid, suid, equid, and antilocaprid. Canids and leporids exhibit a smaller percentage of butchering marks, while felids, ursids, and cervids (the latter two very sparsely represented) exhibit no butchering marks at all. The high percentage of butchered bone is, again, probably due to the nature of the deposits which appear to represent post-consumption waste. The few bison bones included in the sample indicate the presence of hump meat, subdivision of the backbone behind the rib cage, and sawn disarticulation of the front leg. Cattle were better represented within this assemblage. Butchering marks indicate a process of splitting the carcass into halves, subdivision of the rib cage into proximal/central and central portions, disarticulation of the front leg (by saw) and subdivision of both front and back legs into smaller sections using the saw. This basic pattern appears to hold true for the swine, as well, although the back legs appear to have been more intensively butchered than the front legs. Smaller bovids - sheep and goat - were also intensively butchered. The goats exhibit more cut marks rather than saw marks, while the sheep were halved and the ribs

split into sections. Few bones, primarily low utility lower limb bones from swine, exhibited thermal alteration and chewed bone included only upper hind elements of swine.

Medullary bone is evident in chicken and duck bones, providing dates of mid-March to late April for the former, and early May to early July for the latter. Snow geese and swan could have been hunted during spring or fall migrations. The evenness of spread of fish taxa does not indicate the exploitation of any taxa during the spawn, although whitefish were probably exploited at the lakes during the fall spawn. Bullhead pectoral spines indicate a season of death of late fall/winter.

The journals provide very little subsistence information for this period. The journals again focus on trade and interaction with other posts, not internal post activities, especially in terms of subsistence.

6.2 Change Through Time

The main goal of this thesis is to examine changes in faunal exploitation patterns over time, maintaining the environment as a constant. It is evident from the data and interpretations that each sample is distinctly different in a number of ways, despite the general availability of a consistent set of faunal resources. A number of themes run through the examination of specific changes over time. These are: technology, seasonality, length of occupation (nomadic vs. sedentary), catchment area, subsistence resources versus economic resources and the changing economy, cultural preferences, domestication, and environmental degradation. Differences between the samples have been recognized through an examination of differences in taxonomic composition,

richness and diversity; butchering and processing patterns; and seasonality. Variability in these areas are discussed below by taxonomic class.

6.2.i Taxonomic Composition and Taxonomic Richness

Avian Assemblage

The taxonomic richness (i.e. range of taxa) of the avian assemblage increases over time. A part of this increase is due to the addition of domestic taxa - chicken and turkey - but is notable even without these taxa. The increase suggests that domestic birds did not replace the use of wild birds but were, instead, added to the existing selection.

The increase in taxonomic richness may also be due partially to the introduction of firearms within the Postcontact era, which would have made the hunting of birds much easier. "Fowling" is also considered a gentleman's sport and class may have played a role in the increase in shooting of birds, partially in order to diversify the post diet for the officer/clerk class.

The increase in taxonomic richness may also be due to the increased length of occupation. The Precontact occupations appear to have been seasonal and intermittent in nature, while the Postcontact occupations became increasingly permanent. The Fort Gibraltar post was likely abandoned during the summer or maintained by a limited number of men. Fort Garry was also maintained by a smaller group of men during the summer, assisted by a growing local labour pool. Upper Fort Garry was a year-round, permanent establishment. This increase in occupation length means that a greater variety of taxa were available to the site inhabitants for potential procurement.

sturgeon) which were seasonally abundant during a limited spawning period. The Precontact pattern suggests that the exploitation of these fish taxa at the Forks was one segment of an overall seasonal subsistence round. Preserved subsistence resources were a necessary part of the overall adaptive strategy, presumably to mitigate against variability in the availability of other subsistence resources. Fish taxa were continuously utilized during the Postcontact occupations, but with a notably reduced emphasis on seasonally abundant spawning fishes. Increased dependence on bison during the early Fur Trade period and on domesticated bovids during the later period appears to have reduced the need for exploitation of fish taxa. The preserved food of choice during the Fur Trade period was pemmican, while the exploitation and preservation of spawning fish taxa shifted to the fall-spawning whitefish in the lakes. The increased length of occupation during the Fur Trade and the use of nets and night lines also facilitated an ongoing opportunistic exploitation of fish.

Mammalian Assemblage

This assemblage is generally one of the more complex, given the broad range of available species. One of the most obvious changes over time is the introduction of domesticates such as cow, pig, sheep, and goat. This shift happens quite quickly in the few decades between the Fort Gibraltar I and Fort Garry occupation periods. The Fort Gibraltar I sample contains few domesticated animals and taxonomic frequencies are more similar to Blackduck frequencies, while Fort Garry and Upper Fort Garry are similar to each other. The lack of differentiation between the Blackduck and Fort Gibraltar I

samples is partially due to the NWC practice of hiring Métis and French Canadian labourers whose use of the land's resources was closer to that of the Native people. The NWC also encouraged intermarriage of fur traders with Native and Métis women, who likely carried out much of the butchering and meat processing within the posts, creating patterns in the faunal assemblage which are similar to those of Precontact assemblages.

The HBC, on the other hand, hired labourers from Britain and frowned on intermarriage with local women. As the Red River Settlement developed, mixed blood daughters of fur traders were viewed as potential marriage partners and Native women were viewed as inferior. During the early 1830s, however, several high-ranking HBC officers married British women and settled with them in the Red River area (Brown 1980). This initiated a second shift in the perceived desirability of women based on ethnicity and, after 1830, white women were clearly preferred as wives. Whether mixed blood or British, however, the "wives chosen by aspiring fur trade officers ... were increasingly consigned to ... subordinate protected positions, subjected to rigorous moral standards and expected to be "frail".....' (Brown 1980:151). This increasingly Victorian attitude towards women, combined with the selection of wives based on ethnicity, reduced the direct involvement of women in the fur trade. This resulted in subsistence and butchering patterns that were similar to British patterns and these changes are reflected in the Fort Garry and Upper Fort Garry assemblages.

Certain species are present in decreasing frequencies within the later Postcontact samples. Beaver and cervids, for example, decline to the point of complete absence. This may be due to cultural preferences or, more likely, to the effects of local

overhunting and habitat destruction. Cultural preferences also may have had a role in eliminating other small- and medium-sized mammals (e.g. muskrat, skunk, badger) from the later Postcontact diets. Several documentary sources suggest that the consumption of these mammals was characteristic of the Métis and Canadian labourers. Henry (1988:84,111), for instance, notes that "the men" hunted and consumed raccoon, particularly during the spring and fall. Harmon (1903:24) also notes the consumption of dog. Neither of these gentlemen apparently consumed these foods and their use by "the men" was not due to scarcity of resources. Given the seemingly unvaried diet provided by the post, the procurement and consumption of such mammals may have occurred independently for the sake of diversity in the diet.

The consistent presence of leporids (primarily snowshoe hare, *Lepus americanus*) is notable. Such consistent exploitation of hare is not noted in the documents for this area and indicates a significant "fall back" resource.

6.2.ii Taxonomic Diversity

Avian Assemblage

The increase in taxonomic richness is paralleled by a general increase in the diversity index, indicating a more even spread of taxa across the sample. This increase is interpreted as being due to the increased length of occupation, as there is no focused exploitation of seasonally available species or, if there is, this is balanced by similar exploitations at different seasons. The exception to this pattern, the Upper Fort Garry sample, is due to the dramatic increase in the use of domestic chicken, *Gallus gallus*.

This may be partially due to an increasingly limited selection of taxa due to the overhunting of certain species (e.g. passenger pigeon) and/or habitat destruction in the local area.

Fish Assemblage

The diversity index increases significantly over time, with a particularly large increase in index values at the Precontact/Postcontact boundary. The increase in diversity index indicates a less taxonomically focused exploitation during the Postcontact occupations in contrast to the Precontact practice of intensive exploitation of a limited number of taxa.

The increase in diversity is probably affected by the change in fishing technologies. Precontact spawning fishes were probably procured through use of a weir/fish trap and harpoons/spears, targeting large, seasonally abundant fish. The Postcontact technology introduced the use of nets and night lines of hooks. These were set across the rivers almost continuously, interrupted only by the fall freeze-up and spring thaw of river ice.

The use of this new technology meant that taxon selection was not possible during the procurement phase. Undesired fish taxa may have been discarded or fed to the dogs, but nets would catch all fish of mesh size, while night hooks would be similarly non-specific. This, in tandem with a longer occupation period and alternate subsistence foci, increases the diversity indices of the samples. It is also notable that the Archaic sample reflects the greatest emphasis on fish as well as producing the lowest diversity index,

indicating the most probable subsistence focus of the occupation.

Mammalian Assemblage

The mammalian diversity indices are higher during the Precontact than the Postcontact, indicating a focus on specific mammalian taxa (i.e. bovids) during the Postcontact. A low diversity index generally indicates the focus of the exploitation economy of the occupation. In the case of the early Postcontact samples this focus was the bison, in keeping with the early role of the Forks posts as the *forts des prairies*.

6.2.iii Butchering Marks and Element Frequencies

Avian Assemblage

Relative element frequencies of avian taxa are generally consistent. Axial elements are consistently and significantly under-represented throughout the samples, coupled with a dominance of upper limb bones and a corresponding lack of emphasis on lower limb bones. While screen size may have exaggerated the degree of this lack of emphasis on lower limb bones, the pattern is marked even within the samples with the best recovery techniques. This pattern is interpreted as being due to the selection of the most edible, meat bearing parts - breast and upper limbs. The consistency of this pattern is probably a function of the limited potential variability in the butchering and consumption of birds, varying only by body size. The lower legs and head/neck area were usually removed through primary butchery and the rest consumed. The Fort Garry sample is the most intensively butchered avian assemblage in terms of cut marks, due

partially to the use of metal tools (i.e. technology change).

Fish Assemblage

The intensity of fish butchering, as measured by the frequency of butchering marks, mirrors the taxonomic shifts. In the earlier samples (Archaic, Blackduck, Fort Gibraltar I), catfish and sucker exhibit the greatest percentage of butchery, while the later samples are focused on Percidae (primarily *Stizostedion* sp.) and Salmonidae. Fort Garry again exhibits the greatest intensity of butchering, although only a small percentage of all fish remains are butchered. The Fort Garry sample butchering marks indicate an increase in the halving of fish, as well as cutting the fish into "steaks" or transverse slices of the trunk. Other samples generally contain butchering marks indicating head removal and/or filleting.

Earlier assemblages are characterized by overrepresentation of cranial elements and later assemblages by an overrepresentation of trunk elements. The excavated refuse of the Precontact assemblages indicates a fishing procurement/processing activity area, while the Postcontact refuse indicates disposal following butchery and consumption. This may be due to the incomplete sampling of the full range of activity and disposal areas within the occupations. It may also reflect the Precontact focus on fish as a preserved food resource and the Postcontact consumption of fresh fish. Unfortunately, the element frequency analysis is hampered by the incomplete identification of all elements in certain samples, as well as the presence of highly distinctive elements within certain taxa (e.g. catfish pectoral spines, drum anal fin spines).

Mammalian Assemblage

A number of butchering/processing patterns vary between the samples. The Fort Gibraltar I and, to a lesser extent, Fort Garry mammalian assemblages include large amounts of small, unidentifiable fragments of artiodactyls - most probably bison. These indicate intensive processing for extraction of bone grease and can be interpreted as evidence for pemmican production. This pattern is consistent with the documentary evidence regarding the purpose of the *forts des prairies* as producing pemmican for the extensive brigades as well as to support posts in areas of scarce subsistence resources. The general intensity of butchering in the Fort Gibraltar I sample may also be due to a scarcity of resources.

There is a dramatic increase in the occurrence of butchering marks over time. This is partly due to the introduction of metal tools. Axes and saws are increasingly used within the latter two samples. Metal tools are more likely to leave marks while there may have been less concern regarding the blunting of tools on bone. The use of axes and saws also made further subdivision of the carcasses easier and therefore more likely to occur. The increase in butchering marks may also be due to the increased subdivision of the carcasses, as more modern "market cuts" were created.

The greater intensity of butchering evident in the Fort Garry assemblage is also due to the apparent on-site butchery of large animals (domesticates). This is true to a lesser extent during the Upper Fort Garry period.

6.2.iv Seasonality

The seasonality of avian exploitation is also consistent over time. Consistent use is made of birds which are present in the area only during spring and fall migrations (swan, snow goose), those which are present from spring to fall (ducks), and of laying birds (duck, swan, chicken).

The seasonality of fish procurement appears to shift from sample to sample. In examining the relative taxonomic frequencies, the earlier three samples (Archaic, Blackduck, and Fort Gibraltar I) indicate use of spawning fish taxa, namely suckers, catfish, and sturgeon. The catfish pectoral spine analysis suggests a spring/summer capture for the Archaic, and generally spring/summer and fall clusters for the remaining samples, although some summer spines are also indicated. The fall clusters make sense in light of Peter Fidler's (HBC B235/a/3) remarks on the fall availability of catfish, due to their apparent movement down to the lakes in the fall. Scott and Crossman (1973:608) also note the "marked downstream movements in fall" in some areas. Such increased movements would mean that greater numbers of catfish would be caught in nets or night lines, as well as being a targeted species in weirs/fish traps.

The later two assemblages indicate a more continuous use of fish which is not focused on any one taxon. Procurement does not appear to focus on any one season and spawning fishes are not specifically targeted as they appear to have been in the earlier three assemblages.

6.3 Discussion and Summary

This section includes a discussion of a number of recurrent themes that are not dealt with in detail elsewhere, as well as summary statements regarding the major themes involved in the temporal variability of faunal exploitation at the Forks.

6.3.i Fish Spawning and Fish Exploitation

It is often generally presumed that human groups will exploit fish taxa when they are at their most abundant, as this is the most efficient way of catching the greatest amount of fish. This seasonal abundance generally occurs when the fish are spawning. Two bodies of evidence show that, at the Forks, this pattern of exploitation was not the case. Firstly, the pectoral spine analysis of the catfish indicates that, although there is a tendency towards exploitation during the late spring/early summer spawn, there are also indications of procurement corresponding to the annual fall downstream movements, as well as to summer procurement. Secondly, Table 6.6 notes the spawning periods for various taxa as well as the recorded dates of procurement within the fur trade period journals. While there are certain clusters of dates around the spawning periods for certain taxa (e.g. sturgeon), these taxa as well as others were consistently procured at various periods.

The assumption that fish are procured during the spawn makes a number of additional assumptions. Firstly, the procurement of fish is assumed to be the most important consideration of the people at that time, determining their movements and activities. The procurement of fish, however, may be balanced against other competing

Taxon	Spawning Dates	Early 1800s capture dates	1820s/1830s capture dates	1840s-1860s capture dates
Ictalurus sp. (catfish)	May-June	April-May, Aug.-Oct.	June-Aug.	——
Catostomidae (sucker)	mid-April-e. June	Feb., May	——	——
Aplodinotus grunniens (drum)	July-September	Aug.	——	——
Acipenser fulvescens (sturgeon)	e. May-l. June	April-June, Aug.-Oct., Dec.	Jan-June, Oct.-Dec.	June
Hiodon sp. (goldeye/mooneye)	May-e. July	Feb., May, Aug., Sept.	Jan.-Feb.	spring, June
Stizostedion sp. (walleye/sauger)	spring-e.summer	Sept.	Jan.	——
Esox lucius (pike)	April-e. May	Feb., Sept.	Feb., Nov.	——
Lota lota (burbot)	January-March	June	——	——
Perca sp. (perch)	mid-April-e. May	May	Feb.	——
Coregonus sp. (whitefish)	fall	Feb., Sept.	March, Dec.	Oct.-Nov.

Table 6.6 Comparison of spawning dates and capture dates for the Postcontact period ("——" indicates that no data were available for these taxa)

needs, such as the seasonal abundance of other resources, social needs, or the importance

of other activities (e.g. fur trade travel east or to York Factory). Secondly, it assumes

that all fish congregate in large groups when they spawn, which may not be the case for

all taxa. Thirdly, it assumes that the people require *large* numbers of fish at a limited

time. It is evident that, especially during the fur trade, fish were used as a consistent

resource but the nature of other resources resulted in a lack of emphasis on fish and no

need for large amounts of fish. Increased seasonal analysis of fish remains will continue

to clarify this issue.

6.3.ii Environmental Degradation

Some of the pattern shifts noted within the later Postcontact samples may be due

to local overhunting or overfishing of native species or to environmental degradation in

other ways. The increased dependence on domesticates may be due to cultural

preferences, but also to the decreased availability of wild taxa. Bison, passenger pigeon,

and sturgeon are classic cases of the destructive exploitation of wild taxa. The occurrence

of bullheads and the decrease in occurrence of channel catfish within the Upper Fort

Garry sample may be due to increased silt content in the Red and Assiniboine Rivers,

rendering the habitat more suitable for bullheads and less so for catfish.

It should be briefly noted that the overexploitation of wild resources during the

nineteenth century occupations may have been necessary to counter the climatic effects

of the Little Ice Age. The Postcontact assemblages coincide with the closing decades of

the Little Ice Age period which was characterized by increased climatic variability

(Bamforth 1990). The relative flexibility of the Precontact subsistence strategies could offset the effects of such small-scale climatic changes. The agricultural development of the Red River Settlement, however, was hampered by a short growing season, river floods, unseasonal frosts, and insect depredation. At least some of these factors may have been exaggerated as a result of the effects of the Little Ice Age. The survival of the settlement was only made possible by continued exploitation of wild resources, resulting in the environmental degradation reflected in the Fort Garry and Upper Fort Garry faunal assemblages.

6.3.iii Concerns of Economic Position, Ethnicity, and Gender

There also appears to be a division of cultural preference. Henry, for instance, discusses the "men" using raccoon and the Indian women using drowned bison, but these resources were not considered as part of the post's resources. Other journals (e.g. Harmon 1903) note the consumption of dog by the Canadians or Métis, but the lack of use of these types of animals by clerks and others except as starvation foods. Stock (1992:90) cites Fidler in noting that fish were used by "his men," presumably as opposed to himself or the post in general. Some of these taxa, while liable to show up in archaeological deposits, will not show up in journals except by chance. There appears to have been distinct differences between the British/Eurocanadian officer class and the Métis and Canadian labourers as far as diet is concerned. A reconstruction of fur trade subsistence based on only the journals, account books, or personal correspondence of the officer class will be incomplete and, once again, fail to recognize the variability in

research regarding economic position of individuals and groups in the Red River Settlement, using archival and archaeological information, produced a significant negative correlation between archival ranking (relative economic positions) and bird remains, suggesting that as relative economic position increases, the consumption of avian taxa decreases. This apparently contradicts Livermore's (1976) information above, which states that the consumption of birds was more likely within the officers' diet than the labourers' diet. This apparent lack of agreement again suggests an informal and individual use of local resources by the labourers within the fur trade posts. The lack of diversity in the labourer diet may have encouraged them to continue to procure and consume a variety of additional resources and to continue a pattern of cultural preferences developed during the early fur trade. This secondary, independent subsistence economy may also be reflected in Brenner's (1998) results.

It is extraordinarily difficult to extract information regarding gender from the archaeological or the documentary databases. It is clear that women were present and an integral part of the Precontact and early Postcontact activities. They are, however, seldom mentioned in the documentary record. The changes in fishing technology may have had some effect on women's involvement in fishing. The ethnographic and ethnohistoric documents indicate that women fished only by hook and line and generally targeted the smaller fishes. Men used weirs/fish traps and harpoons or fish spears to procure the larger fishes, such as catfish and sturgeon. A shift to a more continuous use of nets may have increased women's involvement in fish procurement. The Fort Garry post journal notes that "a Canadian and his wife" took care of the nets throughout the

winter, including the setting, lifting, and overhauling of the nets.

6.3.iv Concluding Remarks

The analysis and presentation of data concerning the temporal variability in faunal exploitation at the Forks isolated a number of factors which affect the patterns of faunal resource use. These are: the effects of technology, the length of occupation, seasonality and scheduling, and site function, and the nature of the subsistence economy.

The effects of technology include the impact of metal versus lithic tools, the use of fish nets versus fish traps, and the use of firearms. The use of metal tools is reflected and recognized in the faunal assemblages through variability in butchering patterns. The frequency of butchering marks is much higher, the carcass is subdivided through the bone to a greater extent, and smaller meat cuts are created. The use of fish nets and fish traps are indicated archaeologically through the variability in taxonomic composition, diversity and richness. Fish traps are generally constructed to target specific taxa during periods of seasonal abundance and this is reflected in high taxonomic frequencies of a limited range of taxa, with very uneven taxonomic representation. Fish nets, on the other hand, do not permit selection of certain taxa and result in a greater range of taxa which are more evenly represented. The use of firearms appears to affect procurement of birds to a greater extent, increasing the range of taxa as well as the overall general exploitation of birds.

Variability in the length and seasonal limits of occupation are also recognizable in the faunal record. Seasonally limited occupations can be recognized using faunal

seasonal indicators and, often, by the intensive exploitation of seasonally abundant resources. Longer occupations tend to produce faunal assemblages with a broad range of taxa but no intensive focus on specific taxa. Nomadic groups also tend to exploit seasonally abundant resources as part of a diversified subsistence round. Sedentary populations amass resources at a central location, rather than moving to the resources. Sedentary settlements during the fur trade period were also forced to increase their catchment area as local resources become scarce through overhunting.

Scheduling refers to decisions regarding what resources to exploit and the social groups that will carry this out. Scheduling conflicts seem to have coloured the Forks faunal assemblages. Fur trade subsistence patterns were controlled by their trading schedule, resulting in a less efficient use of local resources.

Site function is also reflected in the composition of the faunal assemblages. Exploitation of certain taxa are reflected in taxonomic composition, while specific activities are reflected in butchering and processing patterns. The Archaic faunal assemblage indicated an occupation focused on fish procurement and preservation. The Fort Gibraltar I assemblage indicated an occupation focused on the procurement and production of bison meat and pemmican. The documentary resources assist in placing these limited site functions into a larger subsistence economy context.

The increased emphasis on economic production rather than subsistence needs also affects the faunal assemblages. Within the fur trade posts, the activity emphasis was not on subsistence so much as on processing and stock piling resources (pemmican, salt meat) for export. This shift in economic production, incorporating both subsistence activities

to support the post as well as "industrial" activities to support the fur trade market, are reflected in the faunal assemblages. Taxonomic frequencies are skewed to the fur trade market resources (bison, cattle, pig), while discarded bone refuse may not indicate the remains of post meals but of "industry discard". The "missing" elements may not have been consumed and deposited elsewhere on site, but shipped to Norway House or Fort William to be redistributed elsewhere.

CHAPTER 7:CONCLUSIONS, RECOMMENDATIONS, AND FUTURE DIRECTIONS

7.1 Conclusions

As stated in Chapter 1, the aims of this thesis were: 1) to analyze the five faunal assemblages from the Forks and compare them, providing information on subsistence and faunal exploitation for the various periods; 2) to compare archaeological and documentary information regarding subsistence to provide a better understanding of faunal exploitation as well as to identify areas of disagreement and potential bias; and, 3) to examine possible explanations for changes in faunal exploitation patterns as indicated by faunal recoveries through time at one locality noted for its comparatively stable environmental regime. The thesis asked the questions, is there variability in the faunal record and does this variability indicate differences in adaptation and resource use at the Forks? Can these differences, in turn, be attributed to differences in subsistence economy, social organization, and ideology?

The analyses and interpretations of the archaeological data, combined with the documentary information, were used to respond to these questions. An examination of taxonomic composition, taxonomic richness, taxonomic diversity, butchering and processing patterns, and seasonality of procurement clearly showed that there is a high degree of variability between the different archaeological faunal samples. The variability is not attributable to environmental change, given the general stability of the environmental regime, as noted above. The complementary use of both archaeological

and documentary databases assisted in the isolation of a number of factors which have affected the patterns of resource use at the Forks. These are: technology, length of occupation (nomadic versus sedentary), seasonality and scheduling, site function (subsistence versus trade focus), and the nature of the subsistence economy (focused versus diffuse). The effects of these factors are reflected in the faunal assemblage, providing indications of the differences in adaptation and resource use at the Forks.

A few general statements regarding adaptation and resource use are offered here, focused on the Forks locality. The Precontact occupation pattern is one of low residential mobility, limited catchment area, some food preservation and storage, division of labour based on age and gender, and periods of social aggregation to facilitate the harvesting and processing of stored food stuffs. The Postcontact occupation pattern is one of low residential mobility, a high degree of food storage, a division of labour enforced through hierarchy largely based on ethnicity, and a large catchment area and development of agriculture to offset greater resource requirements.

Binford (1980) discusses variability in hunter-gatherer settlement systems in terms of a continuum from foraging to collecting, from high to low residential mobility and low to high logistical variation. The variability in adaptation to the Parkland environment, reflected in the Forks faunal assemblages, can also be viewed in these basic terms, despite the extraordinary complexity of the Postcontact subsistence/settlement system. Results of the faunal analysis reflect a continuum characterized by decreasing residential mobility and increasing logistical variation. This is coupled with an increase in food storage, the logistical organization of food procurement, and intersite variability.

The earliest assemblage, the Archaic, reflects Binford's "collector" strategy. Fish were procured in large quantities to provide food stores for consumption over longer periods of time. The occupation at the Forks, focused on spawning fishes, would be followed by movement to another area of possibly rich but seasonally limited resources. The Fort Garry and Upper Fort Garry assemblages represent the opposite end of the continuum, characterized by extremely low residential mobility, high food storage, and extreme logistic organization of food procurement. This movement along the continuum is also reflected by variability in the "grain" of the assemblages (Binford 1980). Fine-grained assemblages accumulate over a short period of time and provide better resolution between archaeological remains and the original events. Coarse-grained assemblages are the product of events spanning a longer period of time, with poor resolution between archaeological remains and specific events. Mobility is considered to be the factor that regulates the grain of the assemblage, with higher mobility resulting in more fine-grained assemblages. This variability in assemblage grain is visible in the Forks faunal assemblages, with the more fine-grained Precontact assemblages reflecting the greater mobility of Precontact peoples and the more coarse-grained Postcontact assemblages reflecting the lack of mobility of the Postcontact occupations.

The Fort Gibraltar I assemblage, as noted at various points in the thesis, is transitional in nature between the Precontact and Postcontact. As such, it occupies a mid-point on the continuum of mobility and logistical variation. While less mobile than the Precontact, the occupation was more focused and shorter than the later Postcontact occupations. Pemmican served as the primary form of food storage, but the post was not

the central depot and distribution point as were Fort Garry and Upper Fort Garry. Fort Gibraltar did not maintain the number of specialized purpose outposts that are evident in the later fur trade system. Binford (1980) notes that greater range of intersite variability is a function of increases in logistical components of the subsistence-settlement system. This is evident in the greater number of site types maintained during the later Postcontact (e.g. sturgeon fishery, bison procurement and processing outposts), but is not so in the Fort Gibraltar I system. The assemblages can thus be placed a gradation of adaptation characterized by decreasing residential mobility and increasing logistical organization.

Expected differences in ideology are more difficult to recognize at this level of analysis. The Precontact inhabitants necessarily harvested subsistence resources with consideration of their finite nature, as overharvesting would result in starvation. The Postcontact inhabitants, however, harvested resources to supply a global market economy rather than for immediate subsistence needs. The long term effects of overexploitation of wild resources were not considered.

This lack of consideration can be linked to the eighteenth and nineteenth century concept of progress and a generally Western European view in which humanity controls nature through the progressive improvement of technology. These concepts had developed within the Western European cultural and environmental context and are reflected in the apparent willingness of the fur traders to exhaust the wild resources of the Northwest. The effects of this overexploitation of resources were offset by the increase in catchment area and the local development of agriculture, both made possible by European technology. Further exploration of the integration of ideology and

subsistence strategy might be facilitated through the application of alternate theoretical frameworks.

7.2 Comparison of the Documentary and Archaeological Databases

The second aim of the thesis was to combine archaeological and documentary evidence on faunal exploitation with the intent of producing a more complete picture than would be created from the use of either body of data alone. This information was applied to the third aim of the thesis, as noted above.

The two sets of data were also compared in order to isolate areas of agreement or disagreement which might provide areas for future exploration and identify major biases in each data set. Selection of documents focused on their immediate relevance to the archaeological data and included ethnographic, ethnohistorical, published and unpublished fur trade journals. The comparison focused on the selection and range of taxa exploited, butchering patterns, and seasonality of procurement.

While documentary evidence provided reasonable comparisons for the Precontact samples, the later Fur Trade period documents produced an extraordinary number of discrepancies, even within the most basic exploitation information. The disagreements between the archaeological and documentary data were greatest for the later Fur Trade period occupations of Fort Garry and Upper Fort Garry. The major disagreements related to the range of taxa and recognition of taxa utilized, with the documentary evidence consistently underestimating the range of subsistence taxa. The authors of the journals focused on trade transactions and fur trade industry, but often failed to note

activities internal to the post. Increasing the range of types of documentary resources would probably not correct for this bias. Account books would be even more likely to focus on trade and transaction. The sole use of archaeological data to reconstruct fur trade subsistence, however, might also result in the confusion of day to day post subsistence with the refuse of import and export items, such as bison and pemmican.

Certain fur trade resources were apparently viewed as more significant than others and tended to be reported more often and in more detail. A major drawback with the documents was lack of detail regarding fish exploitation. The writers appeared to view the fish as just that - fish - not, for instance, as sucker, catfish, or drum. This lack of detail may be due to a fur trade perception that fish were less important and/or less favoured subsistence items.

Apparent cultural food preferences of the labourers and their families are generally not mentioned in the journals which were written exclusively by the clerk/officer class. The combination of information from the two datasets suggested that the labourers may have procured and consumed various taxa independently, creating a separate subsistence pattern. The monotonous nature of the provisions provided by the fur trade companies may have encouraged the continuation of these food preferences. The use of documentary resources alone would result in an extreme underrepresentation of wild taxa and would relegate the labourers and their families to historical and archaeological invisibility. The combined documentary and archaeological datasets should be used to further explore the nature of this independent, secondary subsistence economy, in which the labourers appear to maintain control over a certain segment of faunal resources.

7.3 Assessment of the Methodology and Limitations of the Data

The methodology was appropriate to the research goals. The archaeological interpretations could eventually be improved through the incorporation of analysis of the faunal remains within the overall site context. The combination of archaeological and documentary datasets was productive, providing a more complete understanding of the faunal exploitation for each period as well as isolating areas of disagreement between the datasets. The butchering and processing analysis was limited by the lack of detail and inconsistencies in the level of taxonomic identification included in the archaeological catalogues. The seasonality analysis was useful and should eventually be expanded to a greater range of the fish taxa. The use of mammalian epiphyseal fusion and tooth eruption schedules was the least productive technique. The application of a variety of techniques including each taxonomic class provided a firmer basis for interpretation.

The consistent problems in the analysis of these samples has been the distinctive nature of the samples in terms of deposition and activity areas. While complete excavation of a site might produce a more balanced range of activity areas and disposal contexts, the current samples range from the limited privy refuse to the apparent surface scatter of the Archaic and hearth features in the Blackduck. None of the sites has been completely excavated, which would have permitted interpretation of the disposal areas.

7.4 Recommendations

A number of recommendations for future research projects are briefly presented below. The production of more complete and accessible faunal analyses, particularly within the Manitoba region, would facilitate synthetic research and provide a much needed base of data from which archaeologists could work.

The application of consistent standards to both excavation methodology and faunal analysis would produce more usable data. Screen size should be decreased for better recovery, particularly considering the usual biases against fish, birds, and small mammals. Smaller screen size would permit better interpretation of element and taxonomic frequencies, while a *consistent* use of smaller screens would permit comparison between assemblages. The incorporation of faunal analysis into the original research design would also help by considering the goals and requirements of faunal analysis prior to excavation and recovery.

A consistent level of identification would also be helpful, facilitating comparisons between excavation projects. This would be assisted by the development of a more complete faunal comparative collection geared towards archaeological research and based on local taxa.

One problem encountered during this research was the difficulty in accessing a number of different data sets and rendering them somewhat computer comparable and compatible. The capacity to be "translatable" and usable outside of each particular agency, factored into the development of computer cataloguing programs, might encourage more synthetic research, advancing the understanding of regional

archaeological cultures and making better use of previously excavated material.

7.5 Future Directions

This thesis has produced interpretations regarding the nature of subsistence and faunal exploitation of a number of different cultures at the Forks. The use of the Forks by these groups was, however, only one part of an overall adaptive strategy. The next step is to expand the study to place the exploitation of the Forks into the context of the overall adaptive strategy.

A range of assemblages should be included to record the entirety of the seasonal round and to gain a more complete understanding of the movements of people and extraction of resources across the landscape. This approach might also clarify the problem of seasonal Parkland movements of bison and corresponding variability of bison exploitation. In Fur Trade subsistence studies, this approach argues for an incorporation of the study of the contemporaneous network of posts. For instance, a study of the Fort Garry period would ideally include Netley Creek Post and Pembina Post. The approach would also include excavation and analysis of Native sites and sites relating to the Red River bison hunts. It is difficult to gain an understanding of subsistence and faunal exploitation patterns using isolated assemblages.

The analysis presented in this thesis focused on human cultural adaptations within one ecotonal region as reflected in the archaeological occupations of one locality. Future analyses might employ different theoretical frameworks, providing the basis for the situation of the Forks locality within a larger context. This would be particularly useful

for understanding the global context of the Postcontact occupations at the Forks. Alternate theoretical frameworks might also facilitate the exploration of ideology as it relates to subsistence patterns and adaptive strategies.

Given the development of seasonal analysis techniques using incremental growth structures, it should be possible to clarify the seasonal movements of bison. This would assist in the seasonal and cultural interpretation of faunal assemblages in this area. A more complete review of the available historical documents might also be able to identify other environmental triggers of variability in seasonal bison movements.

Experimental archaeology focused on faunal exploitation might assist in the interpretation of patterning in faunal assemblages. For instance, an understanding of the traditional processes of drying and smoking a variety of fish species might assist in understanding butchering patterns (element frequencies) and butchering marks. More studies of the taphonomic effects of such treatments would also be useful, as well as more taphonomic studies on birds and fish.

Faunal analysts also need to move towards learning about what additional social and cultural factors influence subsistence/exploitation decisions. An excessively "economic" approach, viewed in a cultural vacuum, is often biased towards what makes "scientific sense" as far as interpretation of decision making in subsistence. For instance, did the traditional spring ceremonies encourage the exploitation of riverine fishes in the parkland areas, possibly as a carry over from a Boreal Forest cultural past? What are the effects of scheduling conflicts with non-subsistence activities? How does the need for raw materials for bone and antler tools affect exploitation decisions regarding season, age, or

sex of targeted species?

Finally, this thesis is the first research which attempts to use the large body of archaeological information produced from the Forks locality, arguably the most intensively excavated site in Manitoba. The wealth of data from more than ten years of excavation projects, encompassing 6000 years of history, is an enviable data base. While the requirement of working with very different data sets from a number of agencies is time-consuming and occasionally frustrating, the Forks data set is unique in its breadth of time and culture for this area and deserves further attention.

REFERENCES

Adams, G., K. Lunn, M.A. Tisdale, and P.J Priess
  1990 Archaeological Investigations at the Forks National Historic Site, Winnipeg:Mitigation of the North Point Development. Research Bulletin No. 283. Environment Canada, Parks Service, Winnipeg.

Andrews, A. H.
  1982 The use of dentition to age young cattle. In *Ageing and Sexing Animal Bones from Archaeological Sites*, edited by Bob Wilson, Caroline Grigson and Sebastian Payne, pp.141-153. BAR British Series 109. B.A.R., Oxford.

Anfinson, Scott F. (editor)
  1979 *A Handbook of Minnesota Prehistoric Ceramics*. Occasional Publications in Minnesota Anthropology 5. Minnesota Archaeological Society, St. Paul.

Ascher, Robert
  1961 Analogy in Archaeological Interpretation. *Southwestern Journal of Anthropology* 17:317-325.

Ashbrook, Frank G.
  1955 *Butchering, Processing and Preservation of Meat*. Van Nostrand Reinhold, New York.

Ashworth, Allan C. and Alan M. Cvancara
  1983 Paleoecology of the Southern Part of the Lake Agassiz Basin. In *Glacial Lake Agassiz*, edited by J.T. Teller and Lee Clayton, pp. 133-156. Geological Association of Canada.

Bamforth, Douglas B.
  1988 *Ecology and Human Organization on the Great Plains*. Plenum Press, New York.

  1990 An Empirical Perspective on Little Ice Age Climatic Change on the Great Plains. *Plains Anthropologist* 35(132):359-366.

Banfield, A.W.F.
  1974 *The Mammals of Canada*. University of Toronto Press, Toronto.

Beaudry, Mary C.
  1988 Introduction. In *Documentary Archaeology in the New World*, edited by Mary Beaudry, pp.1-3. Cambridge University Press, Cambridge.

Bell, Charles Napier
    1927 *The Old Forts of Winnipeg (1738-1927)*. The Historical and Scientific Society of Manitoba, Transaction No.3. Dawson Richardson Publications, Winnipeg.

Bergquist, Lyn Annette
    1996 *Development of an Archaeometric Dating Technique Using Freshwater Drum Otoliths: An Application of Biochronology*. Unpublished M.Sc. thesis, University of Minnesota, St.Paul.

Binford, Lewis R.
    1977a Smudge Pits and Hide Smoking: The Use of Analogy in Archaeological Reasoning. In *For Theory Building in Archaeology*, edited by Lewis R. Binford, pp.33-51. Academic Press, New York.

    1977b Methodological Considerations of the Archaeological Use of Ethnographic Data. In *For Theory Building in Archaeology*, edited by Lewis R. Binford, pp.59-67. Academic Press, New York.

    1978 *Nunamiut Ethnoarchaeology*. Academic Press, New York.

    1980 Willow Smoke and Dogs' Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation. *American Antiquity* 45(1):4-20.

    1984 *Faunal Remains from Klasies River Mouth*. Academic Press, New York.

    1987 Researching Ambiguity: Frames of Reference and Site Structure. In *Method and Theory for Activity Area Research*, edited by Susan Kent, pp.449-512. Columbia University Press, New York.

Binford, Lewis R. and Jack B. Bertram
    1977 Bone Frequencies - and Attritional Processes. In *For Theory Building in Archaeology*, edited by Lewis R. Binford, pp. 77-153. Academic Press, New York.

Bird, Ralph D.
    1961 *Ecology of the Aspen Parkland of Western Canada in Relation to Land Use*. Contribution No. 27. Canada Department of Agriculture, Ottawa.

Bökönyi, S.
    1970 A New Method for the Determination of the Number of Individuals in Animal Bone Material. *American Journal of Archaeology* 74:291-292.

Bowe, Howard R.
1999 *A Legacy of Stone: Projectile Point and Hafted Knife Forms from Eastern Manitoba*. Anthropology Museum, University of Winnipeg, Winnipeg.

Bowen, Joanne
1988 Seasonality: an agricultural construct. In *Documentary archaeology in the New World*, edited by Mary C. Beaudry, pp.161-171. Cambridge University Press, Cambridge.

Breitburg, Emanuel
1991 Verification and Reliability of NISP and MNI Methods of Quantifying Taxonomic Abundance: A View from Historic Site Zooarchaeology. In *Beamers, Bobwhites, and Blue-Points: Tributes to the Career of Paul W. Parmalee*, edited by James R. Purdue, Walter E. Klippel, and Bonnie W. Styles, pp. 153-162. Illinois State Museum Scientific Papers, Springfield.

Brenner, Bonnie
1998 *Archival and Archaeological Perspectives on Economic Variability in the Red River Settlement, 1830-1870*. Unpublished M.A. thesis, Department of Anthropology, University of Manitoba, Winnipeg.

Brewer, Douglas J.
1987 Seasonality in the Prehistoric Faiyum Based on the Incremental Growth Structures of the Nile Catfish (Pisces: Clarias). *Journal of Archaeological Science* 14:459-472.

1992 Zooarchaeology: Method, Theory, and Goals. In *Archaeological Method and Theory*, vol. 4, edited by M. B. Schiffer, pp. 195-244. University of Arizona Press, Tucson.

Brinkhuizen, D.C.
1997 Some remarks on seasonal dating of fish remains by means of growth ring analysis. *Internet Archaeology*.

Brothers, Edward B.
1987 Methodological approaches to the examination of otoliths in aging studies. In *The Age and Growth of Fish*, edited by Robert C. Summerfelt and Gordon E. Hall, pp.319-330. Iowa State University Press, Ames.

Brown, Jennifer S. H.
1980 *Strangers in Blood*. University of British Columbia Press, Vancouver.

Brumley, John H.
  1973 Quantitative Methods in the Analysis of Butchered Faunal Remains: A Suggested
  Approach. *Archaeology in Montana* 14(1):1-40.

Bryson, Reid A. and Wayne M. Wendland
  1969 Tentative Climatic Patterns for Some Late Glacial and Post-Glacial Episodes in
  Central North America. In *Life, Land and Water*, edited by William J. Mayer-
  Oakes, pp. 271-298. University of Manitoba Press, Winnipeg.

Buchner, Anthony P.
  1979 *The 1978 Caribou Lake Project, Including a Summary of the Prehistory of East-
  Central Manitoba.* Papers in Manitoba Archaeology, Final Report No.8.
  Department of Cultural Affairs and Historical Resources, Historic Resources
  Branch, Winnipeg.

  1980 *Cultural Responses to Altithermal (Atlantic) Climate along the Eastern Margins
  of the North American Grasslands 5500 to 3000 B.C.* National Museum of Man
  Mercury Series Paper no.97. National Museums of Canada, Ottawa.

  1982 *Material Culture of the Bjorklund Site.* Papers in Manitoba Archaeology,
  Miscellaneous Paper No.13. Department of Cultural Affairs and Historical
  Resources, Winnipeg.

Bull, Gail and Sebastian Payne
  1982 Tooth Eruption and Epiphysial Fusion in Pigs and Wild Boar. In *Ageing and
  Sexing of Animal Bones from Archaeological Sites*, edited by Bob Wilson,
  Caroline Grigson, and Sebastian Payne, pp.55-71. BAR British Series 109.
  B.A.R., Oxford.

Butler, Virginia L.
  1993 Natural Versus Cultural Salmonid Remains: Origin of The Dalles Roadcut
  Bones, Columbia River, Oregon, U.S.A. *Journal of Archaeological Science* 20:1-
  24.

Butzer, Karl W.
  1982 *Archaeology as Human Ecology.* Cambridge University Press, Cambridge.

Carlson, Catherine
  1988 An Evaluation of Fish Growth Annuli for the Determination of Seasonality in
  Archaeological Sites. In *Recent Developments in Environmental Analysis in Old
  and New World Archaeology*, edited by Esmée Webb, pp.67-79. BAR
  International Series 416. B.A.R., Oxford.

Casteel, Richard W.
1977   Characterization of Faunal Assemblages and the Minimum Number of Individuals Determined from Paired Elements: Continuing Problems in Archaeology. *Journal of Archaeological Science* 4:125-134.

1978 Faunal Assemblages and the "Wiegemethode" or Weight Method. *Journal of Field Archaeology* 5:71-77.

Casteel, Richard W. and Donald K. Grayson
1977 Terminological problems in quantitative faunal analysis. *World Archaeology* 9:235-242.

Chaplin, R. E.
1971 *The Study of Animal Bones from Archaeological Sites*. Seminar Press, London.

Cleland, Charles E.
1992 From Ethnohistory to Archaeology: Ottawa and Ojibwa Band Territories of the Northern Great Lakes. In *Text-Aided Archaeology*, edited by Barbara J. Little, pp.97-102. CRC Press, Boca Raton.

Colley, Sarah M.
1990   The Analysis and Interpretation of Archaeological Fish Remains.   In *Archaeological Method and Theory*, vol 2, edited by Michael B. Schiffer, pp.207-253. University of Arizona Press, Tucson.

Conkey, Margaret W. and Janet D. Spector
1984 Archaeology and the Study of Gender. In *Advances in Archaeological Method and Theory*, edited by M.B. Schiffer, pp.1-38, vol. 7. Academic Press, New York.

Conover, W. J.
1980 *Practical Nonparametric Statistics*. John Wiley & Sons, Toronto.

Coutts, Robert
1988   *The Forks of the Red and Assiniboine: A Thematic History, 1734-1850*. Microfiche Report Series 383. Environment Canada, Winnipeg.

Crabtree, Pam J.
1989   *West Stow, Suffolk: Early Anglo-Saxon Animal Husbandry*.   East Anglian Archaeology Report No. 47. Suffolk County Planning Department, Ipswich.

1990 Zooarchaeology and Complex Societies: Some Uses of Faunal Analysis for the Study of Trade, Social Status, and Ethnicity. In *Archaeological Method and Theory*, vol 2, edited by Michael B. Schiffer, pp. 155-205. University of Arizona

Press, Tucson.

Dawson, Peter Colin
1992   *From Death Assemblage to Fossil Assemblage: Understanding the Nature of Intra-Site and Inter-Site Variability in Faunal Assemblages*. Unpublished M.A. thesis, Department of Anthropology, University of Toronto, Toronto.

Deagan, Kathleen A.
1982 Avenues of Inquiry in Historical Archaeology. In *Advances in Archaeological Method and Theory*, vol 5, edited by Michael B. Schiffer, pp.151-177. Academic Press, New York.

1988   Neither History Nor Prehistory: the Questions that Count in Historical Archaeology. *Historical Archaeology* 22(1):7-12.

Dolan, Tom
1960 *Know Your Fish*. Hearst, New York.

Drennan, Robert D.
1996 *Statistics for Archaeologists*. Plenum Press, New York.

Dyck, Ian
1983 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.

Ewen, Charles R.
1986   Fur Trade Archaeology: A Study of Frontier Hierarchies.   *Historical Archaeology* 20(1):15-28.

Flannery, Kent V.
1968 Archeological Systems Theory and Early Mesoamerica. In *Anthropological Archeology in the Americas*, edited by Betty J. Meggers, pp. 67-87. Anthropological Society of Washington, Washington, D.C.

Frison, George
1970 The Glenrock Buffalo Jump, 48CO304. *Plains Anthropologist* 15(50):1-66.

1978   Animal Population Studies and Cultural Inference.   *Plains Anthropologist Memoir* 14:44-52.

1982 Bison Dentition Studies. In *The Agate Basin Site: a record of Paleoindian occupation of the northwestern High Plains*, edited by D. J. Stanford and G. C. Frison, pp.240-260. Academic Press, New York.

Frison, G. C. and C. A. Reher

1970 Appendix I: Age Determination of Buffalo by Teeth Eruption and Wear. In The Glenrock buffalo jump, 48CO304: Late Prehistoric period buffalo procurement and butchering in the Northwestern Plains. *Plains Anthropologist* Memoir 7:46-50.

Fuller, W. A.

1959 The Horns and Teeth as Indicators of Age in Bison. *Journal of Wildlife Management* 23(3):342-344.

Gardner, Kenneth A.

1981 *Birds of Oak Hammock March Wildlife Management Area*. Wildlife Branch, Department of Natural Resources, Winnipeg.

Gautier, Achilles

1984 How Do I Count You, Let Me Count the Ways? Problems of Archaeozoological Quantification. In Animals and Archaeology 4: Husbandry in Europe, edited by Caroline Grigson and Juliet Clutton-Brock, B.A.R. International Series #227, pp. 237-251. B.A.R., Oxford.

Gilbert, Allan S. and Burton H. Singer

1982 Reassessing zooarchaeological quantification. *World Archaeology* 14(1):21-40.

Gilbert, B. Miles

1969 Some Aspects of Diet and Butchering Techniques Among Prehistoric Indians in South Dakota. *Pennsylvania Archaeologist* 14(46): 277-294.

1980 *Mammalian Osteology*. B. Miles Gilbert, Laramie.

Glazebrook, G.P. de T.

1968 *The Hargrave Correspondence 1821-1843*. Greenwood Press, New York.

Godfrey, W. Earl

1966 *The Birds of Canada*. Bulletin No. 203. Biological Series No. 73. National Museums of Canada, Ottawa.

Grayson, Donald K.

1979 On the Quantification of Vertebrate Archaeofaunas. In *Advances in Archaeological Method and Theory*, vol.2, edited by M. B. Schiffer, pp.199-237. Academic Press, New York.

1984 *Quantitative Zooarchaeology*. Academic Press, New York.

Greco, Barry B.
1994 Stratigraphy and Features. In *Archaic Occupations at the Forks*, compiled by Sid Kroker, pp. 28-35. Forks Public Archaeology Association, Winnipeg.

Gregg, Michael L.
1994 Archaeological Complexes of the Northeastern Plains and Prairie-Woodland Border, A.D. 500-1500. In *Plains Indians, A.D. 500-1500: The Archaeological Past of Historic Groups*, edited by Karl Schlesier, pp. 71- 95. University of Oklahoma Press, Norman.

Grigson, Caroline
1982 Sex and Age Determination of Some Bones and Teeth of Domestic Cattle: A Review of the Literature. In *Ageing and Sexing Animal Bones from Archaeological Sites*, edited by Bob Wilson, Caroline Grigson, and Sebastian Payne, pp.7-23. BAR British Series 109. B. A. R., Oxford.

Guinn, Rodger
1980 *The Red-Assiniboine Junction: A Land Use and Structural History, 1770-1980.* Manuscript Report Number 355. Parks Canada, Winnipeg.

Hale, James B.
1949 Aging Cottontail Rabbits by Bone Growth. *Journal of Wildlife Management* 13(2):216-225.

Hamilton, James Scott
1985 Competition and Warfare: Functional Versus Historical Explanations. *Canadian Journal of Native Studies* V(1):93-113.

1990 *Fur Trade Social Inequality and the Role of Non-Verbal Communication.* Unpublished Ph.D. dissertation, Department of Archaeology, Simon Fraser University, Burnaby.

1990-1991 Western Canadian Fur Trade History and Archaeology: The Illumination of the Invisible in Fur Trade Society. *Saskatchewan Archaeology* 11 & 12: 3-24.

Hamilton, Scott et al.
1981 *1979 Excavations at the Stott Site (DlMa-1) with Interpretations of Cultural Stratigraphy.* Miscellaneous Paper no. 12. Historic Resources Branch, Winnipeg.

Harmon, Daniel Williams
1903 *A Journal of Voyages and Travels in the Interior of North America.* A.S. Barnes and Company, New York.

Harris, Marvin
1968 *The Rise of Anthropological Theory.* Thomas Y. Crowell Company, New York.

1979 *Cultural Materialism.* Random House, New York.

Hays, William L.
1963 *Statistics.* Holt, Rinehart and Winston, Toronto.

Henry, Alexander
1988 *The Journal of Alexander Henry the Younger 1799-1814.* Volume I. Edited by Barry M. Gough. Champlain Society, Toronto.

1992 *The Journal of Alexander Henry the Younger 1799-1814.* Volume II. Edited by Barry M. Gough. Champlain Society, Toronto.

Hesse, Brian and Paula Wapnish
1985 *Animal Bone Archaeology.* Taraxacum Press, Washington D.C.

Hickerson, Harold
1970 *The Chippewa and Their Neighbours: A Study in Ethnohistory.* Holt, Rinehart and Winston, New York.

Hind, Henry Youle
1969 [1860] *Narrative of the Canadian Red River Exploring Expedition of 1857 and of the Assiniboine and Saskatchewan Exploring Expedition of 1858.* Greenwood Publishers, New York.

Hodder, Ian
1986 *Reading the Past.* Cambridge University Press, Cambridge.

Howard, James H.
1977 *The Plains Ojibwa or Bungi.* Reprints in Anthropology, Volume 7. University of South Dakota, Vermillion.

Hudson's Bay Company Archives
B.235/a/3
B.235/a/4
B.235/a/5
B.235/a/6
B.235/a/15
B.235/a/16

Huelsbeck, David R.
    1991 Faunal Remains and Consumer Behavior: What *Is* Being Measured? *Historical Archaeology* 25(2):62-76.

Hurlburt, Isobel
    1977 *Faunal Remains from Fort White Earth N.W.Co. (1810-1813)*. Human History Occasional Paper No. 1. Provincial Museum of Alberta, Edmonton.

Innis, Harold A.
    1970 *The Fur Trade in Canada*. University of Toronto Press, Toronto.

Johnson, Eileen
    1978 Paleo-Indian Bison Procurement and Butchering Patterns on the Llano Estacado. *Plains Anthropologist* Memoir 14:98-105.

Jolley, Robert L.
    1983 North American Historic Sites Zooarchaeology. *Historical Archaeology* 17(2):64-79.

Kane, Paul
    1925 *Wanderings of an Artist among the Indians of North America*. The Radisson Society of Canada, Toronto.

Kehoe, Thomas F.
    1967 The Boarding School Bison Drive Site. *Plains Anthropologist* 12(35):1-165.

    1973 *The Gull Lake Site: A Prehistoric Bison Drive in Southwestern Saskatchewan*. Publications in Anthropology and History No. 1. Milwaukee Public Museum, Milwaukee.

Keyser, James D. and Audrey L. Murray
    1979 Bison Butchering at the Fresno Reservoir Kill Sites. Appendix 2 in Late Prehistoric Period Bison Procurement on the Milk River in North-Central Montana. *Archaeology in Montana* 20(1):173-216.

Klein, Richard G. and Kathryn Cruz-Uribe
    1984 *The Analysis of Animal Bones from Archeological Sites*. University of Chicago Press, Chicago.

Klimko, Olga
    1989 Fur Trade Faunal Studies and Interpretations: A Review of the Archaeology. *Saskatchewan Archaeology* 10:28-40.

Kroker, Sid

1989 *North Assiniboine Node Archaeological Impact Assessment.* Quaternary Consultants. Submitted to Forks Renewal Corporation, Winnipeg.

1993 Interpretation. In *A 3000 Year Old Native Campsite and Trade Centre at the Forks*, edited by Sid Kroker and Pam Goundry, pp.206-214. Forks Public Archaeology Association, Winnipeg.

1994 Interpretation. In *Archaic Occupations at the Forks*, compiled by Sid Kroker, pp.199-213. Forks Public Archaeology Association, Winnipeg.

1997 Archaeology and Flood Deposits at the Forks, Winnipeg, Manitoba, Canada. In *Proceedings of the North Dakota Academy of Science* 51, supplement 1. Edited by Joseph H. Hartman, pp. 12-16.

Kroker, Sid and Pam Goundry

1993 *Archaeological Monitoring and Mitigation of the Assiniboine Riverfront Quay.* Quaternary Consultants. Submitted to Forks Renewal Corporation, Winnipeg.

Kroker, Sid and Pam Goundry (eds.)

1993 *A 3000 Year Old Native Campsite and Trade Centre at the Forks.* Forks Public Archaeology Association, Winnipeg.

1994 *Archaic Occupations at the Forks.* Quaternary Consultants, Winnipeg.

Kroker, Sid and Barry B. Greco

1994 Stratigraphy and Features. In *Archaic Occupations at the Forks*, compiled by Sid Kroker, pp.28-38. Forks Public Archaeology Association, Winnipeg.

Kroker, Sid, Barry B. Greco, Arda Melikian, and David K. Riddle

1990 *The Forks (1989) Pilot Public Archaeology Project: Research Report.* The Forks Public Archaeology Association, Winnipeg.

Kroker, Sid, Barry B. Greco, and Kate Peach

1992 *1991 Investigations at Fort Gibraltar I: The Forks Public Archaeology Project.* The Forks Public Archaeology Association, Winnipeg.

Kroker, Sid, Barry B. Greco, and Sharon Thomson

1991 *1990 Investigations at Fort Gibraltar I: The Forks Public Archaeology Project.* The Forks Public Archaeology Association, Winnipeg.

Lamb, H. H.

1982 *Climate, history and the modern world.* Methuen, New York.

Lange, Frederick W.
   1980   Prehistory and Hunter/Gatherers: The Role of Analogs.   *Mid-Continental Journal of Archaeology* 5(1):133-147.

Lechleitner, R. R.
   1959   Sex Ratio, Age Classes and Reproduction of the Black-Tailed Jack Rabbit. *Journal of Mammalogy* 40(1):63-81.

Leechman, Douglas
   1951   Bone Grease.   *American Antiquity* 4:355-356.

Lenius, Brian and Dave Olinyk
   1990   The Rainy River Composite: Revisions to Late Woodland Taxonomy.   In *The Woodland Tradition in the Western Great Lakes: Papers Presented to Elden Johnson*, University of Minnesota Publications in Anthropology Number 4, edited by Guy E. Gibbon, pp. 77-112.   University of Minnesota, Minneapolis.

Leone, Mark P. and Constance A. Crosby
   1987   Middle-Range Theory in Historical Archaeology.   In *Consumer Choice in Historical Archaeology*, edited by Suzanne Spencer-Wood, pp.397-410.   Plenum Press, New York.

Leone, Mark P. and Parker B. Potter
   1988   Introduction: Issues in Historical Archaeology.   In *The Recovery of Meaning*, edited by Mark P. Leone and Parker B. Potter, pp.1-22.   Smithsonian Institution Press, Washington.

Lightfoot, Kent G.
   1995   Culture Contact Studies: Redefining the Relationship between Prehistoric and Historical Archaeology.   *American Antiquity* 60(2):199-217.

Little, Barbara J.
   1992   Text-Aided Archaeology.   In *Text-Aided Archaeology*, edited by Barbara J. Little, pp.1-6. CRC Press, Boca Raton.

Livermore, Carol
   1976 *Lower Fort Garry, the Fur Trade and the Settlement at Red River*.   Manuscript Report Number 202.   National Historic Parks and Sites Branch of Parks Canada, Department of Indian and Northern Affairs, Winnipeg.

Lowie, Robert H.
   1909 *The Assiniboine*.   Anthropological Papers Vol. IV, Part I.   American Museum of Natural History, New York.

Lubinski, Patrick M.
1996 Fish Heads, Fish Heads: An Experiment on Differential Bone Preservation in a Salmonid Fish. *Journal of Archaeological Science* 23:175-181.

Lyman, R. Lee
1977 Analysis of Historic Faunal Remains. *Historical Archaeology* 18:66-73.

1987 Archaeofaunas and Butchery Studies: A Taphonomic Perspective. In *Advances in Archaeological Method and Theory*, vol. 10, edited by Michael B. Schiffer, pp. 249-337. Academic Press, New York.

1991 Taphonomic Problems with Archaeological Analyses of Animal Carcass Utilization and Transport. In *Beamers, Bobwhites, and Blue-Points: Tributes to the Career of Paul W. Parmalee*, edited by James R. Purdue, Walter E. Kippel, and Bonnie W. Styles, pp. 125-138. Illinois State Museum Scientific Papers, Springfield.

1992 Anatomical Considerations of Utility Curves in Zooarchaeology. *Journal of Archaeological Science* 19:7-22.

1994a Quantitative Units and Terminology in Zooarchaeology. *American Antiquity* 59(1):36-71.

1994b *Vertebrate Taphonomy*. Cambridge University Press, Cambridge.

MacArthur, Robert H.
1972 *Geographical Ecology*. Harper and Row, New York.

Malainey, Mary Evelyn
1997 *The Reconstruction and Testing of Subsistence and Settlement Strategies for the Plains, Parkland and Southern Boreal Forest*. Unpublished PhD Dissertation, Department of Anthropology, University of Manitoba, Winnipeg.

Mandelbaum, David G.
1979 *The Plains Cree*. Canadian Plains Studies 9. Canadian Plains Research Center, University of Regina, Regina.

Marshall, Fiona
1994 Food Sharing and Body Part Representation in Okiek Faunal Assemblages. *Journal of Archaeological Science* 21:65-77.

Marshall, Fiona and Tom Pilgram
1991 Meat Versus Within-bone Nutrients: Another Look at the Meaning of Body Part Representation in Archaeological Sites. *Journal of Archaeological Science*

18:149-163.

Meyer, David and Scott Hamilton
    1994 Neighbors to the North: Peoples of the Boreal Forest. In *Plains Indians, A.D. 500-1500: The Archaeological Past of Historic Groups*, edited by Karl Schlesier, pp. 96-127. University of Oklahoma Press, Norman.

Monks, G.
    n.d. *Progress Report*. Submitted to the Manitoba Museum of Man and Nature, Winnipeg.

    1981 Seasonality Studies. In *Advances in Archaeological Method and Theory*, vol. 4, edited by Michael B. Schiffer, pp.177-240. Academic Press, New York.

    1982 Preliminary Report on the Archaeological Investigations in Bonnycastle Park, 1982. *Manitoba Archaeological Quarterly* 6(2)46-61.

    1983 Preliminary Report on Archaeological Investigations in Bonnycastle Park (Upper Fort Garry), 1982. *Manitoba Archaeological Quarterly* 7(4):3-29.

    1984 Preliminary Report on Archaeological Investigations in Bonnycastle Park (Upper Fort Garry), 1983. *Manitoba Archaeological Quarterly* 8(3-4):30-50.

    1992 Architectural Symbolism and Non-verbal Communication at Upper Fort Garry. *Historical Archaeology* 26(2):37-57.

    1999 On Rejecting the Concept of Socio-economic Status in Historical Archaeology. In *Historical Archaeology*, edited by Pedro Paulo A. Funari, Martin Hall, and Sian Jones, pp.204-216. Routledge, New York.

Monks, Gregory G. and Robert Johnston
    1993 Estimating season of death from growth increment data: a critical review. *Archaeozoologia* V(2):17-40.

Morey, Darcy F.
    1982 *A Study of Subsistence and Seasonality in the Central Plains*. Technical Report No. 82-12. Division of Archaeological Research, Department of Anthropology, University of Nebraska, Lincoln.

    1983 Archaeological Assessment of Seasonality from Freshwater Fish Remains: A Quantitative Procedure. *Journal of Ethnobiology* 3(1):75-95.

Nichol, R. K. and C. J. Wild
1984 "Numbers of Individuals" in Faunal Analysis: the Decay of Fish Bone in Archaeological Sites. *Journal of Archaeological Science* 11:35-51.

Nicholson, Beverley Alistair
1987 *Human Ecology and Prehistory of the Forest/Grassland Transition Zone of Western Manitoba*. Unpublished PhD Dissertation, Department of Archaeology, Simon Fraser University, Burnaby.

1988 Modeling Subsistence Strategies in the Forest/Grassland Transition Zone of Western Manitoba During the Late Prehistoric and Early Historic Periods. *Plains Anthropologist* 33(121):351-365.

Nielsen, Erik
1994 Dendrochronological Dating of Oak Pilings from the Forks. In *Archaic Occupations at the Forks*, compiled by Sid Kroker, pp. 36-40. Forks Public Archaeology Association, Winnipeg.

Nielsen, Erik, W. Brian McKillop, and Glen G. Conley
1993 Fluvial sedimentology and paleoecology of Holocene alluvial deposits, Red River, Manitoba. *Géographie physique et Quaternaire* 47(2):193-210.

Noe-Nygaard, Nanna
1987 Taphonomy in Archaeology with Special Emphasis on Man as a Biasing Factor. *Journal of Danish Archaeology* 6:7-62.

Ott, Lyman, William Mendenhall, and Richard F. Larson
1978 *Statistics: A Tool for the Social Sciences*. Duxbury Press, North Scituate.

Pearsall, Deborah M.
1989 *Paleoethnobotany: a handbook of procedures*. Academic Press, San Diego.

Peers, Laura
1988 *"A Woman's Work is Never Done": Harold Hickerson, the male bias, and Ojibwa ethnohistory*. Paper presented at the Rupertsland Research Centre Conference, Churchill.

1994 *The Ojibwa of Western Canada, 1780 to 1870*. University of Manitoba Press, Winnipeg.

Pereira, Donald L., Christopher Bingham, George R. Spangler, David J. Conner, and Paul K. Cunningham
1995 Construction of a 110-Year Biochronology from Sagittae of Freshwater Drum (Aplodinotus grunniens). In *Recent Developments in Fish Otolith Research*, edited

by David H. Secor, John M. Dean, and Steven E. Campana, pp. 177-196. University of South Carolina Press, Columbia.

Pielou, E. C.
1975 *Ecological Diversity*. John Wiley & Sons, Toronto.

Pond, Samuel W.
1986 *The Dakota or Sioux in Minnesota As They Were in 1834*. Minnesota Historical Society Press, St. Paul.

Potter, Parker B.
1992 Middle-Range Theory, Ceramics, and Capitalism in 19th-Century Rockbridge County, Virginia. In *Text-Aided Archaeology*, edited by Barbara J. Little, pp.9-23. CRC Press, Boca Raton.

Priess, Peter J., Sheila E. Bradford, S. Biron Ebell, and Peter W. G. Nieuwhof
1986 *Archaeology at the Forks: An Initial Assessment*. Microfiche Report Series 375. Environment Canada, Canadian Parks Service, Winnipeg.

Pyszczyk, Heinz W.
1978 *The Fort Victoria Faunal Analysis: Considerations of Subsistence Change of the Fur Trade Era in North Central Alberta*. Unpublished M.A. Thesis, Department of Anthropology, University of Manitoba, Winnipeg.

Quaternary Consultants Limited
1998 *Archaeology of Main Street Roadworks: York Avenue to Tache Avenue 1996-1998*. Report submitted to Reid Crowther & Partners, Winnipeg.

Quigg, J. Michael
1997 Bison Processing at the Rush Site, 41TG346, and Evidence for Pemmican Production in the Southern Plains. *Plains Anthropologist* 42(159):145-161.

Quimby, Don C. and J. E. Gaab
1957 Mandibular Dentition as an Age Indicator in Rocky Mountain Elk. *Journal of Wildlife Management* 21(4):435-451.

Rannie, W.F., L.F. Thorleifson, and J.T. Teller
1989 Holocene evolution of the Assiniboine River paleochannels and Portage la Prairie alluvial fan. *Canadian Journal of Earth Sciences* 26:1834-1841.

Ray, Arthur J.
1974 *Indians in the Fur Trade*. University of Toronto Press, Toronto.

Reher, C. A.
1974 Population Study of the Casper Site Bison. In *The Casper Site*, edited by G. C. Frison, pp.113-124. Academic Press, New York.

Rick, Anne Meachem
1975 Bird Medullary Bone: A Seasonal Dating Technique for Faunal Analysis. *Canadian Archaeological Association Bulletin* No.7:183-190.

1979 *Some Problems and Solutions in Zooarchaeological Interpretation of Bird Bones*. Paper presented at the 44th Annual Meeting, Society for American Archaeology, Vancouver.

Ringrose, T. J.
1993 Bone Counts and Statistics: A Critique. *Journal of Archaeological Science* 20:121-157.

Ritchie, James C.
1964 Contributions of the Holocene Paleoecology of Westcentral Canada. 1. Riding Mountain. *Canadian Journal of Botany* 42:181-197.

1967 Holocene Vegetation of the Northwestern Precincts of the Glacial Lake Agassiz Basin. In *Life, Land and Water: Proceedings of the 1966 Conference on Environmental Studies of the Glacial Lake Agassiz Region*, edited by William J. Mayer-Oakes, pp. 217-229. University of Manitoba Press, Winnipeg.

1983 The Paleoecology of the Central and Northern Parts of the Glacial Lake Agassiz Basin. In *Glacial Lake Agassiz*, edited by J.T. Teller and Lee Clayton, pp.157-170. Geological Association of Canada Special Paper 26.

1987 *Postglacial Vegetation of Canada*. Cambridge University Press, Cambridge.

Ritchie, J.C. and Sigrid Lichti-Federovich
1968 Holocene pollen assemblages from the Tiger Hills, Manitoba. *Canadian Journal of Earth Sciences* 5:873-880.

Rodnick, David
1978 *The Fort Belknap Assiniboine of Montana*. AMS, New Haven.

Ross, Alexander
1984 [1856] *The Red River Settlement: Its Rise, Progress, and Present State*. Helen Doherty, Winnipeg.

Schulz, Peter D. and Sherri M. Gust
    1983 Faunal Remains and Social Status in 19th Century Sacramento. *Historical Archaeology* 17(1):44-53.

Schuyler, Robert L. (editor)
    1978 *Historical Archaeology: A guide to Substantive and Theoretical Contributions.* Baywood Publishing, New York.

    1988 Archaeological Remains, Documents, and Anthropology: a Call for a New Culture History. *Historical Archaeology* 22(1):36-42.

Scott, Geoffrey A.J.
    1996 Manitoba's Ecoclimatic Regions. In *The Geography of Manitoba*, edited by John Welsted, John Everitt, and Christoph Stadel, pp.43-59. University of Manitoba Press, Winnipeg.

Scott, W. B. and E. J. Crossman
    1973 *Freshwater Fishes of Canada.* Bulletin 184, Fisheries Research Board of Canada, Ottawa.

Seyers, Linda
    1988 *Faunal Analysis of Upper Fort Garry: social and economic implications.* Unpublished M.A. thesis, Department of Anthropology, University of Manitoba, Winnipeg.

Shackley, Myra
    1981 *Environmental Archaeology.* George Allen & Unwin, London.

Shaffer, Brian S.
    1992 Quarter-Inch Screening: Understanding Biases in Recovery of Vertebrate Faunal Remains. *American Antiquity* 57(1): 129-136.

Shaffer, Brian S. and Julia L.J. Sanchez
    1994 Comparison of 1/8"- and 1/4"-mesh Recovery of Controlled Samples of Small-to Medium-Sized Mammals. *American Antiquity* 59(3):525-530.

Shay, Creighton T.
    1967 Vegetation History of the Southern Lake Agassiz Basin During the Past 12,000 Years. In *Life, Land and Water: Proceedings of the 1966 Conference on Environmental Studies of the Glacial Lake Agassiz Region*, edited by William J. Mayer-Oakes, pp. 231-252. University of Manitoba Press, Winnipeg.

Shay, C.T., S. Coyston, H. Isfeld, M. Waddell, and D.M. Deck
1990 *Paleobotanical Studies at the Forks: Analysis of Seeds, Charcoal and Other Organic Remains*. Submitted to the Manitoba Heritage Federation, Winnipeg.

Shennan, Stephen
1988 *Quantifying Archaeology*. Edinburgh University Press, Edinburgh.

Silver, I. A.
1969 The Ageing of Domestic Animals. In *Science in Archaeology*, edited by Don Brothwell and Eric Higgs, pp.283-302. Praeger Publishers, New York.

Simkiss, K.
1961 Calcium Metabolism and Avian Reproduction. *Biological Review* 36:321-367.

1967 *Calcium in Reproductive Physiology*. Chapman and Hall, London.

Singer, David A.
1985 The Use of Fish Remains as a Socio-Economic Measure: An Example from 19th Century New England. *Historical Archaeology* 19(2):110-113.

Skinner, Alanson
1911 *Notes on the Eastern Cree and Northern Saulteaux*. Anthropological Papers Vol IX, Part 1. American Museum of Natural History, New York.

Smith, Brian J.
1991 The Historical and Archaeological Evidence for the use of Fish as an Alternate Subsistence Resource among Northern Plains Bison Hunters. In *Aboriginal Resource Use in Canada*, edited by Kerry Abel and Jean Friesen, pp. 35-49. University of Manitoba Press, Winnipeg.

Smith, Herman A.
1983 Determination of Seasonality in Archaeological Sites through Examination of Fish Otoliths: a Case Study. *Journal of Field Archaeology* 10:498-500.

Sneed, Kermit E.
1951 A Method of Calculating the Growth of Channel Catfish, Ictalurus Lacustris Punctatus. *Transactions of the American Fisheries Society* 80:174-183.

Soprovich, Daniel W.
1994 *Seasonal Patterns of Body Composition and Gut Morphology of Beaver (Castor canadensis)*. Unpublished MSc. thesis, Department of Zoology, University of Manitoba, Winnipeg.

Speer, Roberta D.
1978   Bison Remains from the Rex Rodgers Site. *Plains Anthropologist* Memoir 14:113-127.

Spencer-Wood, Suzanne M.
1987   Miller's Indices and Consumer-Choice Profiles: Status-Related Behaviors and White Ceramics.   In *Consumer Choice in Historical Archaeology*, edited by Suzanne M. Spencer-Wood, pp.321-358. Plenum Press, New York.

Speth, John D.
1983   *Bison Kills and Bone Counts: Decision Making by Ancient Hunters*. University of Chicago Press, Chicago.

Steward, Julian H.
1963   *Theory of Culture Change*. University of Illinois Press, Urbana.

Stewart, Kathlyn M. and Diane Gifford-Gonzalez
1994   An Ethnoarchaeological Contribution to Identifying Hominid Fish Processing Sites. *Journal of Archaeological Science* 21:237-248.

Stock, Karen
1992   The Food and Trading Resources of the Anishinaabe in the Manitoba District, 1800-1820. In *Proceedings of the Prairie Division*, edited by Michael R. Wilson, pp. 77-102. Canadian Association of Geographers.

Sussman, Lynne
1978   *A Preliminary Catalogue of Non-Copeland Patterns Associated with the Hudson's Bay Company*. Manuscript Report Number 430, Parks Canada, Ottawa.

Syms, E. Leigh
1977   Cultural Ecology and Ecological Dynamics of the Ceramic Period in Southwestern Manitoba. *Plains Anthropologist* Memoir 12, 22 (76, pt. 2).

Szuter, Christine R.
1996   A Faunal Analysis of Home Butchering and Meat Consumption at the Hubbell Trading Post, Ganado, Arizona. In *Images of the Recent Past*, edited by Charles E. Orser, Jr.. pp.333-354. Altamira Press, Walnut Creek.

Tamplin, Morgan, Shawn Haley and Deborah DeHetre
1983   Small Mammal Butchering in Prehistory: Beaver and Muskrat Remains from The Pas Reserve Site, Manitoba. *Manitoba Archaeological Quarterly* 7(2,3):5-33.

Tanner, John
1994 *The Falcon: A Narrative of the Captivity and Adventures of John Tanner During Thirty Years Residence among the Indians in the Interior of North America.* Penguin Books, Harmondsworth.

Taylor, T. G. and J. H. Moore
1953 Avian Medullary Bone. *Nature* 172 (4376):504-505.

Thomas, David Hurst
1986 *Refiguring Anthropology.* Waveland Press, Prospect Heights.

Thompson, Ernest E.
1975 [1891] *The Birds of Manitoba.* Smithsonian Institution, Washington. Reprinted by Premium Ventures, Winnipeg.

Tisdale, Mary Ann
1978 *Investigations at the Stott Site: A Review of Research from 1947 to 1977.* Papers in Archaeology, Final Report No. 5. Historic Resources Branch, Winnipeg.

Tisdale, Mary Ann and Peter J. Priess
n.d. *Archaeological Investigations at the Forks National Historic Site: Mitigation of the North Point Development.* Manuscript on file, Parks Canada Agency, Winnipeg.

Trigger, Bruce G.
1989 *A History of Archaeological Thought.* Cambridge University Press, Cambridge.

Wallis, Wilson D.
1947 *The Canadian Dakota.* Anthropological Papers Vol. 41, Part 1. American Museum of Natural History, New York.

West, John
1966 *The Substance of a Journal during a Residence at the Red River Colony.* S.R. Publishers, Wakefield. Johnson Reprint Corporation, New York.

Wheat, Joe Ben
1978 Olsen-Chubbuck and Jurgens Sites: Four Aspects of Paleo-Indian Bison Economy. *Plains Anthropologist* Memoir 14:84-89.

Wheeler, Alwyne and Andrew C.K. Jones
1976 Fish Remains. In *Excavations on Fuller's Hill, Great Yarmouth*, edited by Andrew Rogerson, pp.208-224. East Anglian Archaeology Report No.2.

1989 *Fishes.* Cambridge University Press, Cambridge.

White, Theodore E.
    1953   Observations on the Butchering Technique of Some Aboriginal Peoples. *American Antiquity* 19(2):160-164.

Williams, T. and B.C. Bedford
    1974   The use of otoliths for age determination. In *Ageing of Fish*, edited by T. B. Bagenal, pp.114-123. Unwin Brothers, Old Woking.

Winder, N. P.
    1991   How Many Bones Make Five? The Art and Science of Guesstimation in Archaeozoology. *International Journal of Osteoarchaeology* 1:111-126.

Wobst, H. Martin
    1978   The Archaeo-Ethnology of Hunter-Gatherers or the Tyranny of the Ethnographic Record in Archaeology. *American Antiquity* 43(2):303-309.

Wood, Raymond W.
    1985   Appendix: Journal of John Macdonell, 1793-1795 Assiniboines-River Qu'Appelle. In *Archaeology, ecology, and ethnohistory of the prairie-forest border zone of Minnesota and Manitoba*, edited by J. Spector and E. Johnson, pp.81-139. J & L Reprint Company, Lincoln.

    1990   Ethnohistory and Historical Method. In *Advances in Archaeological Method and Theory*, edited by Michael B. Schiffer, pp. 81-109. University of Arizona Press, Tucson.

Wood, Raymond W. and Donald Lee Johnson
    1978   A Survey of Disturbance Processes in Archaeological Site Formation. In *Advances in Archaeological Method and Theory* vol.1, edited by Michael B. Schiffer, pp.315-381. Academic Press, New York.

Wright, J. V.
    1995   *A History of the Native People of Canada. Volume I (10,000-1,000 B.C.)*. Mercury Series Paper 152. Canadian Museum of Civilization, Hull.

    1999   *A History of the Native People of Canada. Volume II (1,000 B.C.-A.D. 500)*. Mercury Series Paper 152. Canadian Museum of Civilization, Hull.

Wylie, Alison
    1985   The Reaction against Analogy. In *Advances in Archaeological Method and Theory*, vol.8, edited by Michael B. Schiffer, pp.63-111. Academic Press, New York.

Zierhut, Norman W.
  1967 Bone Breaking Activities of the Calling Lake Cree. *Alberta Anthropologist*
        1(3):33-36.

Appendix I, Table 1. Bird NISP counts

Taxon	Archaic	Blackduck	Fort Gibraltar I	Fort Garry	Upper Fort Garry	
Ciconiiformes	0	0	0	0	1	
Anseriformes	0	0	6	6	4	
Anatidae	0	0	31	0	20	
Cygninae	0	0	5	8	0	
Olor sp.	0	0	5	5	0	
Olor buccinator	0	0	3	0	0	
Olor columbianus	0	0	0	0	1	
Anserinae	0	0	8	22	4	
Branta canadensis	0	0	0	5	5	
Chen hyperborea	0	0	0	1	0	
Chen caerulescens	0	0	0	4	5	
Anatinae/Aythyinae	0	0	0	122	0	
Anatinae	0	1	0	19	5	
Anas sp.	0	0	15	31	5	
Anas rubripes/platyrhynchos	0	6	0	0	0	
Anas platyrhynchos	0	0	0	24	19	
Anas crecca/discors	0	1	0	0	0	
Mareca americana	0	0	0	0	1	
Aythyinae	0	0	0	10	0	
Aythya sp.	0	0	0	2	0	
Aythya americana	0	0	0	1	0	
Aythya affinis	0	0	0	0	5	
Merginae	0	0	2	0	0	
Falconiformes	0	0	0	0	0	
Accipitridae	0	0	0	0	0	
Accipiter gentilis	0	1	0	0	0	
Haliaeetus leucocephalus	0	0	0	1	0	
Galliformes	0	0	3	8	2	
Phasianidae	0	0	0	0	1	
Gallus gallus	0	0	0	112	86	
Pedioecetes phasianellus	0	0	0	0	10	
Meleagrididae	0	0	0	0	0	
Meleagris gallopavo	0	0	0	9	1	
Tetraonidae	0	0	0	1	26	*
Gruiformes	0	0	0	0	0	
Gruidae	0	0	0	0	0	
Grus sp.	0	0	0	0	3	
Grus americana	0	0	0	0	1	
Charadriiformes	0	0	2	0	0	
Scolopacidae	0	0	0	0	10	
Columbiformes	0	0	0	0	0	
Columbidae	0	0	0	1	0	
Ectopistes migratorius	0	7	0	81	11	
Cuculiformes	0	0	0	0	3	
Passeriformes	4	2	4	14	9	
Corvidae	0	0	0	0	16	
Corvus sp.	0	0	0	0	1	
Corvus branchyrhynchos	0	0	0	0	16	
TOTAL IDENTIFIED BIRD	4	18	84	487	271	
Unidentified bird	0	26	353	155	28	
Unidentified large bird	0	0	0	11	28	
Unidentified medium/large bird	0	0	0	123	18	
Unidentified medium bird	0	1	0	168	45	
Unidentified small/medium bird	0	0	0	79	7	
Unidentified small bird	0	0	0	37	1	
TOTAL BIRD LESS EGGSHELL	4	45	437	1060	398	

Appendix I, Table 1. Bird NISP counts

Eggshell	1	1	146	1070**	0	
TOTAL BIRD	5	46	583	2130	398	
* = interpreted as Phasianidae						
** = amount of eggshell is an underestimate						

Appendix I, Table 2. Fish NISP counts

Taxon	Archaic	Blackduck	Fort Gibraltar I	Fort Garry	Upper Fort Garry
Acipenser fulvescens	8	247	155	46	0
Clupeiformes	0	0	1	0	0
Esox lucius	250	3	3	2	0
Esox lucius/Esox masquinongy	0	8	0	0	0
Esox masquinongy	0	1	0	0	0
Coregonus sp.	0	0	0	3	17
Coregonus artedii	0	0	0	0	5
Coregonus clupeaformis	0	0	0	1	30
Hiodon sp.	4	12	3	294	1
Hiodon alosoides	0	21	0	0	38
Cypriniformes	0	1	11	0	0
Cyprinus carpio	0	0	0	0	4
Catostomidae	7246	21	52	10	1
Carpiodes cyprinus	0	2	0	0	0
Catostomus sp./Moxostoma sp.	0	3	0	0	0
Moxostoma sp.	0	1	0	0	0
Moxostoma anisurum	0	2	0	0	0
Moxostoma macrolepidotum	0	9	0	0	0
Catostomus sp.	0	1	0	13	5
Catostomus catostomus	0	0	0	0	16
Catostomus commersoni	0	0	0	3	22
Ictaluridae	5673	102	56	6	1
Ictalurus sp.	0	15	118	55	2
I. nebulosus/I. punctatus	0	7	0	0	0
Ictalurus nebulosus	0	0	0	0	11
Ictalurus punctatus	0	727	0	50	1
Lota lota	5	5	0	1	0
Perciformes	0	11	1	0	1
Percidae	0	0	0	0	3
Perca sp.	0	0	1	0	0
Perca flavescens	0	0	0	0	6
Stizostedion sp.	225	12	24	180	8
S. canadense/S. vitreum	0	14	0	0	0
Stizostedion vitreum	0	24	0	5	78
Aplodinotus grunniens	126	63	7	478	2
TOTAL IDENTIFIED FISH	13537	1312	432	1147	252
TOTAL UNIDENTIFIED FISH	90078	3019	3567	1382	1410
Scales	5553	454	1271	1078	57
TOTAL FISH	109168	4785	5270	3607	1719

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Appendix I, Table 3. Mammal NISP counts

Taxon	Archaic	Blackduck	Fort Gibraltar I	Fort Garry*	Upper Fort Garry
Insectivora	0	0	0	0	1
Soricidae	0	0	0	0	3
Sorex sp./Microsorex sp.	1	0	0	0	0
Homo sapiens	0	0	0	0	2
Leporidae	7	0	11	49	12
Sylvilagus floridanus	0	0	1	0	3
Lepus sp.	0	0	3	8	8
Lepus americanus	0	32	0	444	57
Rodentia	7	0	40	1	0
Castor canadensis	32	39	70	9	0
Sciuridae	6	0	2	1	0
Sciurus sp.	0	0	0	2	0
Tamasciurus hudsonicus	0	0	0	2	0
Tamasciurus sp./Sciurus sp.	5	0	0	0	0
Thomomys talpoides	2	0	0	0	0
Spermophilus sp.	1	0	0	0	0
Cricetidae	42	0	60	0	0
Microtus sp./Clethrionomys sp.	15	0	0	0	0
Peromyscus maniculatus	5	0	0	0	0
Ondatra zibethicus	0	4	13	0	0
Carnivora	0	0	3	3	0
Canidae	8	0	12	0	0
Canis sp.	0	6	6	8	1
Canis familiaris	0	2	0	0	0
Canis latrans	3	2	0	0	0
Canis familiaris/Canis latrans	0	4	0	0	0
Canis familiaris/Canis lupus	0	1	0	0	0
Canis lupus	4	1	0	0	0
Vulpes vulpes	314	1	1	9	69
Urocyon cinereoargenteus	0	1	0	0	0
Ursus americanus	1	0	1	10	1
Lynx lynx	0	0	2	0	15
Mustelidae	20	0	0	0	0
Mephitis mephitis	0	0	1	0	0
Taxidea taxus	0	0	1	0	0
Lutra canadensis	2	1	0	0	0
Procyon lotor	0	1	0	0	0
Martes pennanti	92	0	0	0	0
Mustela vison	18	0	0	0	0
Artiodactyla	0	64	95	130	15
Cervidae	4	0	7	1	1
Odocoileus sp.	10	0	0	0	0
Cervus canadensis/Alces alces	0	2	0	0	0
Alces alces	4	3	1	0	0
Cervus canadensis	0	2	21	0	1
Bovidae	0	0	70	34	168
Bison bison/Bos taurus	0	27	0	197	0
Bison bison	104	26	349	8	9
Bos taurus	0	9	0	108	35
Ovis aries/Capra hircus	0	0	0	160	0
Capra sp.	0	0	0	0	1
Capra hircus	0	0	0	1	16
Ovis sp.	0	0	0	0	1
Ovis aries	0	1	2	103	34
Sus scrofa	0	0	4	126	46
Antilocapra americana	0	0	0	0	1
Equus caballus	0	0	11	1	1
TOTAL IDENTIFIED MAMMAL	707	229	787	1415	501
Large mammal	2757	n/a	n/a	468	367
Medium/large mammal	1338	n/a	n/a	2482	141
Medium mammal	192	n/a	n/a	232	88
Small/medium mammal	7	n/a	n/a	117	30
Small mammal	5	n/a	n/a	63	7
Unidentified mammal	549	3620	12470	518	274
TOTAL MAMMAL	5553	3849	13257	5275	1408

* Fort Garry also includes one small Rodentia fragment and 5 other bones/teeth considered non-cultural.

Appendix I, Table 4 Mammal NISP counts, small mammals excluded

Taxon	Archaic	Blackduck	Fort Gibraltar I	Fort Garry	Upper Fort Garry
Leporidae	7	0	11	49	12
Sylvilagus floridanus	0	0	1	0	3
Lepus sp.	0	0	3	8	8
Lepus americanus	0	32	0	444	57
Rodentia	7	0	40	1	0
Castor canadensis	32	39	70	9	0
Ondatra zibethicus	0	4	13	0	0
Carnivora	0	0	3	3	0
Canidae	8	0	12	0	0
Canis sp.	0	6	6	8	1
Canis familiaris	0	2	0	0	0
Canis latrans	3	2	0	0	0
Canis familiaris/Canis latrans	0	4	0	0	0
Canis familiaris/Canis lupus	0	1	0	0	0
Canis lupus	4	1	0	0	0
Vulpes vulpes	314	1	1	9	69
Urocyon cinereoargenteus	0	1	0	0	0
Ursus americanus	1	0	1	10	1
Lynx lynx	0	0	2	0	15
Mustelidae	20	0	0	0	0
Mephitis mephitis	0	0	1	0	0
Taxidae taxus	0	0	1	0	0
Lutra canadensis	2	1	0	0	0
Procyon lotor	0	1	0	0	0
Martes pennanti	92	0	0	0	0
Mustela vison	18	0	0	0	0
Artiodactyla	0	64	95	130	15
Cervidae	4	0	7	1	1
Odocoileus sp.	10	0	0	0	0
Cervus canadensis/Alces alces	0	2	0	0	0
Alces alces	4	3	1	0	0
Cervus canadensis	0	2	21	0	1
Bovidae	0	0	70	34	168
Bison bison/Bos taurus	0	27	0	197	0
Bison bison	104	26	349	8	9
Bos taurus	0	9	0	108	35
Ovis aries/Capra hircus	0	0	0	160	0
Capra sp.	0	0	0	0	1
Capra hircus	0	0	0	1	16
Ovis sp.	0	0	0	0	1
Ovis aries	0	1	2	103	34
Sus scrofa	0	0	4	126	46
Antilocapra americana	0	0	0	0	1
Equus caballus	0	0	11	1	1
TOTAL IDENTIFIED MAMMAL	630	229	725	1410	495
Large mammal	2757	n/a	n/a	468	367
Medium/large mammal	1336	n/a	n/a	2462	141
Medium mammal	192	n/a	n/a	232	88
Small/medium mammal	7	n/a	n/a	117	30
Small mammal	5	n/a	n/a	63	7
Unidentified mammal	549	3620	12470	518	274
TOTAL MAMMAL	5476	3849	13195	5270	1402

Appendix II, Table 1. Element frequency data for birds at the class level

Blackduck	Quantity		Fort Gibraltar I	Quantity
eggshell	1		carpometacarpus	3
furculum	1		coracoid	10
humerus	2		eggshell	146
radius	2		femur	9
synsacrum	1		fibula	1
tibiotarsus	2		furculum	4
ulna	6		humerus	17
unidentified	1		longbone	126
unidentified	23		mandible	7
vertebra	1		pelvis	6
vertebra, cervical	6		phalanx, foot	1
			phalanx, undetermined	4
			phalanx, wing	6
			radius	7
			rib	27
			scapula	4
			skull	8
			sternum	21
			tarsometatarsus	6
			tendon	3
			tibiotarsus	11
			trachea	3
			ulna	6
			vertebra, cervical	1
			vertebra, lumbar	1
			vertebra, thoracic	2
			vertebra, undetermined	20

Fort Garry	Quantity		Upper Fort Garry	Quantity
beak	1		carpometacarpus	16
carpal	1		coracoid	28
carpometacarpus	37		cranial	19
cartilage	1		cuneiform	1
coracoid	42		femur	34
cranial	12		fibula	2
eggshell	1070		furculum	5
femur	35		humerus	18
fibula	9		hyoid	2
furculum	21		innominate	7
humerus	40		longbone	21
innominate	15		mandible	5
longbone	126		maxilla	6
mandible	18		phalanx, foot	4
maxilla	1		phalanx, undetermined	18
ossified tendon	1		phalanx, wing	3
phalanx, foot	29		radius	20
phalanx, undetermined	16		rib	29

Appendix II, Table 1. Element frequency data for birds at the class level

phalanx, wing	24		scapholunar	1
radius	38		scapula	15
rib	69		sternum	11
sacrum	1		tarsometatarsus	20
scapula	41		tibiotarsus	31
skull	46		tongue	2
sternum	87		ulna	26
synsacrum	16		vertebra, centrum	1
tarsometatarsus	36		vertebra, cervical	13
tibiotarsus	34		vertebra, lumbar	3
trachea	55		vertebra, thoracic	2
ulna	45		vertebra,undetermined	5
vertebra, sacral	5			
vertebra, atlas	1			
vertebra, axis	1			
vertebra, caudal	2			
vertebra, cervical	19			
vertebra, thoracic	6			
vertebra, undetermined	3			

Appendix II, Table 2. Blackduck sample element frequency data

BLACKDUCK

Taxon	Element	Quantity
Accipitridae	radius	1
Anatinae/Aythyinae	vertebra, cervical	6
Anatinae/Aythyinae	furculum	1
Anatinae/Aythyinae	ulna	2
Columbidae	humerus	2
Columbidae	ulna	3
Columbidae	radius	1
Columbidae	tibiotarsus	2
Passeriformes	unidentifiable	1

Appendix II, Table 3. Fort Gibraltar I sample element frequency data

FORT GIBRALTAR I

Taxon	Element	Quantity
Anatinae/Aythyinae	skull	2
Anatinae/Aythyinae	mandible	2
Anatinae/Aythyinae	vertebra, cervical	1
Anatinae/Aythyinae	sternum	2
Anatinae/Aythyinae	coracoid	1
Anatinae/Aythyinae	furculum	1
Anatinae/Aythyinae	humerus	3
Anatinae/Aythyinae	pelvis	1
Anatinae/Aythyinae	femur	1
Anatinae/Aythyinae	tibiotarsus	1
Anserinae	rib	1
Anserinae	sternum	6
Anserinae	scapula	1
Cygninae	skull	2
Cygninae	rib	1
Cygninae	coracoid	4
Cygninae	humerus	3
Cygninae	carpometacarpus	1
Cygninae	tibiotarsus	2
Merginae	ulna	1
Merginae	carpometacarpus	1
Charadriiformes	furculum	1
Charadriiformes	tibiotarsus	1
Galliformes	coracoid	1
Galliformes	radius	1
Galliformes	tibiotarsus	1
Galliformes	humerus	1
Passeriformes	ulna	1
Passeriformes	tarsometatarsus	1

Appendix II, Table 4. Fort Garry sample element frequency data

FORT GARRY

Taxon	Element	Quantity
Accipitridae	phalanx, pedal	1
Anatinae/Aythyinae	skull	15
Anatinae/Aythyinae	mandible	9
Anatinae/Aythyinae	vertebra, cervical	7
Anatinae/Aythyinae	vertebra, caudal	2
Anatinae/Aythyinae	sternum	14
Anatinae/Aythyinae	coracoid	10
Anatinae/Aythyinae	scapula	12
Anatinae/Aythyinae	humerus	14
Anatinae/Aythyinae	radius	17
Anatinae/Aythyinae	ulna	22
Anatinae/Aythyinae	carpometacarpus	21
Anatinae/Aythyinae	phalanx, alar	10
Anatinae/Aythyinae	innominate	7
Anatinae/Aythyinae	femur	4
Anatinae/Aythyinae	tibiotarsus	13
Anatinae/Aythyinae	tarsometatarsus	9
Anatinae/Aythyinae	phalanx, pedal	19
Anserinae	sternum	6
Anserinae	coracoid	5
Anserinae	scapula	5
Anserinae	furculum	3
Anserinae	humerus	3
Anserinae	ulna	1
Anserinae	phalanx, alar	4
Anserinae	pelvis	1
Anserinae	femur	3
Anserinae	tibiotarsus	1
Columbidae	skull	23
Columbidae	mandible	1
Columbidae	vertebra, cervical	1
Columbidae	vertebra, sacral	1
Columbidae	sternum	15
Columbidae	coracoid	5
Columbidae	scapula	2
Columbidae	humerus	4
Columbidae	radius	2
Columbidae	ulna	5
Columbidae	carpometacarpus	1
Columbidae	phalanx, alar	1
Columbidae	pelvis	1
Columbidae	femur	11
Columbidae	tibiotarsus	3
Columbidae	tarsometatarsus	8
Cygninae	skull	2
Cygninae	mandible	2

Cygninae	coracoid	1
Cygninae	carpometacarpus	1
Cygninae	phalanx, alar	2
Cygninae	pelvis	1
Cygninae	tibiotarsus	1
Cygninae	phalanx, pedal	3
Meleagrididae	coracoid	1
Meleagrididae	scapula	1
Meleagrididae	furculum	2
Meleagrididae	humerus	1
Meleagrididae	ulna	1
Meleagrididae	carpometacarpus	1
Meleagrididae	phalanx, alar	1
Meleagrididae	fibula	1
Phasianidae	skull	2
Phasianidae	mandible	3
Phasianidae	vertebra, cervical	9
Phasianidae	vertebra, thoracic	4
Phasianidae	vertebra, sacral	2
Phasianidae	vertebra, caudal	1
Phasianidae	rib	7
Phasianidae	sternum	14
Phasianidae	coracoid	8
Phasianidae	scapula	7
Phasianidae	furculum	7
Phasianidae	humerus	10
Phasianidae	radius	5
Phasianidae	ulna	3
Phasianidae	carpometacarpus	3
Phasianidae	phalanx, alar	2
Phasianidae	pelvis	6
Phasianidae	femur	2
Phasianidae	tibiotarsus	4
Phasianidae	fibula	4
Phasianidae	tarsometatarsus	7
Phasianidae	phalanx, pedal	2
Passeriformes	sternum	3
Passeriformes	coracoid	2
Passeriformes	scapula	1
Passeriformes	ulna	2
Passeriformes	carpometacarpus	1
Passeriformes	femur	5

Appendix II, Table 5. Upper Fort Garry sample element frequency data
UPPER FORT GARRY

Taxon	Element	Quantity
Ciconiiformes	pelvis	1
Anserinae	skull	2
Anserinae	mandible	1
Anserinae	vertebra, cervical	1
Anserinae	humerus	1
Anserinae	radius	2
Anserinae	ulna	2
Anserinae	carpometacarpus	1
Anserinae	tibiotarsus	2
Anserinae	tarsometatarsus	2
Cygninae	phalanx, alar	1
Anatinae/Aythyinae	skull	12
Anatinae/Aythyinae	coracoid	1
Anatinae/Aythyinae	scapula	1
Anatinae/Aythyinae	humerus	2
Anatinae/Aythyinae	radius	2
Anatinae/Aythyinae	carpometacarpus	5
Anatinae/Aythyinae	phalanx, alar	2
Anatinae/Aythyinae	tarsometatarsus	3
Anatinae/Aythyinae	phalanx, pedal	1
Phasianidae	skull	2
Phasianidae	vertebra, cervical	9
Phasianidae	vertebra, thoracic	1
Phasianidae	vertebra, lumbar	1
Phasianidae	rib	3
Phasianidae	sternum	5
Phasianidae	coracoid	8
Phasianidae	scapula	6
Phasianidae	furculum	1
Phasianidae	humerus	6
Phasianidae	radius	7
Phasianidae	ulna	8
Phasianidae	carpometacarpus	4
Phasianidae	pelvis	6
Phasianidae	femur	28
Phasianidae	tibiotarsus	18
Phasianidae	tarsometatarsus	4
Meleagrididae	tibiotarsus	1
Gruidae	carpometacarpus	1
Gruidae	carpal	1
Gruidae	tibiotarsus	1
Scolopacidae	radius	2
Scolopacidae	ulna	3
Scolopacidae	tarsometatarsus	3
Scolopacidae	tibiotarsus	2
Columbidae	sternum	1

Columbidae	coracoid	1
Columbidae	scapula	1
Columbidae	humerus	3
Columbidae	radius	2
Columbidae	ulna	3
Passeriformes	skull	1
Passeriformes	scapula	1
Passeriformes	humerus	2
Passeriformes	ulna	1
Passeriformes	carpometacarpus	1
Passeriformes	femur	1
Passeriformes	tibiotarsus	1
Corvidae	cranial	2
Corvidae	mandible	2
Corvidae	rib	7
Corvidae	sternum	2
Corvidae	coracoid	2
Corvidae	scapula	2
Corvidae	furculum	3
Corvidae	humerus	2
Corvidae	ulna	3
Corvidae	carpal	1
Corvidae	carpometacarpus	1
Corvidae	femur	2
Corvidae	tibiotarsus	1
Corvidae	tarsometatarsus	1

Appendix II, Table 6. Archaic sample fish element frequencies

Taxon	Element	Quantity
Acipenser fulvescens	scutes	8
Aplodinotus grunniens	ceratohyal	15
Aplodinotus grunniens	epihyal	9
Aplodinotus grunniens	hypohyal	2
Aplodinotus grunniens	maxilla	1
Aplodinotus grunniens	otolith	23
Aplodinotus grunniens	pharyngeal arch	3
Aplodinotus grunniens	tooth	72
Catostomidae	angular	572
Catostomidae	ceratohyal	673
Catostomidae	dentary	744
Catostomidae	epihyal	322
Catostomidae	hyomandibular	1067
Catostomidae	hypohyal	287
Catostomidae	lacrimal	23
Catostomidae	maxilla	580
Catostomidae	metapterygoid	1
Catostomidae	operculum	461
Catostomidae	pharyngeal arch	1873
Catostomidae	premaxilla	50
Catostomidae	preoperculum	36
Catostomidae	quadrate	383
Catostomidae	suboperculum	2
Catostomidae	urohyal	53
Catostomidae	coracoid	3
Catostomidae	pectoral spine	78
Catostomidae	posttemporal	1
Catostomidae	scapula	5
Catostomidae	supracleithrum	40
Catostomidae	dorsal spine	17
Catostomidae	identifiable/unidentified	125
Esox lucius	ceratohyal	1
Esox lucius	dentary	75
Esox lucius	hyomandibular	1
Esox lucius	maxilla	6
Esox lucius	otolith	6
Esox lucius	pharyngeal arch	2
Esox lucius	premaxilla	19
Esox lucius	quadrate	20
Esox lucius	tooth	101
Esox lucius	identifiable	14
Hiodon sp.	operculum	4
Ictaluridae	angular; articular	259
Ictaluridae	basioccipital	26
Ictaluridae	branchiostegal	43
Ictaluridae	ceratohyal	132
Ictaluridae	dentary	343
Ictaluridae	epibranchial	1

Ictaluridae	epihyal	101
Ictaluridae	ethmoid cornu	1095
Ictaluridae	frontal	33
Ictaluridae	hyomandibular	335
Ictaluridae	hypohyal	107
Ictaluridae	interoperculum	117
Ictaluridae	lacrimal	3
Ictaluridae	lateral ethmoid	82
Ictaluridae	maxilla	80
Ictaluridae	metapterygoid	175
Ictaluridae	nasal	7
Ictaluridae	neurocranium	2
Ictaluridae	operculum	181
Ictaluridae	palatine	151
Ictaluridae	parasphenoid	42
Ictaluridae	pharyngeal arch	1
Ictaluridae	premaxilla	227
Ictaluridae	preoperculum	1204
Ictaluridae	pterotic	6
Ictaluridae	pterygoid	1
Ictaluridae	quadrate	2196
Ictaluridae	skull	222
Ictaluridae	sphenoid	2
Ictaluridae	supraethmoid	50
Ictaluridae	tooth	1
Ictaluridae	urohyal	64
Ictaluridae	vomer	1
Ictaluridae	cleithrum	286
Ictaluridae	coracoid	785
Ictaluridae	pectoral spine	277
Ictaluridae	posttemporal	2
Ictaluridae	supracleithrum	74
Ictaluridae	basipterygium	1
Ictaluridae	dorsal spine	87
Ictaluridae	pterygiophore	16
Ictaluridae	rib	4
Ictaluridae	spine	5
Ictaluridae	vertebrae	118
Ictaluridae	fin	2
Ictaluridae	identifiable/unidentified/undetermined	430
Ictaluridae	ray	3
Ictaluridae	ceratobranchial	1
Lota lota	dentary	2
Lota lota	premaxilla	3
Stizostedion sp.	angular	1
Stizostedion sp.	ceratohyal	1
Stizostedion sp.	dentary	85
Stizostedion sp.	maxilla	31
Stizostedion sp.	premaxilla	36
Stizostedion sp.	quadrate	5

Stizostedion sp.	tooth	69
fish	angular	12
fish	basioccipital	2
fish	branchiostegal ray	67
fish	ceratobranchial	3
fish	ceratohyal	21
fish	circumorbital	51
fish	dentary	90
fish	epihyal	20
fish	frontal	1
fish	hyals	2
fish	hyomandibular	39
fish	hypohyal	179
fish	lacrimal	233
fish	maxilla	67
fish	metapterygoid	2
fish	nasal	5
fish	neurocranium	3
fish	operculum	17
fish	otolith	1
fish	palatine	1
fish	parasphenoid	6
fish	pharyngeal arch	12
fish	premaxilla	19
fish	preoperculum	2
fish	quadrate	24
fish	skull	10
fish	sphenoid	1
fish	tooth	66
fish	urohyal	2
fish	vomer	3
fish	scale	5394
fish	cleithrum	8
fish	pectoral spine	18
fish	posttemporal	29
fish	scapula	94
fish	dorsal spine	53
fish	pterygiophore	126
fish	ray	1052
fish	rib	8534
fish	spine	87
fish	vertebrae	18505
fish	fin	30
fish	sample	23
fish	unidentified/undetermined/identifiable	59029

Appendix II, Table 7. Blackduck sample, fish element frequencies

Family	Taxon	Element	Quantity
Acipenseridae	*Acipenser fulvescens*	parasphenoid	1
Acipenseridae	*Acipenser fulvescens*	unknown	83
Acipenseridae	*Acipenser fulvescens*	spine, pectoral	5
Acipenseridae	*Acipenser fulvescens*	rib	5
Acipenseridae	*Acipenser fulvescens*	scute	108
Acipenseridae	*Acipenser fulvescens*	unknown	45
Catostomidae	Catostomidae	ceratohyal	1
Catostomidae	Catostomidae	hyomandibular	2
Catostomidae	Catostomidae	maxilla	5
Catostomidae	Catostomidae	operculum	11
Catostomidae	Catostomidae	pharyngeal	2
Catostomidae	Catostomidae	quadrate	3
Catostomidae	Catostomidae	cleithrum	1
Catostomidae	Catostomidae	lepidotrichia	1
Catostomidae	Catostomidae	vertebra	8
Catostomidae	Catostomidae	vertebra, caudal	1
Catostomidae	Catostomidae	vertebra, caudal posterior	3
Catostomidae	Catostomidae	vertebra, trunk	1
Esocidae	*Esox lucius/masquinongy*	articular	1
Esocidae	*Esox lucius/masquinongy*	dentary	2
Esocidae	*Esox lucius/masquinongy*	parasphenoid	1
Esocidae	*Esox lucius/masquinongy*	tooth	1
Esocidae	*Esox*	vomer ?	1
Esocidae	*Esox lucius/masquinongy*	scale	1
Esocidae	*Esox lucius/masquinongy*	vertebra	2
Esocidae	*Esox lucius*	vertebra, trunk	2
Esocidae	*Esox masquinongy (cf)*	vertebra, trunk anterior	1
Gadidae	*Lota lota*	vertebra	1
Gadidae	*Lota lota*	vertebra, caudal	1
Gadidae	*Lota lota*	vertebra, trunk	1
Gadidae	*Lota lota*	vertebra, trunk posterior	2
Hiodontidae	Hiodontidae	dentary w/tooth	1
Hiodontidae	Hiodontidae	hyomandibular	2
Hiodontidae	Hiodontidae	operculum	4
Hiodontidae	Hiodontidae	prootic	1
Hiodontidae	Hiodontidae	quadrate	1
Hiodontidae	Hiodontidae	supracleithrum	1
Hiodontidae	Hiodontidae	vertebra	5
Hiodontidae	Hiodontidae	vertebra, caudal	2
Hiodontidae	Hiodontidae	vertebra, trunk	16
Ictaluridae	Ictaluridae	alisphenoid	2
Ictaluridae	Ictaluridae	articular	26
Ictaluridae	Ictaluridae	basihyal	5
Ictaluridae	Ictaluridae	basioccipital	12
Ictaluridae	Ictaluridae	branchiostegal ray	7
Ictaluridae	Ictaluridae	ceratobranchial	2
Ictaluridae	Ictaluridae	ceratohyal	8
Ictaluridae	Ictaluridae	dentary	43

Ictaluridae	Ictaluridae	dermethmoid	1
Ictaluridae	Ictaluridae	epihyal	11
Ictaluridae	Ictaluridae	exoccipital	1
Ictaluridae	Ictaluridae	frontal	9
Ictaluridae	Ictaluridae	hyomandibular	23
Ictaluridae	Ictaluridae	hypohyal, dorsal	2
Ictaluridae	Ictaluridae	interoperculum	13
Ictaluridae	Ictaluridae	intersphenoid	1
Ictaluridae	Ictaluridae	maxilla	1
Ictaluridae	Ictaluridae	mesethmoid	5
Ictaluridae	Ictaluridae	operculum	8
Ictaluridae	Ictaluridae	orbitosphenoid	5
Ictaluridae	Ictaluridae	palatine	10
Ictaluridae	Ictaluridae	parasphenoid	7
Ictaluridae	Ictaluridae	parethmoid	4
Ictaluridae	Ictaluridae	post-temporal	2
Ictaluridae	Ictaluridae	prefrontal	6
Ictaluridae	Ictaluridae	premaxilla	6
Ictaluridae	Ictaluridae	preoperculum	19
Ictaluridae	Ictaluridae	pterotic	2
Ictaluridae	Ictaluridae	pterygoid	4
Ictaluridae	Ictaluridae	quadrate	27
Ictaluridae	Ictaluridae	skull	1
Ictaluridae	Ictaluridae	sphenotic	5
Ictaluridae	Ictaluridae	spine, cranial	5
Ictaluridae	Ictaluridae	supraoccipital	2
Ictaluridae	Ictaluridae	unk	233
Ictaluridae	Ictaluridae	urohyal	2
Ictaluridae	Ictaluridae	cleithrum	96
Ictaluridae	Ictaluridae	coracoid	31
Ictaluridae	Ictaluridae	spine, pectoral	68
Ictaluridae	Ictaluridae	hypural	4
Ictaluridae	Ictaluridae	pterygiophore	1
Ictaluridae	Ictaluridae	ray	50
Ictaluridae	Ictaluridae	rib	1
Ictaluridae	Ictaluridae	spine	5
Ictaluridae	Ictaluridae	vertebra	20
Ictaluridae	Ictaluridae	vert c 1	2
Ictaluridae	Ictaluridae	vertebra, caudal	19
Ictaluridae	Ictaluridae	vertebra, trunk	7
Ictaluridae	Ictaluridae	vert ural 1	1
Ictaluridae	Ictaluridae	weberian apparatus	7
Ictaluridae	Ictaluridae	unknown	57
Percidae	*Stizostedion* sp.	articular	3
Percidae	*Stizostedion* sp.	ceratohyal	4
Percidae	*Stizostedion* sp.	dentary	5
Percidae	*Stizostedion* sp.	maxilla	3
Percidae	*Stizostedion* sp.	palatine	1
Percidae	*Stizostedion* sp.	parasphenoid	3
Percidae	*Stizostedion* sp.	post-temporal	1

Percidae	*Stizostedion* sp.	premaxilla	3
Percidae	*Stizostedion* sp.	preoperculum	1
Percidae	*Stizostedion* sp.	quadrate	1
Percidae	*Stizostedion* sp.	vomer	1
Percidae	*Stizostedion* sp.	scapula	1
Percidae	*Stizostedion* sp.	supracleithrum	3
Percidae	*Stizostedion* sp.	rib	1
Percidae	*Stizostedion* sp.	vertebra	6
Percidae	*Stizostedion* sp.	vertebra, caudal	3
Percidae	*Stizostedion* sp.	vertebra, trunk	7
Percidae	*Stizostedion* sp.	vertebra, trunk anterior	4
Sciaenidae	*Aplodinotus grunniens*	ceratohyal	1
Sciaenidae	*Aplodinotus grunniens*	interoperculum	1
Sciaenidae	*Aplodinotus grunniens*	otolith	29
Sciaenidae	*Aplodinotus grunniens*	pharyngeal	5
Sciaenidae	*Aplodinotus grunniens*	post-temporal	1
Sciaenidae	*Aplodinotus grunniens*	premaxilla	2
Sciaenidae	*Aplodinotus grunniens*	quadrate	1
Sciaenidae	*Aplodinotus grunniens*	urohyal	1
Sciaenidae	*Aplodinotus grunniens*	supracleithrum	1
Sciaenidae	*Aplodinotus grunniens*	spine, anal	1
Sciaenidae	*Aplodinotus grunniens*	lepidotrichia	11
Sciaenidae	*Aplodinotus grunniens*	pterygiophore	5
Sciaenidae	*Aplodinotus grunniens*	spine, dorsal	1
Sciaenidae	*Aplodinotus grunniens*	vertebra	1
Sciaenidae	*Aplodinotus grunniens*	vertebra, trunk	2
Cypriniformes	Cypriniformes	weberian apparatus	1
Perciformes	Perciformes	articular	1
Perciformes	Perciformes	branchiostegal ray	1
Perciformes	Perciformes	quadrate	2
Perciformes	Perciformes	lepidotrichia	4
Perciformes	Perciformes	spine	1
Perciformes	Perciformes	vertebra, trunk	2
Fish	Osteichthyes	unknown	6
Fish	Osteichthyes	branchial	1
Fish	Osteichthyes	branchiostegal ray	2
Fish	Osteichthyes	exoccipital ?	1
Fish	Osteichthyes	operculum	1
Fish	Osteichthyes	pharyngeal plate	1
Fish	Osteichthyes	quadrate	1
Fish	Osteichthyes	scale	1
Fish	Osteichthyes	spine	5
Fish	Osteichthyes	supraoccipital ?	1
Fish	Osteichthyes	tooth	1
Fish	Osteichthyes	scale	27
Fish	Osteichthyes	cleithrum ?	1
Fish	Osteichthyes	spine	1

Fish	Osteichthyes	pterygiophore	2
Fish	Osteichthyes	ray	42
Fish	Osteichthyes	rib	111
Fish	Osteichthyes	rib+spine	18
Fish	Osteichthyes	rib/ray	8
Fish	Osteichthyes	scale	8
Fish	Osteichthyes	spine	67
Fish	Osteichthyes	unknown	1
Fish	Osteichthyes	vertebra	87
Fish	Osteichthyes	vertebra, trunk	1
Fish	Osteichthyes	weberian apparatus	3
Fish	Osteichthyes	scale	418
Fish	Osteichthyes	spine	4
Fish	Osteichthyes	unknown	2653

Appendix II, Table 8. Fort Gibraltar I sample, fish element frequencies

Family	Taxon	Element	Quantity
Acipenseridae	*Acipenser fulvescens*	skull element	3
Acipenseridae	*Acipenser fulvescens*	pectoral spine	4
Acipenseridae	*Acipenser fulvescens*	scute	122
Acipenseridae	*Acipenser fulvescens*	unidentified fragments	26
Esocidae	*Esox* sp.	frontal	1
Esocidae	*Esox* sp.	tooth	2
Esocidae	*Esox* sp.	scapula	1
Hiodontidae	*Hiodon* sp.	dentary	1
Hiodontidae	*Hiodon* sp.	operculum	2
Catostomidae	Catostomidae	angular	1
Catostomidae	Catostomidae	branchiostegal	2
Catostomidae	Catostomidae	ceratohyal	1
Catostomidae	Catostomidae	dentary	4
Catostomidae	Catostomidae	hyomandibular	3
Catostomidae	Catostomidae	maxilla	2
Catostomidae	Catostomidae	metapterygoid	1
Catostomidae	Catostomidae	operculum	5
Catostomidae	Catostomidae	parasphenoid	3
Catostomidae	Catostomidae	pharyngeal arch	9
Catostomidae	Catostomidae	pharyngeal pite	1
Catostomidae	Catostomidae	preoperculum	1
Catostomidae	Catostomidae	prootic	1
Catostomidae	Catostomidae	quadrate	5
Catostomidae	Catostomidae	skull fragment	1
Catostomidae	Catostomidae	vomer	1
Catostomidae	Catostomidae	suboperculum	1
Catostomidae	Catostomidae	supraoccipital	1
Catostomidae	Catostomidae	cleithrum	4
Catostomidae	Catostomidae	pectoral spine	4
Catostomidae	Catostomidae	rib	1
Catostomidae	Catostomidae	vertebra	1
Ictaluridae	Ictaluridae	angular	4
Ictaluridae	Ictaluridae	ceratohyal	1
Ictaluridae	Ictaluridae	dentary	6
Ictaluridae	Ictaluridae	epihyal	2
Ictaluridae	Ictaluridae	frontal	1
Ictaluridae	Ictaluridae	hyomandibular	3
Ictaluridae	Ictaluridae	interoperculum	1
Ictaluridae	Ictaluridae	lateral ethmoid	1
Ictaluridae	Ictaluridae	maxilla	3
Ictaluridae	Ictaluridae	metapterygoid	2
Ictaluridae	Ictaluridae	neurocranium	10
Ictaluridae	Ictaluridae	operculum	3
Ictaluridae	Ictaluridae	palatine	5
Ictaluridae	Ictaluridae	parasphenoid	1
Ictaluridae	Ictaluridae	premaxilla	3
Ictaluridae	Ictaluridae	preoperculum	4
Ictaluridae	Ictaluridae	quadrate	11

Ictaluridae	Ictaluridae	skull frags	8
Ictaluridae	Ictaluridae	supraethmoid	4
Ictaluridae	Ictaluridae	cleithrum	10
Ictaluridae	Ictaluridae	coracoid	32
Ictaluridae	Ictaluridae	pectoral spine	48
Ictaluridae	Ictaluridae	basipterygium	1
Ictaluridae	Ictaluridae	dorsal spine	3
Ictaluridae	Ictaluridae	modified spine	1
Ictaluridae	Ictaluridae	pterygiophore	1
Ictaluridae	Ictaluridae	dorsal/pectoral spine	1
Ictaluridae	Ictaluridae	undiagnostic	4
Percidae	Percidae	simplectic	1
Percidae	Percidae	pharyngeal plate	1
Percidae	Percidae	dentary	2
Percidae	Percidae	epihyal	3
Percidae	Percidae	frontal	1
Percidae	Percidae	hyomandibular	2
Percidae	Percidae	maxilla	1
Percidae	Percidae	premaxilla	5
Percidae	Percidae	quadrate	4
Percidae	Percidae	tooth	3
Percidae	Percidae	cleithrum	1
Percidae	Percidae	undiagnostic	1
Sciaenidae	*Aplodinotus grunniens*	hyomandibular	1
Sciaenidae	*Aplodinotus grunniens*	hypohyal	1
Sciaenidae	*Aplodinotus grunniens*	otolith	2
Sciaenidae	*Aplodinotus grunniens*	premaxilla	1
Sciaenidae	*Aplodinotus grunniens*	supraoccipital	1
Sciaenidae	*Aplodinotus grunniens*	cleithrum	1
Perciformes	Perciformes	preoperculum	1
Cypriniformes	Cypriniformes	branchiostegal	1
Cypriniformes	Cypriniformes	epihyal	1
Cypriniformes	Cypriniformes	hypohyal	1
Cypriniformes	Cypriniformes	operculum	1
Cypriniformes	Cypriniformes	skull fragment	1
Cypriniformes	Cypriniformes	skull fragment	1
Cypriniformes	Cypriniformes	skull fragment	1
Cypriniformes	Cypriniformes	pterygiophore	1
Cypriniformes	Cypriniformes	vertebra;2nd.	1
Cypriniformes	Cypriniformes	undetermined	1
Cypriniformes	Cypriniformes	undiagnostic	1
fish	fish	angular	1
fish	fish	articular	1
fish	fish	basioccipital	1
fish	fish	branchiostegal	62
fish	fish	ceratobranchial	7
fish	fish	ceratohyal	3
fish	fish	dentary, fish	5
fish	fish	epibranchial	1

fish	fish	epihyal	2
fish	fish	hyomandibular	1
fish	fish	hypobranchial	1
fish	fish	hypohyal	1
fish	fish	metapterygoid	1
fish	fish	operculum	1
fish	fish	preoperculum	2
fish	fish	pterygoid	1
fish	fish	quadrate	1
fish	fish	skull	22
fish	fish	suboperculum	1
fish	fish	supraoccipital	1
fish	fish	tooth	2
fish	fish	urohyal	1
fish	fish	vomer	1
fish	fish	scale	1271
fish	fish	tibiotarsus	1
fish	fish	cleithrum	2
fish	fish	coracoid	2
fish	fish	pectoral spine	7
fish	fish	scapula	2
fish	fish	dorsal spine	10
fish	fish	fin ray	198
fish	fish	pterygiophore	38
fish	fish	rib	434
fish	fish	spine	14
fish	fish	vertebra	347
fish	fish	dorsal/pectoral spine	29
fish	fish	undetermined	18
fish	fish	undiagnostic	2344

Appendix II, Table 9. Fort Garry sample, fish element frequencies

Family	Taxon	Element	Quantity
Acipenseridae	*Acipenser fulvescens*	frontal	1
Acipenseridae	*Acipenser fulvescens*	spines	29
Acipenseridae	*Acipenser fulvescens*	scute	8
Acipenseridae	*Acipenser fulvescens*	undetermined	5
Acipenseridae	*Acipenser fulvescens*	unidentifiable	3
Esocidae	*Esox lucius*	dentary	2
Hiodontidae	*Hiodon* sp.	angular	3
Hiodontidae	*Hiodon* sp.	ceratohyal	5
Hiodontidae	*Hiodon* sp.	dentary	18
Hiodontidae	*Hiodon* sp.	frontal	4
Hiodontidae	*Hiodon* sp.	hyomandibular	12
Hiodontidae	*Hiodon* sp.	interoperculum	17
Hiodontidae	*Hiodon* sp.	operculum	19
Hiodontidae	*Hiodon* sp.	pharyngeal plate	13
Hiodontidae	*Hiodon* sp.	preoperculum	26
Hiodontidae	*Hiodon* sp.	quadrate	1
Hiodontidae	*Hiodon* sp.	suboperculum	24
Hiodontidae	*Hiodon* sp.	cleithrum	43
Hiodontidae	*Hiodon* sp.	postcleithrum	11
Hiodontidae	*Hiodon* sp.	posttemporal	3
Hiodontidae	*Hiodon* sp.	scapula	3
Hiodontidae	*Hiodon* sp.	rib	1
Hiodontidae	*Hiodon* sp.	vertebra, caudal	47
Hiodontidae	*Hiodon* sp.	vertebra, abdominal	57
Salmonidae	*Coregonus* sp.	interoperculum	1
Salmonidae	*Coregonus* sp.	posttemporal	1
Salmonidae	*Coregonus* sp.	vert caudal	2
Catostomidae	*Catostomus* sp.	dentary	1
Catostomidae	*Catostomus* sp.	hyomandibular	2
Catostomidae	*Catostomus* sp.	operculum	2
Catostomidae	*Catostomus* sp.	ray	6
Catostomidae	*Catostomus* sp.	rib	1
Catostomidae	*Catostomus* sp.	vertebra, caudal	7
Catostomidae	*Catostomus* sp.	vertebra, abdominal	6
Catostomidae	*Catostomus* sp.	vertebra	1
Ictaluridae	*Ictalurus* sp.	articular	1
Ictaluridae	*Ictalurus* sp.	branchiostegal	6
Ictaluridae	*Ictalurus* sp.	ceratobranchial	1
Ictaluridae	*Ictalurus* sp.	dentary	3
Ictaluridae	*Ictalurus* sp.	hyomandibular	2
Ictaluridae	*Ictalurus* sp.	interoperculum	3
Ictaluridae	*Ictalurus* sp.	operculum	1
Ictaluridae	*Ictalurus* sp.	palatine	1
Ictaluridae	*Ictalurus* sp.	premaxilla	1
Ictaluridae	*Ictalurus* sp.	preoperculum	1
Ictaluridae	*Ictalurus* sp.	ptergyoid	1
Ictaluridae	*Ictalurus* sp.	quadrate	2
Ictaluridae	*Ictalurus* sp.	cleithrum	8

Ictaluridae	*Ictalurus* sp.	coracoid	9
Ictaluridae	*Ictalurus* sp.	spine, pectoral	15
Ictaluridae	*Ictalurus* sp.	supracleithrum	2
Ictaluridae	*Ictalurus* sp.	basipterygium	3
Ictaluridae	*Ictalurus* sp.	spine, dorsal	3
Ictaluridae	*Ictalurus* sp.	pterygiophore	2
Ictaluridae	*Ictalurus* sp.	rib	1
Ictaluridae	*Ictalurus* sp.	spine	1
Ictaluridae	*Ictalurus* sp.	vertebra, abdominal	18
Ictaluridae	*Ictalurus* sp.	vertebra, caudal	22
Ictaluridae	*Ictalurus* sp.	vertebra, complex	2
Ictaluridae	*Ictalurus* sp.	vertebra, modifed 2nd	1
Ictaluridae	*Ictalurus* sp.	unidentified	1
Gadidae	*Lota lota*	vertebra, abdominal	1
Percidae	*Stizostedion* sp.	alisphenoid	1
Percidae	*Stizostedion* sp.	angular	1
Percidae	*Stizostedion* sp.	branchiostegal	2
Percidae	*Stizostedion* sp.	ceratohyal	1
Percidae	*Stizostedion* sp.	cranial	5
Percidae	*Stizostedion* sp.	dentary	1
Percidae	*Stizostedion* sp.	entopterygoid	1
Percidae	*Stizostedion* sp.	epihyal	1
Percidae	*Stizostedion* sp.	epiotic	1
Percidae	*Stizostedion* sp.	frontal	2
Percidae	*Stizostedion* sp.	hyomandibular	2
Percidae	*Stizostedion* sp.	interoperculum	1
Percidae	*Stizostedion* sp.	maxilla	2
Percidae	*Stizostedion* sp.	metapterygoid	1
Percidae	*Stizostedion* sp.	operculum	3
Percidae	*Stizostedion* sp.	palatine	1
Percidae	*Stizostedion* sp.	parasphenoid	2
Percidae	*Stizostedion* sp.	premaxilla	1
Percidae	*Stizostedion* sp.	prootic	1
Percidae	*Stizostedion* sp.	pterotic	2
Percidae	*Stizostedion* sp.	quadrate	1
Percidae	*Stizostedion* sp.	sphenotic	1
Percidae	*Stizostedion* sp.	suboperculum	1
Percidae	*Stizostedion* sp.	supraoccipital	2
Percidae	*Stizostedion* sp.	vomer	1
Percidae	*Stizostedion* sp.	cleithrum	4
Percidae	*Stizostedion* sp.	postcleithrum	2
Percidae	*Stizostedion* sp.	posttemporal	2
Percidae	*Stizostedion* sp.	supracleithrum	2
Percidae	*Stizostedion* sp.	basipterygium	3
Percidae	*Stizostedion* sp.	spine, dorsal	1
Percidae	*Stizostedion* sp.	hypural	1
Percidae	*Stizostedion* sp.	vertebra, abdominal	77
Percidae	*Stizostedion* sp.	vertebra, caudal	53
Sciaenidae	*Aplodinotus grunniens*	angular	2
Sciaenidae	*Aplodinotus grunniens*	branchiostegal	18

Sciaenidae	*Aplodinotus grunniens*	ceratobranchial	3
Sciaenidae	*Aplodinotus grunniens*	ceratohyal	3
Sciaenidae	*Aplodinotus grunniens*	hypohyal	1
Sciaenidae	*Aplodinotus grunniens*	cranial	2
Sciaenidae	*Aplodinotus grunniens*	epiotic	1
Sciaenidae	*Aplodinotus grunniens*	frontal	4
Sciaenidae	*Aplodinotus grunniens*	hyomandibular	3
Sciaenidae	*Aplodinotus grunniens*	interoperculum	1
Sciaenidae	*Aplodinotus grunniens*	lacrimal	1
Sciaenidae	*Aplodinotus grunniens*	maxilla	2
Sciaenidae	*Aplodinotus grunniens*	metapterygoid	1
Sciaenidae	*Aplodinotus grunniens*	operculum	3
Sciaenidae	*Aplodinotus grunniens*	palatine	1
Sciaenidae	*Aplodinotus grunniens*	otolith	3
Sciaenidae	*Aplodinotus grunniens*	parasphenoid	2
Sciaenidae	*Aplodinotus grunniens*	pharyngeal plate	1
Sciaenidae	*Aplodinotus grunniens*	premaxilla	2
Sciaenidae	*Aplodinotus grunniens*	preoperculum	6
Sciaenidae	*Aplodinotus grunniens*	prootic	2
Sciaenidae	*Aplodinotus grunniens*	sphenotic	1
Sciaenidae	*Aplodinotus grunniens*	suboperculum	1
Sciaenidae	*Aplodinotus grunniens*	supraoccipital	1
Sciaenidae	*Aplodinotus grunniens*	urohyal	2
Sciaenidae	*Aplodinotus grunniens*	vomer	1
Sciaenidae	*Aplodinotus grunniens*	cleithrum	22
Sciaenidae	*Aplodinotus grunniens*	coracoid	10
Sciaenidae	*Aplodinotus grunniens*	ray, pectoral	1
Sciaenidae	*Aplodinotus grunniens*	spine, pectoral	20
Sciaenidae	*Aplodinotus grunniens*	postcleithrum#1	17
Sciaenidae	*Aplodinotus grunniens*	postcleithrum #2	15
Sciaenidae	*Aplodinotus grunniens*	postcleithrum	2
Sciaenidae	*Aplodinotus grunniens*	posttemporal	3
Sciaenidae	*Aplodinotus grunniens*	scapula	9
Sciaenidae	*Aplodinotus grunniens*	supracleithrum	8
Sciaenidae	*Aplodinotus grunniens*	basipterygium	26
Sciaenidae	*Aplodinotus grunniens*	spine, anal	18
Sciaenidae	*Aplodinotus grunniens*	spine, dorsal	66
Sciaenidae	*Aplodinotus grunniens*	hypural	2
Sciaenidae	*Aplodinotus grunniens*	interhaemal	19
Sciaenidae	*Aplodinotus grunniens*	interhaemal, anal	3
Sciaenidae	*Aplodinotus grunniens*	pterygiophore	13
Sciaenidae	*Aplodinotus grunniens*	rib/ray	1
Sciaenidae	*Aplodinotus grunniens*	spine	1
Sciaenidae	*Aplodinotus grunniens*	vertebra, abdominal	58
Sciaenidae	*Aplodinotus grunniens*	vertebra, caudal	82
Sciaenidae	*Aplodinotus grunniens*	vertebra, penultimate	1
Sciaenidae	*Aplodinotus grunniens*	vertebra, ultimate	1
Sciaenidae	*Aplodinotus grunniens*	vertebra	3
Sciaenidae	*Aplodinotus grunniens*	undetermined	9
fish	fish	branchial	1

fish	fish	branchiostegal	16
fish	fish	ceratobranchial	1
fish	fish	ceratohyal	1
fish	fish	dentary	2
fish	fish	epibranchial	1
fish	fish	hypohyal	1
fish	fish	mandible	1
fish	fish	operculum	1
fish	fish	otolith	1
fish	fish	urohyal	1
fish	fish	scale	1078
fish	fish	cleithrum	2
fish	fish	spine, pectoral	1
fish	fish	supracleithrum	1
fish	fish	spine, dorsal	13
fish	fish	ray	430
fish	fish	hypural	1
fish	fish	spine	11
fish	fish	pterygiophore	134
fish	fish	rib	347
fish	fish	rib/ray	86
fish	fish	vertebra, abdominal	9
fish	fish	vertebra, caudal	6
fish	fish	vertebra	47
fish	fish	undetermined	105
fish	fish	unidentifiable	162

Appendix II, Table 10. Upper Fort Garry sample, fish element frequencies

Family	Taxon	Element	Quantity
Sciaenidae	*Aplodinotus grunniens*	otolith	1
Sciaenidae	*Aplodinotus grunniens*	vertebra, caudal	1
Catostomidae	*Catostomus* sp.	branchiostegal	5
Catostomidae	*Catostomus* sp.	epihyal	1
Catostomidae	*Catostomus* sp.	interoperculum	6
Catostomidae	*Catostomus* sp.	ethmoid	2
Catostomidae	*Catostomus* sp.	operculum	4
Catostomidae	*Catostomus* sp.	preoperculum	3
Catostomidae	*Catostomus* sp.	prootic	1
Catostomidae	*Catostomus* sp.	pterotic	3
Catostomidae	*Catostomus* sp.	parietal	4
Catostomidae	*Catostomus* sp.	sphenotic	6
Catostomidae	*Catostomus* sp.	suboperculum	4
Catostomidae	*Catostomus* sp.	supraoccipital	2
Catostomidae	*Catostomus* sp.	vomer	1
Catostomidae	*Catostomus* sp.	entopterygoid	1
Catostomidae	*Catostomus* sp.	hyomandibular	2
Catostomidae	*Catostomus* sp.	frontal	1
Catostomidae	*Catostomus* sp.	prefrontal	1
Catostomidae	*Catostomus* sp.	cleithrum	1
Salmonidae	*Coregonus* sp.	angular	1
Salmonidae	*Coregonus* sp.	ceratohyal	1
Salmonidae	*Coregonus* sp.	dentary	1
Salmonidae	*Coregonus* sp.	frontal	2
Salmonidae	*Coregonus* sp.	hyomandibular	3
Salmonidae	*Coregonus* sp.	interoperculum	1
Salmonidae	*Coregonus* sp.	operculum	9
Salmonidae	*Coregonus* sp.	parasphenoid	2
Salmonidae	*Coregonus* sp.	preoperculum	8
Salmonidae	*Coregonus* sp.	suboperculum	4
Salmonidae	*Coregonus* sp.	urohyal	1
Salmonidae	*Coregonus* sp.	cleithrum	9
Salmonidae	*Coregonus* sp.	posttemporal	1
Salmonidae	*Coregonus* sp.	scapula	1
Salmonidae	*Coregonus* sp.	supracleithrum	1
Salmonidae	*Coregonus* sp.	pubis	6
Salmonidae	*Coregonus* sp.	vertebra, abdominal	1
Cyprinidae	*Cyprinus carpio*	vertebra, caudal	4
Hiodontidae	*Hiodon* sp.	angular	1
Hiodontidae	*Hiodon* sp.	hyomandibular	4
Hiodontidae	*Hiodon* sp.	maxilla	1
Hiodontidae	*Hiodon* sp.	operculum	6
Hiodontidae	*Hiodon* sp.	premaxilla	1
Hiodontidae	*Hiodon* sp.	preoperculum	10
Hiodontidae	*Hiodon* sp.	quadrate	1
Hiodontidae	*Hiodon* sp.	vomer	2
Hiodontidae	*Hiodon* sp.	cleithrum	10
Hiodontidae	*Hiodon* sp.	posttemporal	2

Hiodontidae	*Hiodon* sp.	vertebra, abdominal	1
Perciformes	Perciformes	cleithrum	1
Percopsidae	Percopsidae	sternum?	1
Percidae	Percidae	palatine	1
Percidae	Percidae	parasphenoid	2
Percidae	Percidae	prootic	1
Percidae	Percidae	cleithrum	4
Percidae	Percidae	pubis	1
Percidae	*Stizostedion* sp.	angular	4
Percidae	*Stizostedion* sp.	ceratohyal	3
Percidae	*Stizostedion* sp.	dentary	4
Percidae	*Stizostedion* sp.	epihyal	1
Percidae	*Stizostedion* sp.	frontal	2
Percidae	*Stizostedion* sp.	hyomandibular	1
Percidae	*Stizostedion* sp.	interoperculum	4
Percidae	*Stizostedion* sp.	lateral ethmoid	1
Percidae	*Stizostedion* sp.	maxilla	6
Percidae	*Stizostedion* sp.	nasal	1
Percidae	*Stizostedion* sp.	operculum	5
Percidae	*Stizostedion* sp.	palatine	3
Percidae	*Stizostedion* sp.	parasphenoid	2
Percidae	*Stizostedion* sp.	premaxilla	4
Percidae	*Stizostedion* sp.	preoperculum	7
Percidae	*Stizostedion* sp.	pterygoid	3
Percidae	*Stizostedion* sp.	quadrate	4
Percidae	*Stizostedion* sp.	suboperculum	6
Percidae	*Stizostedion* sp.	cleithrum	5
Percidae	*Stizostedion* sp.	coracoid	1
Percidae	*Stizostedion* sp.	scapula	1
Percidae	*Stizostedion* sp.	supracleithrum	3
Percidae	*Stizostedion* sp.	pubis	1
Percidae	*Stizostedion* sp.	rib	4
Percidae	*Stizostedion* sp.	vertebra, abdominal	10
Ictaluridae	*Ictalurus* sp.	angular	2
Ictaluridae	*Ictalurus* sp.	ceratohyal	1
Ictaluridae	*Ictalurus* sp.	epihyal	1
Ictaluridae	*Ictalurus* sp.	weberian apparatus	1
Ictaluridae	*Ictalurus* sp.	cleithrum	6
Ictaluridae	*Ictalurus* sp.	pectoral spine	3
Ictaluridae	*Ictalurus* sp.	posttemporal	1
Ictaluridae	*Ictalurus* sp.	dermal bones?	1
fish	fish	branchiostegal	32
fish	fish	ceratohyal	1
fish	fish	frontal	5
fish	fish	hyomandibular	1
fish	fish	interoperculum	1
fish	fish	operculum	3
fish	fish	preoperculum	2
fish	fish	quadrate	1
fish	fish	suboperculum	3

fish	fish	urohyal	2
fish	fish	head bones	4
fish	fish	scale	57
fish	fish	cleithrum	2
fish	fish	pectoral spine	8
fish	fish	posttemporal	1
fish	fish	pubis	1
fish	fish	vertebra, abdominal	62
fish	fish	vertebra	90
fish	fish	ray	243
fish	fish	rib	381
fish	fish	spine	77
fish	fish	vertebra, caudal	108
fish	fish	unidentified	29
fish	fish	unidentified	340

Appendix II, Table 11. Archaic sample mammal body area summary

Bison bison	fore, lower	2
	fore, upper	2
	hind, lower	2
	hing, upper	3
	limb	1
	limb, lower	1
	trunk	92
Alces alces	head	1
	trunk	1
Odocoileus sp.	fore, lower	2
	hind, upper	2
	limb, lower	3
	trunk	3
Cervidae	fore, lower	2
	hind, lower	1
	hind, upper	1
	unk	2
Artiodactyla	head	2
Canis latrans	fore, upper	1
	hind, lower	1
	limb, lower	1
C.latrans?familiaris?	fore, upper	1
Canis lupus	fore, upper	1
	head	2
Vulpes sp.	fore, lower	1
Vulpes vulpes	fore, lower	22
	fore, upper	17
	head	4
	hind, lower	38
	hind, upper	32
	limb, lower	73
	trunk	109
Canidae	head	1
Lutra canadensis	fore, upper	1
	hind, upper	1
Martes pennanti	fore, lower	6
	fore, upper	8
	head	4
	hind, lower	7
	hind, upper	9
	trunk	44
	limb, lower	12
Mustela vison	trunk	18
Mustelidae	head	1
	limb, lower	12
	trunk	7
Ursus americanus	hind, upper	1
Carnivora	head	1
	hind, upper	4

	limb, lower	1
	trunk	1
Leporidae	head	4
	trunk	1
Castor canadensis	head	27
Sciurus sp.	fore, upper	2
	hind, upper	2
Sciuridae	head	3
	hind, upper	4
Large mammal	head	18
	hind, upper	2
	limb	490
	limb, lower	6
	trunk	98
	unk	1488
Medium mammal	fore, upper	1
	head	1
	limb	30
	limb, lower	4
	trunk	43
	unk	64
Medium/Large mammal	fore, upper	1
	head	1
	limb	36
	trunk	9
	unk	1949
Small mammal	limb	3
Small/Medium mammal	head	1
	limb	17
	trunk	8
	unk	7
Mammal, undifferentiated	head	2
	limb	23
	trunk	1
	unk	562

Appendix II, Table 12. Blackduck sample mammal body area summary

Alces alces	head	1
	limb, lower	2
Alces/Cervus	hind, upper	1
	trunk	1
Cervus canadensis	head	2
Artiodactyla	fore, upper	9
	head	28
	hind, lower	2
	hind, upper	4
	limb	2
	limb, lower	7
	trunk	11
	unk	1
Bison bison	fore, lower	5
	fore, upper	7
	hind, lower	7
	hind, upper	1
	limb, lower	4
	unk	2
Bison/Bos	fore, lower	1
	fore, upper	2
	head	4
	hind, lower	3
	hind, upper	3
	limb, lower	8
	trunk	5
	unk	1
Bos taurus	fore, upper	3
	head	3
	hind, upper	2
	limb, lower	1
Canis sp.	trunk	6
Canis familiaris	head	2
Canis latrans	trunk	2
C. latrans/familiaris	fore, upper	1
	hind, lower	3
Canis lupus	limb, lower	1
C. lupus/familiaris	head	1
Castor canadensis	fore, lower	1
	fore, upper	10
	head	14
	hind, upper	5
	limb, lower	2
	trunk	6
	unk	1
Lepus americanus	fore, upper	1
	head	18
	hind, upper	1

	limb	6
	limb, lower	1
	trunk	5
Lutra canadensis	hind, lower	1
Ondatra zibethicus	fore, upper	4
Ovis aries	fore, upper	1
Procyon lotor	head	1
Urocyon cinereoargenteus	head	1
Vulpes vulpes	head	1
Mammal, undifferentiated	fore, upper	3
	head	35
	hind, upper	5
	limb	60
	limb, lower	2
	trunk	82
	unk	3433

Appendix II, Table 13. Fort Gibraltar I sample, mammal body area summary

Mammal, undifferentiated	fore, lower	1
	fore, upper	18
	head	73
	hind, lower	2
	hind, upper	24
	limb	93
	limb, lower	37
	trunk	233
	unk	11989
Artiodactyla	fore, lower	2
	fore, upper	5
	head	18
	hind, lower	2
	hind, upper	6
	limb	17
	limb, lower	14
	trunk	29
	unk	2
Bovidae	fore, lower	1
	fore, upper	9
	head	4
	hind, lower	1
	hind, upper	6
	limb	42
	limb, lower	5
	trunk	2
Bison bison	fore, lower	1
	fore, upper	3
	hind, lower	3?
	hind, upper	3
	limb, lower	2
Ovis aries	hind, upper	1
	trunk	1
Cervidae	fore, upper	1
	trunk	1
Alces alces	limb, lower	1
Cervus canadensis	fore, lower	3
	fore, upper	12
	head	1
	hind, upper	3
	limb, lower	4
	trunk	3
Sus scrofa	limb, lower	2
	head	1
	trunk	1
Carnivora	head	2
	limb, lower	1
Canidae	fore, upper	4
	head	8

Canis sp.	head	5
	hind, upper	1
Vulpes sp.	head	1
Ondatra zibethicus	fore, lower	1
	fore, upper	3
	head	1
	hind, lower	2
	hind, upper	3
	trunk	3
Sciuridae	head	1
	fore, upper	1
Lynx lynx	head	2
Mephitis mephitis	fore, upper	1
Taxidea taxus	hind, lower	1
Ursus americanus	head	1
Leporidae	fore, upper	2
	head	4
	hind, upper	1
	limb, lower	4
Lepus sp.	head	3
Sylvilagus sp.	fore, upper	1
Equus caballus	fore, lower	3
	fore, upper	2
	head	3
	hind, lower	2
	hind, upper	1
Rodentia	fore, upper	4
	head	34
	hind, upper	1
	limb	1
Castor canadensis	fore, lower	6
	fore, upper	9
	head	5
	hind, lower	10
	hind, upper	5
	limb, lower	15
	trunk	20
Cricetidae	fore, upper	2
	head	41
	hind, upper	16
	limb, lower	1

Appendix II, Table 14. Fort Garry sample, mammal body area summary

Taxon	Body area	Quantity
Bison bison	hind, upper	1
	limb, lower	2
	trunk	5
Bison/Bos	fore, lower	4
	fore, upper	24
	head	23
	hind, lower	8
	hind, upper	17
	limb	2
	limb, lower	14
	trunk	80
	unk	25
Bos taurus	fore, lower	15
	fore, upper	4
	head	1
	hind, lower	12
	hind, upper	7
	limb, lower	5
	trunk	64
Capra hircus	hind, lower	1
Ovis aries	fore, lower	27
	fore, upper	8
	head	5
	hind, lower	19
	hind, upper	6
	limb, lower	37
	trunk	1
Ovis/Capra	fore, upper	17
	head	30
	hind, lower	6
	hind, upper	11
	limb, lower	15
	trunk	81
Bovidae - large	fore, upper	1
	hind, upper	2
	limb	2
	limb, lower	1
	trunk	11
	unk	1
Bovidae - medium	trunk	1
Bovidae - med/lge	fore, upper	1
	head	6
	trunk	3
	unk	1
Bovidae - no size	trunk	4
Odocoileus sp.	hind, upper	1
Sus scrofa	fore, lower	13
	fore, upper	12

	head	38
	hind, lower	8
	hind, upper	15
	limb, lower	12
	trunk	28
Artiodactyla	fore, upper	9
	head	30
	hind, upper	10
	limb	6
	limb, lower	9
	trunk	64
	unk	2
Canis domesticus	head	1
Canis latrans	trunk	1
Canis sp.	fore, upper	1
	head	2
	hind, upper	1
	trunk	2
Vulpes vulpes	hind, lower	7
	limb, lower	2
Canidae	limb, lower	2
Carnivora	head	1
Lepus americanus	fore, upper	49
	fore, lower	71
	head	30
	trunk	1
	hind, lower	222
	hind, upper	35
	limb, lower	36
Lepus sp.	head	2
	hind, lower	1
	hind, upper	4
	trunk	1
Leporidae	fore, lower	1
	fore, upper	5
	head	18
	hind, lower	6
	hind, upper	8
	limb	1
	limb, lwoer	3
	trunk	6
Equus caballus	trunk	1
Castor canadensis	fore, upper	1
	hind, lower	7
	trunk	1
Sciurus sp.	fore, lower	2
Tamasciurus hudsonicus	head	2
Sciuridae	hind, upper	1
Rodentia	limb	1
Mammal - no size	head	108

	fore, lower	13
	fore, upper	13
	hind, lower	13
	hind, upper	12
	limb	60
	limb, lower	116
	trunk	113
	unk	80
Mammal - large	fore, upper	4
	head	30
	hind, upper	2
	limb	94
	limb, lower	3
	limb, upper	1
	trunk	49
	unk	285
Mammal - medium/large	head	72
	trunk	59
	unk	2219
	limb	95
	fore, lower	1
	fore, upper	1
	hind, upper	3
	limb, lower	3
	limb, upper	2
Mammal - medium	fore, upper	1
	head	17
	hind, upper	3
	limb	28
	limb, lower	5
	trunk	61
	unk	116
Mammal - small	fore, upper	2
	head	11
	limb	18
	limb, lower	3
	trunk	8
	unk	20
Mammal - small/medium	head	6
	limb	9
	trunk	4
	unk	97

Appendix II, Table 15. Upper Fort Garry sample mammal body area summary

Taxon	Body area	Quantity
Antilocapra americana	hind, upper	1
Artiodactyla	fore, upper	1
	head	3
	hind, lower	2
	trunk	8
	hind, upper	1
Bison bison	fore, upper	2
	head	2
	hind, upper	3
	trunk	3
Bos taurus	fore, lower	2
	fore, upper	9
	head	2
	hind, lower	3
	hind, upper	4
	trunk	15
Bovidae	fore, lower	20
	fore, upper	22
	head	1
	hind, lower	3
	hind, upper	19
	limb, lower	13
	trunk	88
	unk	2
Canis sp.	trunk	1
Capra hircus	fore, upper	3
	hind, lower	2
	hind, upper	5
	trunk	7
Cervidae	hind, lower	1
Cervus canadensis	head	1
Equus caballus	hind, upper	1
Insectivora	unk	1
Mammal, large	fore, upper	9
	head	3
	hind, upper	5
	limb	57
	limb, lower	2
	trunk	176
	unk	115
Leporidae	fore, lower	4
	fore, upper	1
	limb, lower	6
	trunk	1
Lepus sp.	hind, lower	2
	limb, lower	6
Lepus americanus	fore, upper	12
	head	13

	hind, lower	4
	hind, upper	20
	limb, lower	2
	trunk	6
Lynx lynx	fore, upper	1
	head	11
	limb, lower	1
	unk	2
Mammal - no size	fore, upper	12
	head	30
	limb	20
	trunk	61
	unk	148
Mammal - medium	fore, upper	2
	hind, upper	1
	limb	10
	limb, lower	3
	trunk	32
	unk	40
Mammal - medium/large	fore, upper	1
	head	1
	hind, upper	3
	limb	22
	trunk	43
	unk	74
Ovis aries	fore, upper	3
	head	1
	hind, upper	2
	trunk	29
Mammal - small/medium	fore, upper	2
	head	2
	hind, upper	1
	limb	1
	limb, lower	6
	trunk	9
	unk	9
Mammal - small	head	2
	limb	2
.	trunk	1
	unk	2
Soricidae	fore, lower	1
	head	2
Sus scrofa	fore, lower	1
	fore, upper	6
	head	5
	hind, lower	3
	hind, upper	14
	limb, lower	1
	trunk	16
Sylvilagus floridanus	fore, upper	2

	hind, upper	1
Ursus americanus	head	1
Vulpes vulpes	head	65
	trunk	4

Appendix III, Table 1. Modern sample data for *Ictalurus* sp. pectoral spine analysis

SPECIMEN #	WEEK #	Morey's growth index
229-1627	22	14.28571429
232-1633	22	16.66666667
228-1625	22	57.14285714
227-1623	22	50
216-1603	22	50
182-1541	21	33.33333333
155-1481	21	33.33333333
152-1475	21	25
140-1451	21	25
119-1409	21	20
116-1403	21	33.33333333
81-1285	21	25
82-1287	21	28.57142857
63-1249	20	16.66666667
55-1233	20	16.66666667
46-1215	20	30
37-1197	20	25
35-1191	20	16.66666667
22-997	20	12.5
20-993	20	25
19-991	20	40
1-1157, 1158, 1159	19	50
3-1160, 1163	19	12.5
13-977	19	40
K4A	31	34.88372093

Appendix III, Table 2. *Ictalurus* sp. pectoral spine data for archaeological specimens

Sample	Growth Index	Growth Index.[363]	Estimate of DOD	Week
Archaic	16.67	2.7769	May 21-27	21
Archaic	25	3.217	June 18-24	25
Archaic	33.33	3.571	July 9-15	28
Archaic	80	4.9071	Oct 8-14	41
Blackduck II	20	2.9667	June 4-10	23
Blackduck II	25	3.217	June 18-24	25
Blackduck III	25	3.217	June 18-24	25
Blackduck III	25	3.217	June 18-24	25
Blackduck III	33.33	3.571	July 9-15	28
Blackduck IV	60	4.42	Sept 3-9	36
Blackduck I	66.67	4.593	Sept 10-16	37
Blackduck III	100	5.321	Nov-Dec	49
Fort Gibraltar I	25	3.217	June 18-24	25
Fort Gibraltar I	25	3.217	June 18-24	25
Fort Gibraltar I	33.33	3.571	July 9-15	28
Fort Gibraltar I	33	3.558	July 9-15	28
Fort Gibraltar I	33	3.558	July 9-15	28
Fort Gibraltar I	33	3.558	July 9-15	28
Fort Gibraltar I	33	3.558	July 9-15	28
Fort Gibraltar I	62.5	4.486	Sept 3-9	36
Fort Gibraltar I	62.5	4.486	Sept 3-9	36
Fort Gibraltar I	71.43	4.709	Sept 24-30	39
Fort Gibraltar I	80	4.907	Oct 8-14	41
Fort Garry	25	3.217	June 18-24	25
Fort Garry	50	4.137	Aug 13-19	33
Fort Garry	66.67	4.593	Sept 10-16	37
Fort Garry	80	4.907	Oct 8-14	41
Upper Fort Garry	100	5.321	Nov-Dec	49
Upper Fort Garry	100	5.321	Nov-Dec	49