PROTO-HURON/PETUN AND PROTO-ST. LAWRENCE IROQUOIAN SUBSISTENCE AS CULTURALLY DEFINING

by

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ABSTRACT

This zooarchaeological study compares the diets of two groups of Iroquoians *ca.* A.D. 1500. One group is the proto-Huron/Petuns in York County and the other is the proto-St. Lawrence Iroquoians in Grenville County, Ontario. The zooarchaeological remains from one village in each area provide most of the comparative data. For the proto-Huron/Petuns, the zooarchaeological sample from the Keffer site (AkGv-14) is used and for the proto- St. Lawrence Iroquoians, the McKeown site (BeFv-1). Standard procedures for faunal identifications are used, but some modifications are made to accepted methods of analysis to adapt them to these Iroquoian samples. Because the Iroquoians were horticulturalists, palaeoethnobotanical evidence from the two sites and the two areas is considered as is previous work on Ontario human and animal skeletal remains.

Contrasts were found between the Keffer and McKeown zooarchaeological samples. Comparisons with faunal remains from contemporaneous sites in the same two areas confirmed the distinctions. There are differences in the particular species exploited and in the degrees to which the same animals were exploited.

It is concluded that the proto-Huron/Petuns had a more nutritious diet than that of the proto-St. Lawrence Iroquoians. This was likely influential in the success of proto-Huron/Petuns and the decline of the proto-St. Lawrence Iroquoians. This Iroquoian material supports Malthus' position that population growth is dependent upon agriculture as opposed to Boserup's position that growth causes changes in food production.

RÉSUMÉ

Il s'agit d'une étude zooarchéologique qui consiste à analyser et à comparer les régimes alimentaires entre deux groupes d'Iroquois vers 1500 (après Jésus-Christ). Le premier groupe comprend les proto-Hurons/Pétuns dans le comté de York, et le deuxième groupe se compose de proto-Iroquois du Saint-Laurent dans le comté de Grenville, en Ontario. Les ossements archéologiques provenant de deux villages constituent la plus grande partie des données de base de cette étude comparative. L'échantillon zooarchéologique du groupe proto-Hurons/Pétuns provient du site Keffer (AKGv-14), comté York, Ontario; quant aux proto-Iroquois du Saint Laurent, les restes fauniques proviennent du site McKeown (BeFv-1), comté Grenville, Ontario.

Les méthodes "standard" d'analyse et d'identification des restes fauniques sont utilisées pour satisfaire aux données de base. Cependant, certaines modifications s'avèrent nécessaires parce que les Iroquois étaient horticulteurs. Il a donc fallu tenir compte des vestiges paléoethnobotaniques provenant des deux sites ainsi que des travaux antérieurs portant sur des ossements humains et animaux trouvés en Ontario.

Les données zooarchéologiques révèlent des contrastes entre le site Keffer et le site McKeown. Les études comparatives faites des restes fauniques provenant d'autres sites contemporains confirment les différences entre ces deux régions. Les différences sont d'ordre quantitatif en ce qui concerne les mêmes espèces d'animaux; il faut également noter les différences entre les animaux consommés par chacun de ces deux villages. Les données botaniques et les vestiges humains d'ordre ostéologique appuient les découvertes fauniques.

Cette recherche mène à la conclusion suivante : les proto-Hurons/Pétuns avaient un régime alimentaire plus nutritif que les proto-Iroquois du Saint-Laurent. Il est fort probable que ce fait explique le succès des proto-Hurons/Pétuns et le déclin des proto-Iroquois. La conclusion renforce la position théorique proposée par Malthus selon laquelle les hausses de la population sont liées à l'essor de l'agriculture et non l'inverse comme l'a proposé Boserup.

PREFACE AND ACKNOWLEDGEMENTS

This study of the zooarchaeological remains from two roughly contemporary Iroquoian villages demonstrates that faunal remains can be used effectively to differentiate populations and provide explanations for their histories. Accepting the premise that subsistence is basic to all societies, it is essential that this sort of archaeological data be incorporated into Iroquoian research as fully as ceramic or settlement data have been and that subsistence be considered carefully when Iroquoian history is being reconstructed. Iroquoian zooarchaeological data are presented often as merely an appendix or a separate chapter of an archaeological report, whereas such data should be integrated with other data and used in explanations of human behaviour and cultural histories. In this dissertation, ethnohistorical descriptions relating to food as well as the available biological and palaeoethnobotanical research on the Iroquoians are considered along with the zooarchaeological material to arrive at a better understanding of the nutrition of the proto-Huron/Petuns and the proto-St. Lawrence Iroquoians.

For almost 400 years people have wondered about the demise of the people now called the St. Lawrence Iroquoians and the prosperity of the Huron/Petuns. In this dissertation, it is argued that there were important differences in subsistence between the proto-St. Lawrence Iroquoians and the proto-Huron/Petuns and that these differences likely contributed to the markedly different histories of these two groups. Following accepted practice, the word Iroquoian in this work refers to the speakers of Iroquoian languages, whereas the term Iroquois refers to five confederated Iroquoian speaking groups located south of the Great Lakes. Iroquoians in southern Ontario included many groups who saw themselves as distinct; in this dissertation those living around A.D. 1500 in Grenville County are referred to as proto-St. Lawrence Iroquoians of the Prescott cluster and those living in York County as proto-Huron/Petuns.

The specific work relating to this dissertation has been done over the past five years (1992-1997) with the help of the members of my supervisory committee and others in the Department of Anthropology at McGill University. My advisor, Dr. Bruce Trigger, filled his role superbly and it is to him that I owe the greatest thanks. His influence extends to before I returned to university for doctoral studies in 1992. At the 1990 Canadian Archaeological Association Annual Meeting in Whitehorse, Dr. Trigger expressed interest in my paper on floatation and the Keffer site sample. On another occasion, on a visit to Fredericton to give an address on Dr. Alfred Bailey's contributions to ethnohistory, Dr. Trigger's plane arrived late and instead of touring an historic site he spent the afternoon at my home. These fortuitous events were influential in my applying to the PhD programme at McGill University. Once there, Dr. Trigger guided me through the requirements of the programme and continued to meet weekly with me well into the summer. In 1992-1993, Dr. Trigger led a graduate seminar on processual and post-processual archaeology which was very educational and influential for me. In addition, Dr. Trigger has provided many useful suggestions for improvements in both the content and style of this dissertation. I cannot imagine a better supervisor. I was also fortunate in my other supervisors. Dr. Fumiko Ikawa-Smith, despite heavy administrative duties, agreed to have me study palaeonutrition with her. She directed me through that literature and has been most helpful with all the physical anthropology aspects of my research and their incorporation into this dissertation. Dr. James Savelle's expertise in zooarchaeology aided me immeasurably in my studies and our discussions of zooarchaeological methods and theory were very beneficial to me. He too has made many useful suggestions about the analysis and the presentation of the results in this work. I also thank Dr. Michael Bisson who read and commented on the two long chapters on the zooarchaeological samples from the Keffer and McKeown sites and answered specific queries about the descriptions and names of fish in the ethnohistorical sources. As well, I thank my fellow graduate students who welcomed me into their midst, even making a space for me in the crowded archaeology lab, and became my friends. Rob Danielson, Max Friesen, Lynda Gullison, and Junko Habu helped to make my stay in Montreal a really enjoyable one.

Many people assisted me in the work on which this dissertation is based. Dr. William Finlayson, London Museum of Archaeology, contracted me to identify and analyze the zooarchaeological material he had excavated from the Keffer site. From April 2 to June 27, 1986 and from September 3 to December 22, 1986, the faunal specimens were identified in my laboratory in Fredericton. For three days late in December, I identified the turtle specimens at the University of Toronto in Dr. Howard Savage's laboratory and in January 1987, I identified the bird bones in the Department of Ornithology at the Royal Ontario Museum. In February, in Fredericton, 180 artifactual pieces made from skeletal elements were identified. Research and writing continued until June 3, 1987 when the completed 212 page report was submitted to William Finlayson. Thus, I worked part-time on the 9,243 vertebrate skeletal specimens excavated from the largest midden of the Keffer site for over a year. In April and May 1986, Louise Hale, a student I had supervised in a reading course on faunal analysis, was subcontracted by me to sort this midden material to class and label it, while I was teaching. I thank Louise for her careful work. After the specimens were sorted to class, I examined each one to determine its origin to as low a zoological taxon as possible. In addition each was carefully observed for evidence of modifications by either natural or human agencies. Often this latter task was performed using a simple binocular microscope with an external light source and a magnification of up to 40 times. Once these observations were made, coded and entered in the computer for each specimen, they were checked and the coding was verified. This aspect of faunal work, which is extremely time consuming, is essential to create a reliable data base.

For allowing me access to his excellent collection and for his opinions on some of the difficult identifications, I thank Dr. Howard Savage. Similarly, the members of the ROM's Ornithology Department were very helpful when I was a visiting scholar there identifying the bird bones as well as on later occasions when

I identified more Keffer bird bones as well as those from the McKeown site. In particular, I thank Dr. James Dick of that department. Most of the specimens from the other classes were identified using my own reference collection which I enlarged by preparing southern Ontario specimens, particularly fish, to allow more detailed identifications. I thank all those who have donated specimens for my reference collection. Some of the identifications were verified in the University of Toronto's faunal lab with Dr. Howard Savage who, as always, was very helpful and encouraging. Dr. Savage introduced me to faunal research and for that and his friendship and assistance ever since, I am sincerely grateful.

One of the terms of the Keffer contract was that the research be done on computer. Dr. James Burns, University of Alberta, had written a coding manual for the zooarchaeological mammal remains from the Draper site which was used as the basis for the Keffer code. I am very appreciative of Jim's work on this. I enlarged his code for the mammals and devised my own for the other classes. Thanks are due to the University of New Brunswick, where as a Research Associate I am given library and computer privileges, for allowing me use of their computing system. In particular I thank Nancy Burnham, Programmer Analyst of UNB's Computing Centre, for her cheerful help with my data entry and manipulation. With 76 possible entries for each specimen this task took many months, as did entering the data into the University of New Brunswick mainframe. Dr. Gail R. Pool, Department of Anthropology, University of New Brunswick, is thanked for his weeks of work on the computer, helping me with the data entry and formatting for SPSS programmes. I also thank the University of New Brunswick librarians who often helped locate sources and cheerfully processed my numerous requests for inter-library loans.

The research on the zooarchaeological sample from Keffer Midden 57 was the basis of my 1990 paper at the Annual Meeting of the Canadian Archaeological Association, mentioned above. That paper was enlarged and published in 1991 in the *Canadian Journal of Archaeology*.

In May 1990, I was again contracted by William Finlayson to analyze material from the Keffer site. This time 2,880 remains, excavated in 1988 from the undisturbed parts of four houses and two small middens, were identified. This research and the writing of a report on these remains followed a pattern similar to that summarized above for the Midden 57 study. For 23 days in May and June 1990, the fish and mammalian remains from four houses were identified and the data were entered into the computer in Fredericton. In August, the bird and turtle remains from these houses were identified in Toronto, as were the faunal specimens from two small internal middens. In September, I began to analyze the identifications and a 262 page monograph combining the results of both Keffer studies was submitted on October 25, 1990.

A paper comparing the faunal samples in the Keffer middens to those in the houses was presented at the 1991 Annual Meeting of the Canadian Archaeological Association. In the same year, the Keffer monograph was sent out for review and published as Research Report 21 of the then Museum of Indian

Archaeology (London). This publication forms the basis for the material presented in chapter 6 of this dissertation. For his continuing support of my work, I owe Bill Finlayson many thanks. More specifically, relating to my research for this dissertation, I appreciate his prompt and generous responses to my questions and requests for information. In this he was ably assisted by Dr. David Smith, whom I also thank. Finally, crew members on the site were very welcoming and patient with my questions about the faunal material they were finding and suggestions about how it should be treated.

Between the two Keffer contracts, I worked on material from the McKeown site. For entrusting those specimens to me as well as for his help during the analysis and the warm welcome he extended to me and my family when we visited the site, I thank Dr. James Pendergast. Following a pattern similar to that detailed above for the Keffer research, from April to September 30, 1988, I analyzed 4,536 macrofaunal remains from three longhouses on the McKeown site and on October 19, 1988 I submitted a 124 page monograph to Dr. Pendergast on this material. Several anthropology students at the University of New Brunswick aided in the initial sorting of this material. In particular, I thank David Fahey who also compiled data on the freshwater mollusc distributions in southern Ontario. Throughout this period and during the additional research for this dissertation, Dr. Pendergast was most generous with the data from this site, much of it as yet unpublished.

My work on the McKeown faunal sample was presented at the 1989

Annual Meeting of the Canadian Archaeological Association. This paper, which was on the unexpected scarcity of dog remains and the numerous bear specimens, was published the same year in *The Ottawa Archaeologist*. In 1992, my article on the macrofaunal remains from McKeown was published in *Ontario Archaeology*. This material is included in chapter 7 of this dissertation.

The unsorted float samples from one of the McKeown houses was loaned to me by the Archaeological Survey of Canada, Canadian Museum of Civilization, through the efforts of Robert Pammett, Collections Management Section. I thank him for his help in locating these specimens and processing the loan of this material, with the approval of Jim Pendergast and Dawn Wright. Dr. David Keenlyside, Atlantic Archaeologist, Archaeological Survey of Canada, Canadian Museum of Civilization, kindly returned these specimens to the museum for me. The Canadian Museum of Civilization is also thanked for providing photocopies of information filed in their archives on the Keffer site and for giving me permission to reproduce A.J. Clark's 1925 map of the Keffer site. I thank Geneviève Eustache and Nicole Chamberland, Information Management Services, for their assistance in providing a reproduction of this map.

From March through June 1994, I sorted the microfaunal remains from the McKeown House 2 float samples, identified the 5,392 microfaunal specimens recovered, entered these data into the computer and checked the identifications and the entries. These microfaunal specimens are included in chapter 7. They were also the basis for a paper on the most appropriate quantification methods for the

McKeown sample which I presented to the Eastern States Archaeological Federation in 1994. These ideas were expanded in a plenary session presentation at the Manitoba Archaeological Society Meeting in September 1994. This paper in turn was enlarged and published in 1995 in the *Manitoba Archaeological Journal*. Many of ideas expressed there also appear in chapter 5 of this dissertation. Similarly, a comparison of the Keffer and McKeown faunal material, which forms part of chapter 8, was presented at the 1996 Annual Meeting of the Canadian Archaeological Association in a zooarchaeology session that I organized in honour of Dr. Howard Savage. Finally, part of the review of previous zooarchaeological research in chapter 3 of this dissertation was presented at the 1993 Meeting of the Eastern States Archaeological Federation and the substance of most of it was published in *Canadian Zooarchaeology* later that year.

Funding for both the excavations and research on the Keffer and McKeown sites has come from a variety of sources. The 1985 excavations at the Keffer site were funded by the Government of Ontario through the Ministry of Culture and Communications, Communities Facilities Improvement Program and the Ministry of Skills Development, Ontario Youth Opportunities; MI Developments, a division of Magna International (Canada) Inc.; the Town of Vaughan and the Government of Canada through the Canada Employment and Immigration Commission, Challenge '85, Summer Employment Experience Development program. In 1988, more excavations were undertaken thanks to funding from the Government of Ontario through the Ministry of Culture and Communications, Wintario Program;

from Villarboit Holding Ltd.; and from the Town of Vaughan.

Financing for the excavation and analysis of the McKeown site was obtained by Dr. Pendergast from the Social Sciences and Humanities Research Council of Canada and by the Heritage Merrickville Foundation from the Ministry of Citizenship and Culture. Both these grants supported the analysis of the faunal remains. The provision of these essential funds for excavation and research of both these sites is greatly appreciated.

My five years of graduate studies and research have been financially supported by several sources. The Social Sciences and Humanities Research Council of Canada is gratefully acknowledged for granting me a Doctoral Fellowship for the first two years of my studies and a Renewal Doctoral Fellowship for the next two. For my first year, 1992-1993, I also received an O'Brien Foundation Fellowship. The following year, I was one of the first group of recipients of the New Brunswick Women's Doctoral Fellowship, which has been renewed each year since 1993-1994. I sincerely thank all these organizations for their support.

Finally, I wish to acknowledge the support of my family and friends. So many people have encouraged me in my work that I cannot thank them all individually. However, fellow students at Toronto, and McGill and co-workers at the Archaeological Survey of Canada and at the Zooarchaeological Analysis Programme in Ottawa as well as those in New Brunswick have often given me useful ideas, material to analyze and animal carcasses to skeletonize, as have other friends as well. I thank Dean Knight particularly for his encouragement over the years. Merci beaucoup to Anna De Aguayo and Wladyslaw Cichocki for translating my abstract. I am sorry my mother did not live to see the completion of this work which she encouraged me to do, but which I delayed until I thought my two daughters, Madeline and Emily, could manage with less input from their mother. Their support and especially that of my husband, Dr. Gail R. Pool, for my returning to school was a great bonus to this most interesting experience.

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CHAPTER 1

THE PURPOSES AND THEORETICAL APPROACHES OF THIS ZOOARCHAEOLOGICAL STUDY OF IROQUOIAN SUBSISTENCE

Introduction

Most archaeological sites are identified as the remains of particular cultures on the basis of their ceramic and stone artifacts. In this study, I want to determine to what extent zooarchaeological remains are indicative of different groups. I am not opposing diet and culture; rather I am considering diet as a significant component of culture. I wish to show that dietary remains can be significant in comparing similarities and differences in archaeological cultures and should be considered as useful as other artifacts for understanding other aspects of those cultures. Therefore, the faunal remains from two village sites are compared and contrasted and it is shown that proto-Huron/Petun sites dating to around A.D. 1500 can be distinguished from contemporaneous proto-St. Lawrence Iroquoian sites by their zooarchaeological samples. This study is a zooarchaeological one, but differences complimentary to those in the faunal remains were found in osteological and palaeoethnobotanical studies relating to these people. Conclusions are drawn on the significance of these differences. Thus this study demonstrates that zooarchaeological studies can help to explain dietary and also other aspects of culture.

Ever since Europeans first sailed up the St. Lawrence River, there has been speculation about the inhabitants who lived there, who are now known as the St. Lawrence Iroquoians (Trigger and Pendergast 1978). They inhabited the region around the present locations of Quebec City and Montreal when Jacques Cartier explored the St. Lawrence region in 1534 and 1535-1536 and when he and Jean-François de La Rocque, Sieur de Roberval attempted colonization in 1541-1543 (Biggar 1924), but by Samuel de Champlain's visit of 1603 they had disappeared (Biggar 1922-1936). A possible cause of their demise will be explored by comparing the zooarchaeological evidence from a St. Lawrence Iroquoian village with that from a village of the related and contemporaneous, but seemingly more successful, proto-Huron/Petun Iroquoians.

Most scholars of Iroquoian archaeology continue to emphasize pottery and settlement data (see summaries in Ellis and Ferris 1990, specifically J. Jamieson on the St. Lawrence Iroquoians and Ramsden on the Hurons; Bamann *et al.* 1992), whereas subsistence is treated only superficially. In the present study, a major role for zooarchaeology in the investigation of Iroquoian archaeology will be demonstrated. By reconstructing and then comparing the diets of the inhabitants of two *ca.* A.D. 1500 village sites, located in slightly different ecological areas and belonging to different Iroquoian groups, it will be determined whether they can be distinguished on the basis of their zooarchaeological remains. Differences in types of subsistence will be searched for, but as Bruce G. Trigger noted, "there is a moderately well represented gradient of variation between the two extremes [of the Stadaconans and the Hurons]" (Trigger 1963:99), with peoples living south of Huronia fitting in between these extremes. Assuming such distinctions, the possibility of these differences being influential in allowing the proto-Huron/Petuns to expand while the St. Lawrence Iroquoians declined will be discussed.

The subsistence reconstruction, while using ethnohistorical information (reviewed in chapter 2), will be based on archaeological materials. Vegetal remains provide evidence for corn in Ontario between *ca.* A.D. 540 and 900 (Fecteau 1985:126-150; Jackson 1983; Crawford and Smith 1996), with horticulture common after A.D. 1300 (Fecteau 1985:169; Williamson 1990:306). More common than floral remains are faunal ones. Interest in Iroquoian zooarchaeology has a long history but, except for William J. Wintemberg's work from 1912 and 1915 at the Roebuck site and through the 1920s and 1930s on other sites (Wintemberg 1928, [1936] 1972, 1939, 1946, 1948), faunal remains were not considered important until the New Archaeology of the late 1960s (Stewart 1993). Since 1969, many Ontario Iroquoian faunal samples have been analyzed, greatly increasing the number of taxa known to have been exploited. A review of previous zooarchaeological research is presented in chapter 3. A third source of information is human skeletons. Recently, osteologists have performed palaeonutritional studies on Iroquoian skeletons. The results of these studies are evaluated in chapter 4. Thus, the archaeological data sources can be organized in three subsets: botanical, faunal and osteological.

Of these, faunal studies are the most numerous and they will form the major portion of my data. Because most of the faunal work in Ontario has been done by students of Dr. Howard Savage, the methods and results are comparable in most instances. Careful identification to as small taxa as possible has been emphasized and the technical expertise of identifying faunal material is high, but only recently have sieving through narrow-gauge screens and floatation become routine excavation practices. It is well-known that sieving (Clason and Prummel 1977; Payne 1972b) and the mesh size of the screen, whether 1/4 inch (Shaffer 1992) or 1/8 inch (Shaffer and Sanchez 1994), improves the representation of the smaller animals and the smaller elements of all animals. Such remains, specially fish, are under-represented in most Iroquoian faunal samples (Stewart 1991a). Therefore, much of the existing literature can be used only as supportive, rather than as primary, data. Because of this, most of the material used in my analysis will come from two large and recently excavated sites which have samples retrieved by floatation.

There are additional weaknesses in the Iroquoian zooarchaeological literature. In the past, faunal reports were primarily lists of the identified remains and nutrition was seldom discussed. Written in scientific, gender-neutral language, their interpretations either treat *people* as an undifferentiated whole or seem to ignore them altogether. Few include discussions of divisions of labour or differential consumption, both of which were recorded ethnohistorically. Finally, only a small number of Ontario faunal studies have been published (Cooper and Savage 1994). In general, floral and faunal analyses have been allotted a minor role, at most, in the interpretation of Iroquoian sites, instead of being regarded as a major source of information for understanding differences over time or across cultures.

The major question to be addressed is why the proto-Huron/Petuns expanded when, contemporaneously, the St. Lawrence Iroquoians declined and by around A.D. 1580, had ceased to exist as a distinct entity (Pendergast 1991:49, 1993a). To answer this, following Richard A. Gould's (1990) recommendation that archaeologists begin with first order explanations, I will consider the possibility that differences in something as fundamental as diet contributed to the opposing histories. Data needed to determine if one group had a more nutritious diet are available in the archaeological evidence, particularly in the faunal refuse discarded at village sites. Analysis of these samples, combined with information from plant remains, human skeletons and the ethnohistorical sources, will allow determination of whether the two groups had distinctive subsistence differences that are significant for understanding their histories.

Introduction to Pertinent Ethnohistorical Sources

Iroquoian subsistence, or the procurement and consumption of dietary items, was first described by early explorers, traders and missionaries. The primary sources of information about sixteenth and seventeenth century Indians in New France are *The Voyages of Jacques Cartier* (Biggar 1924); Champlain's *Works*, specifically Volume 3 (Biggar 1922-1936); Gabriel Sagard's *Long Journey to the*

Country of the Hurons (Wrong 1939) and the *Jesuit Relations*, Volumes 4 to 35 (Thwaites 1896-1901). These and other more minor sources are discussed in Chapter 2.

From the historical accounts, it is known that Iroquoians in the sixteenth century were slash and burn horticulturists, relying on corn, beans and squash, and that some cultivated sunflowers and tobacco as well. They lived in permanent villages that were occupied generally for about 15 years, but which could have been used for as little as five or as long as 50 years. The record of the first encounters between Cartier and the Stadaconans indicates that some St. Lawrence Iroquoians were also marine fishers and hunters of sea mammals. Champlain's journals and the Jesuits' reports indicate that horticulturalists located farther inland, including the St. Lawrence Hochelagans and the Hurons, also fished and hunted. From these sources, it is known that there were gender differences in Iroquoian subsistence practices. Iroquoian women primarily were responsible for planting, tending and harvesting the crops, whereas men cleared the fields and dominated in the fishing and hunting exploits. Subsistence information from the ethnohistorical sources is reviewed in chapter 2.

Iroquoian Osteology and Palaeoethnobotany Studies

Combining the results of faunal analyses with studies of other aspects of the archaeological record increases our understanding of the past. One of these related fields of study is human osteology. For the Iroquoians, most such studies have been on remains excavated in Ontario; very few skeletons have been excavated in Quebec (Larocque 1986). The Ontario studies include research on the palaeopathology of bones and teeth (Melbye 1985; Patterson 1986; Pfeiffer 1977, 1984, 1985; Pfeiffer and Fairgrieve 1994), studies of bone chemistry (Katzenberg 1984, 1988a, 1988b; Katzenberg, Saunders and Fitzgerald 1993; Katzenberg and Schwarcz 1984; Katzenberg, Schwarcz, Knyf and Melbye 1995; Schwarcz, Melbye, Katzenberg and Knyf 1985) and palaeodemography (Jackes 1986; Saunders and Melbye 1990; Sutton 1988). Each new method developed for palaeonitrition investigations has been heralded as an important breakthrough in research capabilities, only to be followed by disclaimers after attempts have been made to employ the new methods. Information about a living population is difficult to obtain from its dead (Bocquet-Appel and Masset 1982, 1985; Wood, Milner, Harpending and Weiss 1992). Only in rare cases where a sudden catastrophe kills the population, as at the Ozette site in Washington for example, does the skeletal population mirror the living one from which it is derived. A review of the literature (chapter 4) results in the pessimistic conclusion that it might not be possible to assess the health of the Ontario Iroquoians from their skeletons. However, some information may be obtained from osteological studies when comparisons are made within a sample which has been excavated, cleaned and analyzed identically. Thus, some of the studies done on bones from Ontario ossuaries have the potential for supporting the ethnohistorical evidence that males and females followed distinct subsistence cycles.

Another related field of study is that of the plant remains found on archaeological sites and pollen from samples cored from bodies of water near sites (B. Smith 1992). The results of zooarchaeological and palaeoethobotonical studies should be integrated because a major objective of each is reconstruction of diets (O'Connor 1996) and because both plants and animals were essential ingredients of most diets. In Ontario, the amount of work on plant remains is very limited. However, there have been a few very detailed studies (Heidenreich 1971 and Fecteau 1985 in particular), and recently, more attention has been paid to such remains (Monckton 1992, 1994; McAndrews 1994). These studies (reviewed in chapter 5) enrich the faunal information in the reconstruction of the diets that is presented in chapter 8.

In sum, most of the previous work pertaining to Iroquoian diets and palaeonutrition has been on faunal remains; there are some detailed studies of Iroquoian skeletons, but little has been done with plant remains. Prior to this dissertation, the results of these studies have seldom been combined. It will be shown that integrating the results from these related research areas provides a better understanding of the palaeonutrition of a population (Sobolik 1994a, 1994b; Ezzo 1994).

An Introduction to the Faunal Data Base

The principal sites to be used in this research are the Keffer site (AkGv-14), located in the proto-Huron/Petun region, and the McKeown site (BeFv-1), in the St. Lawrence Iroquoian region (Figure 1-1). Being neither large urban nor small, low-intensity sites, these two are the type of site Amorosi, Woollett, Perdikaras and McGovern (1996) recommend for zooarchaeological comparisons. The faunal data from these two sites are presented in chapters 6 and 7 respectively, after chapter 5 which includes details on the methods of excavation and analysis.

The Keffer site is a prehistoric Southern Division Huron village site, located on a tributary of the Don River, just north of Toronto, and excavated under the direction of William D. Finlayson. The site was expanded and surrounded with palisades, which at the maximum enclosed at least 19 houses over 2.1 hectares. There were also 26 middens. Keffer dates from the late 1400s through the first half of the sixteenth century. At Keffer, human burials were excavated, as were an estimated over 20,000 faunal specimens.

The final report on the Keffer site is not yet complete, but several unpublished and published studies are available. Reports on the work done in 1985 (Finlayson, Smith, Spence and Timmins 1986) and 1988 (Finlayson 1989) have been submitted to the Ontario Ministry of Culture and Communications. The 1986 submission includes several appendices; one on the human burials by Michael W. Spence (1986) and another on some dog bones by Stephen C. Thomas (1986). There are two additional reports on the human remains (Spence 1987, 1989). Published materials include a popular account by Finlayson, Smith and Wheeler (1987) and three monographs. One of these is on 12,132 faunal specimens from three middens and four houses (Stewart 1991b). Another is on floated plant remains (D. Wright 1991) and the third is on pottery and pipes (D. Smith 1991). Shorter works include a preliminary account of the 1985 season by Finlayson, Smith, Spence and Timmins (1985) and one on floatation and the Midden 57 macrofaunal and microfaunal remains (Stewart 1991a).

Other faunal reports with which the Keffer material can be compared include a few general comments in published reports, such as those of David Boyle and Wintemberg, and unpublished papers of Savage's students and submissions to the Ontario Ministry of Culture, Tourism and Recreation. From such comparisons it can be demonstrated that the Keffer faunal sample is typical of the zooarchaeological remains of contemporaneous sites in the Toronto area (chapter 9).

The McKeown site, located south of Ottawa and just north of the St. Lawrence River, is an approximately 1.6 hectare St. Lawrence Iroquoian village site of which approximately one quarter was excavated in 1987 under the direction of James F. Pendergast. The approximately 6,000 square metres of excavation uncovered two palisades and parts or all of at least 23 structures. As was true of Keffer, the overlapping of the houses and one palisade line indicated that the McKeown village was expanded twice in its history. Also like Keffer, radiocarbon dates (Pendergast 1993b) and recovered artifacts (Wright and Wright 1993) indicate that McKeown dates to around A.D. 1500. In addition to artifacts, over 32,000 macrofaunal specimens and all the soil from over 1000 features were collected from the site.

Although the final report on the site has not been completed, a preliminary report has been published (Pendergast 1988), as has a note on an iron awl (Wright and Wright 1990) which could indicate a slightly more recent date for the site. James V. Wright and Dawn Wright (1993) have published a report on the preliminary results of analyses of the contents of some of the features. On the faunal remains, a short paper (Stewart 1989b) and a more detailed article (Stewart 1992) have been published and there are two unpublished reports, one on about 4,500 faunal specimens from three houses (Stewart 1988) and the other on about 27,500 faunal specimens from the remaining areas (Ostéothèque de Montréal Inc. 1989). J. Jamieson (n.d., 1993) completed a study of bone and shell artifacts. Lisa Ranklin (1990) wrote an undergraduate paper on the settlement pattern. Glenna Ounjian (1988) has prepared a report on a small sample of seeds from this site. Because it was agreed not to exhume any human skeletal material, there are no palaeonutritional data from human skeletons for this site. Thus, there is a total of about 32,000 identified macrofaunal remains with more, as yet mostly unidentified, microfaunal specimens in samples processed by the Wrights and in those floated in the field. Of these latter, 5,392 microfaunal specimens from one house have been analyzed for this study.

The results of the McKeown faunal studies will be compared with those from other St. Lawrence Iroquoian sites in chapter 9. Pendergast has dominated work in this area and has supported faunal analyses that are useful for comparison.

In addition Wintemberg's comments about the Roebuck site and numerous student reports show that the McKeown zooarchaeological material was quite typical for contemporaneous sites in the Prescott cluster.

Theoretical Approach

The theoretical position underlying most subsistence studies is a positivist-empiricist one, a position shared with the natural sciences from which methods of analysis have been adopted for studying archaeological remains. "Animal bone studies have, of necessity perhaps, been firmly grounded in a positivist approach, and have given rise to functionalist interpretations" (O'Connor 1996:6). In positivist science, sensory observations of objects are the data for analyses. Zooarchaeologists, palaeoethnobotanists and osteologists have assumed that the remains they study exist independently of the observer and they have used formal logic and scientific methods to investigate relationships linking these "natural" remains and other sorts of archaeological evidence. But archaeologists have emphasized the importance of cultural traditions also as factors influencing human behaviour, which is inevitably culturally mediated, and have also acknowledged both that science is a culturally determined activity and that facts are theory-laden (Cowgill 1993). These realizations have greatly complicated research and undermined the certainty of prediction assumed by positivists. Two camps of researchers have emerged. Pragmatically, some argue that the scientific method has demonstrated its usefulness in problem solving. Others have moved towards deconstruction, post-structuralism and post-positivism, hoping to reach a better understanding by questioning underlying assumptions.

Positivist approaches using the deductive method, as exemplified by the work of Lewis Binford and others, have been instrumental in developing more precise data collecting and recording of archaeological faunal material. Michael Schiffer's (1976:12-15) observations on the combined effects of natural and cultural (N and C) transformations in producing zooarchaeological samples have directed attention to taphonomy (Lyman 1994b). Now, researchers routinely consider both the N and C aspects. The acceptance of both as determining factors has led to inquiries regarding the most appropriate ways to describe faunal samples; specifically, is it better to rely on the total numbers of specimens identified to species (NISP), or on derivative figures such as the minimum numbers of individual animals (MNI) or parts of animals (MNE, MAU) represented? (The merits and limitations of the various methods of quantification are discussed in chapter 5.) To reach their ultimate goal of explaining human behaviour (upper level theory) from archaeological deposits, processual archaeologists saw a need to test and improve the middle range theories of data interpretation first. As a result of the New Archaeology of the 1960s, increased attention has been paid to subsistence and the methods used to investigate this domain have become more precise and more explicitly stated by archaeologists.

In contrast to the processualists' reliance on general laws of human behaviour, post-processualists have stressed the importance of culturally specific ideas and the symbolic systems underlying cultures. Post-processualists have shown that objects convey different meanings even within the culture that produced them (Hodder 1982), and therefore archaeologists must be extremely cautious in their interpretations. In the extreme, no one can be sure that his or her ideas match any others' and all are value-laden; thus, it can be argued that the only validation for an explanation is that it is internally logical. Is this pessimistic philosophy useful to subsistence studies? In the extreme it is not. However, this movement has brought culture and the historical perspective back into the generalizing scientific position promoted in the 1960s, when cultural differences and historical factors were greatly underrated and the use of analogy was stretched across both space and time (Stahl 1993). A recent study of animal exploitation on the Mississippi River between *ca.* A.D. 800 and 1400 has employed a structuralist approach to investigate the animal taxonomy of the Native people inhabiting this region (Holt 1996). Another (Bond 1996) demonstrates that information about ritualism and symbolism relating to animals can be found in animal remains excavated from human burials. Since both the processual and the more recent post-processual paradigms have benefitted subsistence studies, rather than relying exclusively on either one, the strengths of each will be used in my study.

Similarly, both etic and emic approaches have been used by archaeologists. Like those of most zooarchaeologists, my reconstruction of the diets of the proto-Huron/Petuns and the St. Lawrence Iroquoians will be mainly in the etic sphere. Generally, it is agreed that subsistence studies involve less emic input than those of other aspects of human behaviour such as kinship relations or religion. But the gathering, preparing and consuming of food items are surrounded by rituals, symbolism and specific cultural interpretations, and scarcity can be induced by ideas such as food taboos. In my discussion of behaviours related to diet, I will rely heavily on the ethnohistorical information to add emic insights to the mainly etic analysis.

My interest in the subsistence of the proto-St. Lawrence Iroquoians and proto-Huron/Petuns as a factor in their differing developments can be considered as part of the larger issue of the relationship between population densities and agriculture. Most of the research on this topic has been related to the introduction of agriculture in various parts of the world. Since the *ca.* A.D. 1500 date of the two sites emphasized in this work post-dates both the adoption of horticulture in Ontario and the marked growth in population that followed during the fourteenth century (Warrick 1990), the traditional question of which came first, agriculture or population growth is not central to an investigation of population changes after A.D. 1500. However, other aspects of the debate are relevant.

Interest in the question of the interdependency of population growth and the development of agriculture can be traced back at least to the essays by Thomas Robert Malthus [1798]. Briefly stated, Malthus argued that human population tends to increase geometrically whereas food resources increase arithmetically (1959:5-10). A "strong and constantly operating check on population from the difficulty of subsistence" (ibid.:5) is the result. As a specific population approaches or exceeds the carrying capacity of its environment, catastrophes such as starvation, disease, or intergroup strife are the inevitable means of restoring the equilibrium between population and resources. Binford's (1968b) "edge-zone hypothesis" was a variant of these ideas, with over-population in one area or a diminution in the resources of the original locale resulting in migration, which in turn would stress the receiving population. However, Binford went beyond the Malthusian position, suggesting that in the new environment, and in response to population pressure, more efficient subsistence techniques for increasing food resources would be developed (ibid.:331). Pendergast (1991) favoured a Malthusian explanation for the inter-relationship between population growth and agriculture for the St. Lawrence Iroquoians. He wrote, "There is the suggestion that an increase in population took place on this time level [c. A.D. 1350], probably as a result of the increased importance of agriculture" (ibid.:56). Adopting Malthusian arguments, the demise of the St. Lawrence Iroquoians can be considered as a possible "natural" adjustment to over-population, although the St. Lawrence Iroquoians' numbers should have been reduced only until homeostasis was reached, not until there were none left. Conversely, the proto-Huron/Petuns could be viewed as continuing to increase because they had not yet over-populated their region. The adequacy of the Malthusian position for explaining the population changes in proto-historic Ontario will be discussed in the concluding chapter of this study.

Responding to Malthusian ideas, Ester Boserup (1965) treated population increase as a universal feature of human behaviour and argued that in response to population pressures relative to the available resources, people make dramatic changes, from domesticating plants and animals and adopting agriculture to developing civilizations and industrial technologies (Boserup 1981). This determining role of population in bringing about cultural change has been accepted by many archaeologists and anthropologists (Binford 1968b; Childe 1936; Dumond 1965; P. Smith and Young 1972).

Mark Cohen argued that agriculture developed over a long period during which knowledge about plants and animals slowly accumulated, not as a conceptual breakthrough (1977:23), but because hunters and gatherers had exhausted the calorie supply available to them under a subsistence economy:

> ...The nearly simultaneous adoption of agricultural economies throughout the world could only be accounted for by assuming that hunting and gathering populations had saturated the world approximately 10,000 years ago and had exhausted all possible (or palatable) strategies for increasing their food supply within the constraints of the hunting-gathering life style. The only possible reaction to further growth in population, worldwide, was to begin artificial augmentation of the food supply.
>
> ... rather than stabilizing at some optimal level or "carrying capacity", the human population as an aggregate has grown continuously, requiring more or less continuous redefinition of the ecology of the species as a whole (Cohen 1977:279-80).

Both the Malthusian and Boserupian positions emphasize population growth rather than decline. As a result they do not directly apply to the depopulation of the St. Lawrence Iroquoians. However, as Brian Spooner noted:

> the obverse of her [Boserup's] thesis should also be true: population decline should logically result in "extensification" or technological "reversion" to methods that are both less labour-intensive and less land-intensive. And in fact, "in cases where population density was reduced by wars or other catastrophes there often seems to have been a relapse into more extensive forms of cultivation" (Boserup 1965:62) (Spooner 1972:xvii).

Boserup was referring to the depletion of populations practising an intensive form of agriculture, but the idea of returning to "traditional" methods under stress can be considered for any group of people.

Considering Boserup's positive role for population growth as an independent agent causing change and, more specifically, in determining land use developments (1965:11), and considering the people living in southern Ontario around A.D. 1500, the possibility of the proto-Huron/Petuns' society changing in some way that the St. Lawrence Iroquoians' did not, will be examined. Different gender roles may offer an explanation of the divergent histories of these two cultures in the sixteenth century.

Site-catchment analysis as a model for understanding human use of environments underlies most Ontario zooarchaeological studies and some of the assumptions for this model have been incorporated in the present study. The premise underlying catchment analysis is that resources located closest to a site will be exploited more than those located farther away, reflecting the time and energy differences required to exploit the resources. Higgs and Vita-Finzi (1972) adapted their "site-catchment analysis" for archaeology from a much earlier agricultural model by von Thunen ([1826] 1966), who argued that economic activities occur most frequently close to the center of population. This center is surrounded by rings where activities which must be pursued at greater distances are progressively more costly in terms of the amounts of energy expended for accumulation of the distant resources. He assumed that transportation was by foot only, that the environment was basically uniform around the population centre and that population centres were isolated. Higgs and Vita-Finzi argued that for mobile economies, input-output analysis demonstrates that activities are generally limited to within a circle with a 10 kilometre radius, 10 km being the distance that can be walked in two hours. For sedentary communities, a 5 km radius circle delimits the productively exploitable area, although some people have argued that the returns decline greatly beyond one km from the base site and "become oppressive between 3 and 4 km" (Byrd 1996:312). Although it was soon realized that circles might not be the most appropriate configuration for sites located on shorelines and that water-transport would increase the distance that could be covered in two hours, with an expenditure of less energy than walking in many instances, the assumption that the food resources closest to living sites are exploited most has underlain most zooarchaeological research (Flannery 1976). Catchment analysis models are often used to predict habitation site locations. For example, this has been done for Late Middleport sites in southern Ontario, relying on water sources and soil types principally as the significant features of the environment (S. Jamieson 1986).

There are problems in applying the catchment idea to North American sites, especially where animal resources are considered. Many of the animals which were important food sources to the Natives were migratory and thus only seasonally available within a 10 kilometre area of any village. From the ethnohistorical sources, it is known that at least in the early 1600s, the Huron travelled by foot and boat more than 10 kilometres from their villages to fish and hunt. From the archaeological evidence, it appears that fishing trips away from villages were common to both the proto-Huron/Petuns and the proto-St. Lawrence Iroquoians *ca.* A.D. 1500. The model of concentric areas of exploitation probably does not fit the Keffer and McKeown villagers exactly. Yet, as will be shown, some of the resources exploited by these peoples were different and many of these differences can be explained by the discrete ranges of those species. Those closest to a particular group were exploited by that group most, which conforms to the principles of catchment theory.

The Significance of this Subsistence Research

My research will contribute primarily to a better understanding of differences in prehistoric Iroquoian subsistence, but it will have significance also for methodology in archaeology. Using the diverse sorts of available information, I hope to determine what dietary differences existed between the people living at the Keffer and McKeown sites. With those two sites as a basis, I propose to characterize the St. Lawrence Iroquoians and the proto-Huron/Petuns primarily on the basis of their subsistence patterns and to demonstrate that zooarchaeological remains can be used for cross-regional comparisons in much the same way as ceramics and settlement data have been used in the past. Thus, by integrating zooarchaeological data with that from other fields of inquiry and by using the data to address broad archaeological issues, I will be following the recommendation for such an approach made over 20 years ago by Uerpmann (1973) and recently reiterated by O'Connor (1996). These traditional foci of archaeological study will be used to support my interpretation of the subsistence evidence, a reversal of their roles in previous Iroquoian studies.

Using primarily ethnohistorical data, it will be shown that, at least for the Iroquoians, zooarchaeologists should consider the subsistence systems of the genders as two discrete, although complimentary, subsystems rather than giving a single interpretation of subsistence for whole cultures as has been the common practice. Since the ethnohistorical accounts were overwhelmingly recorded by men, the activities noted in them relate primarily to males. Many of the skeletal elements found on sites can be related to hunting or fishing parties, activities which, at least historically, were primarily those of the Iroquoian men. However, there are other unmentioned and/or only briefly mentioned different animal species. I will argue that some of these were exploited by females primarily. Using both the ethnohistorical information and the natural histories of the exploited animals, explanations for their occurrences on the archaeological sites will be offered.

Once the differences in the palaeonutrition of these contemporaneous peoples have been delineated, the role of subsistence in the Hurons' domination of the region by the 1600s can be evaluated. The possibility of Huron nutrition having been better than that of neighbouring Iroquoians has not been considered as a factor in increases in Huron village sizes and the size of area in which they hunted. As the articles in a recent summary of southern Ontario archaeology demonstrate (Ellis and Ferris 1990), despite the work in zooarchaeology over the past 20 years, little attention has been accorded to zooarchaeological research in interpreting changes in prehistory. Like Binford and Gould, I am adopting the position that subsistence is a basic component of culture. Thus, I will use this first level evidence to compare two related cultures and to determine whether differences in their diets might have been a factor in the proto-Huron/Petuns increasing in numbers and populating a greater area.

Conclusions reached about the subsistence levels and systems of the proto-Huron/Petuns and proto-St. Lawrence Iroquoians are relevant to the wider issue of population growth and cultural change. Using the reconstructions of the McKeown and Keffer sites' subsistence, Malthusian and Boserupian theories can be evaluated as explanatory ideas. By asking whether population levels reflect changes and limitations in environment and/or technology (Malthus 1959) or cause changes in subsistence systems (Boserup 1965), these theories complement each other (P. Smith and Young 1984:153-154). Which of their tenets are useful for understanding population changes in protohistoric Ontario will be considered as well as which features are not supported by the archaeological and more especially the zooarchaeological evidence. These questions will be discussed in the conclusions to this study after the methods of analysis and the data collected have been described and interpreted.

CHAPTER 2

A REVIEW OF THE SUBSISTENCE INFORMATION IN IROQUOIAN ETHNOHISTORICAL SOURCES AND ETHNOHISTORIES

Introduction

Ethnohistory has a long tradition of use in Ontario archaeology. In the nineteenth century, many site surveys were undertaken to confirm accounts of site locations and descriptions given by European visitors (for example, A. Jones 1903) and much current research uses ethnohistorical and ethnographical information relating to Ontario in interpretations of archaeological data (for example, Fox and Molto 1994).

Peter Ramsden (1993) has objected that this traditional heavy reliance on such sources has been detrimental to the development of Ontario archaeology because archaeologists have relied on written descriptions to do their work for them and have forced interpretations of their data to fit those descriptions. Yet it has been demonstrated that an ethnohistorical approach can enrich an understanding of archaeological data (for example, Trigger 1985b). While not denying that ethnohistorical models can be over-used, far more would be lost than gained by archaeologists refusing to use these sources. Archaeologists studying Eastern Canadian peoples are extremely fortunate to have ethnohistorical accounts and ethnographies, which can be used as sources of information about things which are not retrievable, or at least not easily so, from the material remains of cultures (Stewart 1989a).

Archaeologists can use the information found in these sources to anticipate and interpret their findings. For example, based on ethnohistorical information, it can be expected that eel bones would be common in the fish samples of St. Lawrence Iroquoian sites (Junker-Anderson 1988) and trout and whitefish in Huron ones. The ethnohistorical material also offers cultural explanations for the lack of certain animal remains. For example, if deer remains are scarce at a village site, it might be because their bones were discarded at remote kill sites. The knowledge that the Hurons believed fish and deer refuse should be neither burnt nor chewed by dogs is significant for interpretations of bone modifications. In addition, the ethnohistorical sources contain information about subsistence activities that are not discernable in the archaeological data. For example, even if portions of hemp nets were to be excavated, they would not reveal that the Hurons used set nets, nets at weirs and seine nets to gather their fish.

There is danger in extending ethnohistorical information beyond the specific groups described and into the more remote past unless direct historical links and specific similarities between the cultures being compared can be demonstrated (Stahl 1993; Trigger 1989:364, 390). On the other hand, much, if not all, archaeological interpretation derives from analogy and it can be argued that ethnohistorical descriptions provide the most direct and hence the most reliable analogues for the late prehistoric period.

For southern Quebec and Ontario, the available ethnohistorical documents are sources for one of R. Ascher's two types of analogy (1961:319), that based on continuity between the written records and the archaeological sites. Yet even when using such clearly relevant materials, archaeologists must be critical of them:

> Following the lead of historians, archaeologists must acquaint themselves with the need to subject sources, both ethnographic and historical, to source criticism in their efforts to establish the relevance of a particular analogical model. Variables that require scrutiny include the position of the author, intended audience, method of data collection, as well as the time frame and location on which the description is based. Further, we must be careful to scrutinize evidence of ubiquity as a criterion enhancing the value of an analogical insight. We must be aware of the potentially biased aspects of ethnographic and historical sources, especially with respect to issues of gender ... (Stahl 1993:253).

In Iroquoian research, information from the ethnohistorical sources on the Hurons of the seventeenth century have been applied to many sites that are earlier in time and belonged to different ethnic groups. Sometimes the descriptions have been used with little regard for the prejudices and purposes of the writers, who often misunderstood and failed to record important elements of the alien cultures they were observing. The intended audiences of ethnohistorical reports as well as the times, cultures and circumstances in which they were written and originally read were not those in which they are now being used. On the other hand, Stahl's recommendations have been applied by some scholars. In large part through Trigger's work (for example, [1969], 1976, 1985b) and the pioneering efforts of Alfred G. Bailey (1937), it is evident that ethnohistorical sources, when carefully analyzed and contextualized, can enrich our understanding of earlier societies. As Trigger noted (1991:562) and Stahl (1993) reiterated, both the archaeological data and the early written descriptions are fragments of a changing history. Each provides a "snapshot"; neither defines how things *always were*. They are about particulars, which we may be able to develop into generalities. For the Iroquoians, the ethnohistorical sources offer information about subsistence that would be unobtainable from archaeology alone. Thus, both sources of data combined should provide a fuller understanding of protohistorical and historical Iroquoian subsistence than either can by itself.

However, even descriptions of the environment and subsistence in the ethnohistorical material can be confusing. The authors of these seventeenth century documents were in an unfamiliar continent, seeing plants and animals previously unknown to Europeans. They were not professional or even trained botanists or zoologists, and they were working in the pre-Linnaean period. Thus, sea mammals were considered fish and some descriptions seem almost like flights of fancy to modern readers. The repeated description of a bird with one webbed and one clawed foot or large armoured fish are examples of attempts to describe unknown animals. Similarly, plants recorded as apples were probably what we call hawthorn berries. Problems arise with giving modern scientific meaning to what the early Europeans wrote about; specific examples of such confusion surrounding some of the plants and animals reportedly exploited by the St. Lawrence Iroquoians and the Hurons are discussed below.

The ethnohistorical sources, which are much richer for the Hurons than for the St. Lawrence Iroquoians, inform readers about the available animals and plants and how these were exploited in different seasons. The accounts of Champlain and Brother Gabriel (Théodat) Sagard are most complete for these aspects. The *Jesuit Relations and Allied Documents* supplement these and are particularly rich in discussions of rituals in which food played a part (Thwaites 1896-1901). All the sources describe food, but only Sagard and Jean de Brébeuf mention refuse disposal. The most details about the non-dietary uses of animals and plants are provided by Sagard. Brébeuf and Jérome Lalemant are particularly informative about taboos and rituals related to subsistence.

Certainly the accounts of the explorers and priests cannot be accepted automatically as well informed or unbiased. The explorers (Cartier, Roberval and Champlain), fur traders (Pierre Esprit Radisson and Pierre Boucher) and priests (Sagard, Joseph de La Roche Daillon and the Jesuits) were all trying to interest and even impress Europeans at home. Thus, their reports may have exaggerated the richness of the natural resources and skewed accounts of some Native activities. In general, there is less chance of biased reporting of subsistence activities, which were directly observed by the writers, than of reporting intangibles, such as kinship or beliefs, explained in a language foreign to the writers. Using the ethnohistorical sources carefully, one can learn about food procurement activities, the sexual division of labour in food preparation and eating, and some of the rituals surrounding food and eating. These are aspects which likely could not be derived from the faunal and floral remains alone. When the authors are describing what they themselves saw and several sources agree, the information will be accepted. Contrary to the recent criticism of their use (Ramsden 1993), I conclude that the ethnohistorical sources yield a variety of useful information about Iroquoian subsistence and allow for more detailed and nuanced interpretations of the archaeological data.

Iroquoian Ethnohistorical Sources

As mentioned in Chapter 1, the major, primary sources of information about the Native people in New France are Champlain's *Works*, particularly his account of his voyage of 1615-16 in volume three of Biggar's set of six (Biggar 1922-36); Sagard's *Long Journey to the Country of the Hurons* (Wrong 1939) and his *Histoire du Canada* and the numerous clerics' reports, letters and journal entries compiled in Thwaites' 73-volume edition of the *Jesuit Relations and Allied Documents*, of which volumes 4 to 36 contain material relating to the early period in New France (Thwaites 1896-1901). Champlain's and Sagard's writings contain information about the natural resources and the people along the St. Lawrence River and to the north of it, including along the route to Huronia, but they are most significant for their documentation of the Hurons of south-central Ontario. Of the entries in the *Jesuit Relations*, those written by Jean de Brébeuf, François-Joseph Le Mercier, Jérôme Lalemant and Paul Ragneneau, with minor contributions by François du Peron and Pierre-Joseph-Marie Chaumonot, emphasize the Hurons. For information about conditions and people farther east, particularly around the settlements at Quebec, Trois-Rivières and Montreal, the works of Charles Lalemant, Paul Le Jeune, Barthélemy Vimont, and Jérôme Lalemant (with minor contributions from Isaac Jogues) are valuable, although some of the observations are of a general nature rather than being specific to a single group of people or locality. Under the direction and censorship of his Superior, François Du Creux [1664], a Jesuit, wrote an official Latin summary of the *Relations* of 1625 to 1658, to promote the work of the Society. It is primarily a digest, but contains some previously unpublished material (Robinson 1951:ix-xii).

Like Champlain's first publications on his voyages in 1603, 1613 and 1619, the accounts of the Jesuits were composed soon after the events they described. The *Jesuit Relations* were usually published within a year of being written and written within twelve months of the events they portray. This should have contributed to the accuracy of their accounts. They were, however, subject to censorship by the Superiors in France who edited them to ensure that the Jesuits' activities were presented in a favourable light. In addition, the Huron reports may have been edited by the Quebec Superiors, although often there was not time for this before the boats sailed for Europe (Campeau 1979:136). Lucien Campeau found that little editing occurred at least for 1632 to 1634 editions of the *Jesuit Relations* and argues that the patterns set then were followed for the later reports from the Huron missions, although occasionally there are differences between the edited versions and the originals (Campeau 1979:136-140). He has published many of the available original documents dating from 1616-1634.

Information about subsistence was probably not altered, unless parts were deleted because they were thought to be too repetitive of earlier accounts and thus might bore readers.

Other sources exist. Published with Cartier's *Voyages* is a brief account of Roberval's *Voyage* up the St. Lawrence River. Pierre Boucher's [1664] *True and Genuine Description of New France* (Montizambert 1883), as the author conceded, repeats much from the *Relations* and Champlain's narratives (1883:10). However, it contains some new and corroborating information, since Boucher lived most of his life at Quebec and Trois-Rivières, dying at Boucherville, near Montreal. Finally, there are *The Explorations of Pierre Esprit Radisson* (Adams:1961), with details of his approximately one and a half year captivity among the Mohawks, living to the south and west of Trois-Rivières, where he was captured in May 1651. Similarly, Jogues' letter describing his captivity among the Iroquois is relevant (1643 JR 25:43-63).

In addition to the above-mentioned sources, early maps exist. These are useful mostly for revealing the extent of the geographical knowledge of the early explorers and for locating named villages and/or peoples. Illustrations on the maps depict Indian activities, dwellings, tools and clothing. (See Trigger 1990 for reproductions of some of these illustrations.)

There are also some dictionaries. To his four-volume *Histoire du Canada...*, Sagard appended his *Dictionnaire de la langue huronne* (1866). It is really a phrase book with the phrases and words entered by topic rather than alphabetically. Of greatest interest to subsistence studies are the entries for animals. This dictionary was followed by more extensive and systematic dictionaries and grammars compiled by various Jesuits. Sagard's and the Jesuits' definitions, as well as words recorded by Champlain and others, have been studied by John Steckley (1991), a linguist. He has translated and discussed the names for the divisions ("months") of the Huron calendar (1983), as well as those for some fish (1986b), for raccoon and grey squirrel (1986a) and for tobacco (1985).

Finally, both Elisabeth Tooker's [1964] and Trigger's [1969] ethnographies of the Huron Indians have proved so useful that they have been reprinted (Tooker 1967) and revised (Trigger 1990). The compilation of data on the Hurons by both these authors includes much related to Huron food procurement, preparation and consumption.

Limitations of the Iroquoian Ethnohistorical Material

One weakness of the historical documents for Eastern Canada is that they do not reflect the earliest contact between Natives and Europeans. The Norse visited Canada around A.D. 1000 (G. Jones 1986) and lived briefly at L'Anse aux Meadows, Newfoundland (Wallace 1986). John Cabot's 1497 explorations were followed by those of Portuguese sailors, such as Gaspar Corte Real in 1501, whose ships bought fifty captured Natives back to Lisbon to be sold as slaves (Quinn 1977:123). English boats sailed in 1501 and 1502 and returned with three captives (ibid.:126). Breton and Basque fishermen and whalers continued exploiting the Gulf of St. Lawrence and encountering its inhabitants throughout the 1500s. Seven Indian males, likely Micmacs, were transported to Normandy in 1509 (ibid.:131; see also Whitehead 1991:239-242). Pendergast argues that "as early as the second decade [of the 16th century]" (Pendergast 1991:47) and possibly since 1508 (ibid.:48), there was interaction with some St. Lawrence Iroquoians (ibid.:1991:47-9). Thus, the descriptions in the ethnohistorical reports record activities only after decades of sporadic European contact.

No evidence of contact has been found for the two archaeological sites central to this study, however. For the proto-Huron/Petuns who lived at the Keffer village, contact was both indirect and limited until after 1580 (Trigger 1985b:148-155). For the westernmost St. Lawrence Iroquoians, including those who constructed the McKeown village, direct or indirect contact, if there was any, was extremely limited prior to Cartier's trips (Pendergast 1991:63). It is possible that some of the McKeown villagers lived to see Cartier and his men or at least to learn about his visits and that the people inhabiting the Keffer site, through their eastern contacts, heard about Europeans. But there is no evidence that Europeans visited either of these communities. While there may be no significant gap in time between the observations made by Cartier and Roberval and the habitation of the McKeown site (ibid.:56, 1993b:6-9), a period of approximately 100 years may separate the occupation of the Keffer village (Finlayson, Smith and Wheeler 1987:20) from the first ethnohistorical accounts of the Hurons. Unfortunately, the experiences of the traders who were the first Europeans to live among the Hurons for the most part went unrecorded. Champlain and the Jesuits occasionally recorded what Etienne Brûlé told them about the Hurons and about his visits to other native groups but most of what Brûlé himself could have related was not recorded.

A second weakness is that most of the accounts reflect both what their authors were most concerned with and also what they thought would be of greatest interest to their backers. These men were not always good writers. While the Society of Jesus was a scholarly order and its well-educated priests described the Hurons carefully, usually giving examples to support their statements, they and Sagard, a Récollet priest, described the native practices in relation to their own particular religious norms. Others were not as well trained; Radisson's account, for example, had to be heavily edited. In addition, the unnumbered pages of his original manuscript had to be organized in the most reasonable sequence by the editor. Sometimes these early writers augmented their personal observations with material derived from other unacknowledged and sometimes distant sources.

Besides having individual objectives, interests and abilities, these early Europeans were with the Indians for differing amounts of time. Champlain is often considered a good source on the Hurons because he lived among them in 1615-16. But, he was only with the Hurons from late summer to mid-May and much of that time was spent on a raiding and hunting mission to what is now New York State and visiting the Petuns. He was not in the area over the warm months (from the middle of May to August) and was away from the daily village life for about half of his visit. The Jesuits, particularly Brébeuf, lived with the Native people longer. But the Jesuits in Huronia distanced themselves from the daily activities of the Native peoples by living apart in their own cabins and eventually in their own community of Sainte-Marie. They were oddities in the Huron villages because of their religious beliefs and their celibacy. They did not try to live like the Native people, rather they wanted the Hurons to adopt European values.

Because these observers were males and because they were visiting a society where activities were strictly prescribed by sex, most of their time was spent with men. As a consequence, there are more details concerning male than female activities, which are interpreted from a European male perspective. Champlain's account of Huron clothing and the number of skins required to complete a winter outfit is imprecise, probably because it was the women who sewed the clothes in both France and New France. There has been considerable debate about how many skins were needed. Richard Gramly (1977, 1979) was not careful enough in his reading of Champlain's account, so his reconstruction was criticized (Turner and Santley 1979; Webster 1979). Gary Webster's interpretations were questioned by Trigger (1981), resulting in a response from Webster (1981). These debates about the hunting territories and the need for skins (Starna and Relethford 1985) show how careful archaeologists must be when using ethnohistorical information and how frustratingly inadequate those descriptions can be. However, much related to subsistence can be extracted from these sources. Something of the rich environment of the St. Lawrence Iroquoians and the Hurons can be reconstructed. In addition, information about the animal species exploited by the St. Lawrence Iroquoians and the Hurons as well as about some of the animals found to the south of Huronia, can be extracted from the historical descriptions. Unfortunately, there are no direct reports of the proto-Hurons who lived near the north shore of Lake Ontario. The best that can be done from an ethnohistorical perspective to understand their subsistence is to reconstruct that of their descendants, the Hurons. This information can then be compared and contrasted with the zooarchaeological remains.

Animals Mentioned in the Ethnohistorical Sources

Fish

The first Europeans in New France were very impressed by both the quantities and sizes of the fish. In 1534, Cartier noted the abundance of mackerel (1924:60, 132) and eels (1924:120), both of which the St. Lawrence Iroquoians caught in large numbers (1924:62, 132). From his 1535 voyage up the St. Lawrence River beyond Stadacona [near present day Quebec City] to Hochelaga [Montreal], Cartier reported that the St. Lawrence River was:

> the richest in every kind of fish that any one remembers having seen or heard of; for from its mouth to the head of it, you will find in their season the known varieties and species of salt-and fresh-water fish....
>
> ...You will find in this river in June, July and August great numbers of mackerel, mullets, maigres, tunnies, large-sized eels and other fish. When their season is over you will find as good smelts as in the River Seine. In Spring again there are quantities of lampreys and salmon. Up above Canada [the Quebec City area] are

> many pike, trout, carp [a kind of sucker according to Wrong 1939:60], breams and other fresh-water fish. All these varieties are caught, each in its season in considerable quantities by these people for their food and sustenance (1924:199).

If the large-sized eels are the same species as the eels that had impressed Cartier the previous year, then he recorded 12 different fish that were harvested by Native peoples from the St. Lawrence River. In 1542 Cartier sailed back to Europe, leaving Roberval to try to re-establish a settlement west of Quebec City. Roberval was favourably impressed by the Natives' clothing, meat (Biggar 1924:268) and bread (ibid.:269). Of the fish caught by the Native people, Roberval gave prominence to *aloses* (the common shad, according to the footnote) which he described separately from the other fish, as being somewhat red, like a salmon (1924:267), and which he placed first in his list of fish which includes "aloses, salmons, sturgeons, mullets, surmullets (the red mullet), barz (maigre) [drum], carpes, eeles, pinperneau (?) and other fresh water fish" (1924:268). Thus, Roberval adds another three or four species (shad, sturgeon and red mullet, possibly pinperneau) to Cartier's list. These are the only ethnohistorical records of fish taken by the St. Lawrence Iroquoians and in both cases, the Stadaconans were observed much more than the Hochelagans. For those who still might have been living even farther west at this period, in the vicinity of the McKeown site, there are no direct records. However, it is clear that the St. Lawrence River was a rich fishing ground which both the Stadaconans and the Hochelagans exploited.

Later European explorers and missionaries also praised the wealth of this river. Sagard (1939:51) and Le Jeune found the number of eels "incredible" (1633

JR 5:89), as did Boucher (Montizambert 1883:19). To the minimum of 15 or 16 species noted by Cartier and Roberval can be added the cod and herring observed by Sagard (Wrong 1939:41, 47). He also mentioned tuna and halibut on the Grand Banks (ibid.:32) and pike, sturgeon and carp [sucker] in the river (ibid.:60). Sagard commented on the great quantities of herring near Tadoussac and the small sea-urchins which the French collected from the shore and ate (ibid.:47). Like previous reporters, Sagard noted the "immense number of eels" around Quebec City (ibid.:51). Similarly, Boucher noted the "infinite number of shad" caught around Quebec (Montizambert 1883:18, 45) and that the tributaries to the St. Lawrence River abounded with fish, especially salmon (ibid.:25, 28), but he too stressed the incredible abundance of eel, claiming that one man had taken more than fifty thousand in the fall (ibid.:19, 45). Besides repeating the species noted by previous observers, Boucher added catfish, loach, bar shad, bass and a flatfish (possibly halibut which was previously recorded by Sagard), as well as oysters and crabs, and noted that there were suckers of various kinds (Montizambert 1883:44-7).

For the most part the Jesuit priests did not repeat the descriptions of fish in the St. Lawrence already known from earlier reports. However, their comments confirm the earlier descriptions. Le Jeune in 1633 noted that "the quantity of eels which they [Natives] catch in this season [October] is incredible" (1633 JR 5:89). According to Vimont, God sent prodigious amounts of eels for both the French and the "savages" to catch and preserve for the winter (1643 JR 23:307-9). J.

Lalemant reported that in the late summer and fall of 1646, the Indians caught forty thousand eels (1646 JR 28:239) and "more than 300 sturgeon were taken in 15 days at Montreal" in 1649 (1649 JR 34:55).

Combining these sources, it is apparent that the St. Lawrence River was rich in fish, of which at least 23 different species were harvested by the Iroquoians. By all accounts, eels were particularly significant but shad and sturgeon were also very significant. Most of the fishing efforts of the St. Lawrence Indians appear from these reports to have been directed towards marine species, although some freshwater species were also fished.

Concerning Huron fishing activities, Champlain and Sagard reported the most information. Champlain, aware of the fish around Quebec, was very impressed by the variety and particularly the sizes of the fish in Huronia:

> It [Lake Huron] abounds in many kinds of excellent fish ... and principally in trout, which are of enormous size; I have seen some that were as much as four and a half feet long, and the smallest one sees are two and a half feet in length (Biggar 1929:45).

He also found the pike to be enormous (ibid.:46). Champlain was impressed with the great catches obtained by weir fishing at the Narrows between Lakes Simcoe and Couchiching (ibid.:56) and noted that the Trent River "abounds greatly in good fish" (ibid.:59). Fish were caught around Lake Ontario during a fall raiding expedition at the end of October (ibid.:81), when trout and pike of enormous size were plentiful. Champlain noted that fishing was "plentiful for several sorts and species of fish" south of Huronia (ibid.:105, 116). Back in Huronia, he observed ice fishing (ibid.:167), likely for whitefish. In his general summary of the possibilities for fishing in New France, Champlain wrote about the:

> ... abundance of salmon, very beautiful fine large trout of every kind, sturgeons of three sizes, shad, very good bass, some weighing twenty pounds, suckers of all kinds, some of them very large, and pike, some of them five feet long, catfish without scales in two or three varieties, large and small whitefish, a foot in length, pickerel, smelts, trench [=chub], [and] perch... (ibid.:256).

From Champlain's account, it can be concluded, conservatively, that at least 15 freshwater species were fished, if we assume that "all kinds of suckers" must be at least three species and that at least two types of catfish were caught. Furthermore, the individual fish were often large and the regions south of Huronia were good fishing areas.

Like Champlain, Sagard did not live with the Hurons over the summer months but, unlike Champlain, he spent most of his time in Huron villages (Ossossané and Carhagouha), although he accompanied one autumn fishing expedition to Georgian Bay. Sagard confirmed Champlain's descriptions of ice fishing (Wrong 1939:98) and of the large sizes of the fish, particularly sturgeon (ibid.:113) and whitefish (ibid.:185):

> In this freshwater sea, there are sturgeon, Assinhendos, trout and pike, of such monstrous size that nowhere else are they to be found bigger, and it is the same with many other species of fish that are unknown [in France] (ibid.:189).

But his description of the fall fishing trip to Georgian Bay is most valuable. There *assihendo* [whitefish] were netted in great numbers but trout, sturgeon and other fish were also taken (ibid.:186). According to Sagard, the principal fish in the Huron country, and especially from the "freshwater sea", were whitefish, trout, pike and sturgeon (ibid.:230). Whitefish were "unfamiliar to the Canadians [the Indians who lived along the St.Lawrence]" (ibid.). The *einchataon* (burbot, according to Steckley 1986b), two sorts of herring, including the lake herring which was caught in immense numbers, and the gar pike were exploited also (ibid.:232-3). Sagard described very few species but his account is useful for his account of fall fishing, his comment that fish were larger here than anywhere else, and his observation that whitefish were not known to the Indians on the St. Lawrence. From his account, there are only four new species (gar pike, burbot, lake herring, some small herring) to be added to the 15 that Champlain said were exploited by the Hurons.

The Jesuits offered very few comments on the specific fish eaten. J. Lalemant noted that in many respects the Neutrals did not differ from the Hurons. The abundance of fish seemed equal in the two regions, although some species were found in one region that were not in the other. Unfortunately, he does not elaborate on these species (J. Lalemant 1641 JR 21:195). However, his observation lends support for assuming that the information about fish in Huronia can be applied generally to more southerly regions including the Keffer area.

From these records of Native fishing, several conclusions can be drawn. A greater number of species were mentioned in connection with the St. Lawrence Iroquoians (at least 23) than with the Hurons (at least 19). In part this should be expected, because people living along the St. Lawrence River had access to both marine and freshwater species. However, fishing was very important to the Hurons and often the reports include phrases like "and other species". Thus, it is not definite that a greater variety of fish was exploited by the St. Lawrence Iroquoians than by the Hurons. Furthermore, most of the information about the St. Lawrence Iroquoians concerned the easternmost group, the Stadaconans. The Hochelagans and peoples located farther inland appear to have been more involved in horticulture. Thus the St. Lawrence Iroquoians living at the McKeown village likely did not eat as many marine fish as did the Stadaconans. In this respect, the McKeown fish diet may have been more like that of the proto-Huron/Petuns along the north shore of Lake Ontario. Champlain's account shows that fishing was productive in that region and around the eastern end of the lake, which was possibly within the area exploited by the people living at McKeown. However, the staple of the Hurons, the whitefish, was reportedly unknown to the people along the St. Lawrence River and the eel upon which the St. Lawrence Iroquoians relied was not mentioned in connection with the Hurons. It is clear from the reports of both Champlain and Sagard that the runs of different species were large in both regions, but that the size of fish in southern Ontario was generally larger than those seen along the St. Lawrence or anywhere else. From these descriptions, it is evident that, while fishing was a very important part of each economy, the particular species most relied upon were different.

Mammals

Sea mammals were considered types of fish by many of the French explorers and while they were impressed by the quantities of whales, porpoises, seals and even walruses in the St. Lawrence River (Biggar 1924:117, 193, 199; Sagard 1939:30, 47), these apparently were not significant to the proto-Huron/Petuns or the westernmost St. Lawrence Iroquoians. From both the ethnohistories and archaeological excavations, it is evident that the people at the Keffer and McKeown sites did not have access to sea mammals.

Very little is reported about the use of land mammals by the Stadaconans and the Hochelagans. Cartier mentions a Stadaconan chief visiting the ship wearing a bear skin (Biggar 1924:65) and three Indians dressed "up as devils, arrayed ... in black and white dog-skins" (ibid.:136). Throughout 1535-36, when Cartier was forced to over-winter on the St. Lawrence, he observed that the Natives, presumably the Stadaconans since his ship was frozen-in near Quebec City, "caught great numbers of wild animals such as fawns, stags, and bears, hares, martens, foxes, otters and others" (ibid.:185-6). He also noted that squirrels, rabbits (distinct from hares), and wonderfully large muskrats inhabited this area (ibid.:198). One evening, he rowed over to Hare Island where he saw "a great number of hares and caught a quantity of them" (ibid.:234).

Three days below Hochelaga, Cartier came across five Indians on an island hunting muskrat (ibid.:147). From his description of blankets at Hochelaga, we know that these people had skins of "otters, beavers, martens, foxes, wild cats [raccoons], deer, stags and others" (ibid.:158). The headband worn by the Hochelagan chief who was carried in on a deer skin to meet Cartier (ibid.:163) was described as being made of porcupine skin (ibid.:164). Perhaps the headband was decorated with porcupine quills. Despite seeing the skins and furs, Cartier commented that "this whole tribe gives itself to manual labour and to fishing merely to obtain the necessities of life" (ibid.:160). According to Roberval, moose were hunted too (Biggar 1924:268). Combining the species recorded in association with the Stadaconans (n=11, excluding dog, counting fawns and stags as one and adding the moose) and the Hochelagans (n=9, including muskrat), 15 different land mammals were reportedly exploited by the St. Lawrence Iroquoians but the impression given by Cartier and Roberval is that fishing and, for the Hochelagans farming, were more important than hunting.

Nineteen species (excluding dog and the cross fox) are listed in Sagard's *Dictionnaire* (Table 2-2). In his text, Sagard describes the "Anasatey" fox as red (Wrong 1939:222) rather than grey as the dictionary translation has it and mentions lynx, "Toutsitsoute" (ibid.:223), porcupine (ibid.:227) and common mice (ibid.:227). At least two types of deer, probably wapiti and whitetail, as well as caribou and moose were known to the Hurons, as were buffalo (ibid.:225). But Sagard noted that the moose "is common in the province of Canada and very rare among the Hurons inasmuch as these animals usually keep to the secluded parts in the colder and mountainous regions ..."(ibid.:224) and that deer were more plentiful to the south of Huronia (ibid.:225). Adding the second type of deer and the lynx, the total number of mammals recorded as known to the Hurons becomes 23.

Champlain discussed the animals of New France as an unprovenienced group. Many that he mentioned were later included in Sagard's dictionary and text. However, from Champlain's account, weasels and ermines (in addition to martens), badgers, which Biggar footnotes as wolverines, and a deer called roebuck (in addition to moose, wapiti, whitetail deer and caribou, which he also lists) can be added to those found in the New World. However, since Champlain travelled around southern Ontario, southern Quebec and Acadia, these additional mammals cannot be conjoined with any specific Native group.

No previously unrecorded mammalian species are found in the *Jesuit Relations* but from them some ideas of relative quantities can be formed. It is evident that deer, beaver and dogs were the animals most often boiled for feasts (Brébeuf 1636 JR 10:177-79) and that great efforts were made to hunt deer and bears. In addition, these animals were more common south of Huronia (Ragueneau 1648 JR 33:83); the black squirrel, too, was hunted mostly in the Neutral area (J. Lalemant JR 27:165). Thus, it appears that those animals of particular importance to the Hurons were in greater numbers in the region of the Keffer site than in Simcoe County.

Comparing the mammals recorded as being used by the St. Lawrence Iroquoians, and more particularly the Hochelagans, with those reported to have been exploited by the Hurons, it appears that the Hurons hunted a wider variety of land mammals. Champlain's trip to Lake Ontario, as well as the comments made by Sagard and some of the Jesuits (for example, Ragueneau 1648 JR 33:83), indicate that the region around the north shore of this lake was recognized as a good hunting ground. This suggests that Keffer may have been in a richer environment for mammal procurement than McKeown.

Birds

Although the number of birds along the St. Lawrence was praised by Cartier (Biggar 1924:198), Sagard (1939:33, 37) and Boucher (1883:21, 23), the impression gained from Cartier and Roberval is that birds were not very important to the St. Lawrence Iroquoians. Cartier mentions the:

> great number of birds, to wit: cranes, bustards, swans, white and grey wild geese, ducks, drakes, blackbirds, thrushes, turtledoves, wood-pigeons, goldfinches, farins, canaries, linnets, nightingales, sparrows and other birds the same as in France (Biggar 1924:198)

but, like Roberval (Biggar 1924) and Sagard (Wrong 1939), he does not mention the natives hunting or eating any of these 17 species. Sagard described the many sea birds in the lower St. Lawrence area, including razor-billed auks and fulmars near the Grand Banks (ibid.:33), the great auks on Bird Island and the gannets in that region (ibid.:37-8). He also mentioned partridges down the St. Lawrence River below where the Saguenay River flows into it (ibid.:40) and numerous larks on an island at the mouth of the Saguenay (ibid.:47). About the exploitation of animals from the St. Charles River, half a league distant from Quebec City, Sagard wrote, "It is in our little river that the savages catch an immense number of eels in the autumn, and the French kill the game-birds which come to it in quantity" (ibid.:51). An inference which can be drawn from this quote is that the Stadaconans were little interested in bird hunting, although it may be merely that eel fishing was more important in this instance. In the Hochelagan region there were "many cranes, swans, bustards, geese, ducks, larks, pheasants, partridges, blackbirds, thrushes, turtledoves, goldfinches, canaries, linnets, nightingales, sparrows the same as in France and in great numbers" (Biggar 1924:144), but again there is no description of the Hochelagans hunting or eating these birds. Le Jeune described a bald eagle killed by a soldier at Tadoussac (1632 JR 5:21) and stated that French hunters found many "bustards, geese, ducks, teals, and other birds" on the islands in the St. Lawrence River (ibid.:99). J. Lalemant reported the story of an eagle attacking a nine year-old boy at Quebec (1647 JR 33:47) and an injured crane attacking a Frenchman (ibid.:47). Combining these various sources, at least 21 non-marine species are reported in the St. Lawrence Iroquoian region.

When Champlain travelled to Lake Ontario in the fall of 1615, he noted many cranes and other kinds of birds, but that the Huron men went to hunt mammals or to fish in order to feed themselves (Biggar 1929:62). He mentioned entering a lake [Lake Loughborough] "in which was a great quantity of game such as swans, white cranes, bustards, ducks, teals, thrushes, larks, snipe, geese and several other kinds of fowl too numerous to count" (ibid.:82). Since this lake is only *ca.* 70 kilometres west of McKeown and, because many of the same species were noted east of the McKeown site area by Cartier (Biggar 1924), it can be assumed that these species were in the site's catchment area. Thus, the snipes and possibly teals (teals may have been included in Cartier's or Sagard's "ducks"), bring the reported bird total to 22 or 23 for the St. Lawrence Iroquoian area.

The nine species noted by Champlain north of Lake Ontario could have been hunted by the Keffer people. Farther west Champlain noted that game birds were available in quantity in their proper seasons (ibid.:116). Even farther west and south, particularly in the Neutral area, wild turkeys were common (ibid.:254), as J. Lalemant's *Relation* confirms (1641 JR 21:197). These large birds were also known near the Tobacco people, to the west of the Hurons, and occasionally, in Huronia itself (Wrong 1939:220). Le Mercier (1637 JR 13:241) reported a Huron sorcerer having a turkey wing which he used ceremoniously to fan people and two more which he gave to two initiates (ibid.:243). The presence of this large bird in the proto-Huron/Petun region but not in the proto-St Lawrence Iroquoian area is significant.

More information on birds and bird hunting is available for the Hurons (Tooker 1967:66; Trigger 1990:35). A good source is Sagard's *Dictionnaire de la langue huronne* which lists names for 15 different birds (Table 2-1). From his text, vultures (Wrong 1939:220), owls, hawks, falcons, sparrow-hawks, gulls and cormorants (ibid.:221) can be added to the list. His inclusion of gannets and puffins on certain islands in Georgian Bay (ibid.) seems highly improbable though. Le Jeune (1634 JR 6:225) described a bird which was probably the night-hawk. Ignoring the gannets and puffins, the number of birds is increased to a minimum of 26 species. These are all large or at least medium-sized species and were likely of greater economic importance than the six or seven song birds included in the lists of birds in the St. Lawrence area given above, assuming they were all hunted. Thus, the early visitors reported more species in connection with the Hurons than the St. Lawrence Iroquoians and most of the Huron birds were larger than those mentioned in the St. Lawrence area.

Appealing to hunters, Champlain (1922-36:253-4) praised 15 birds of prey, three types of partridges and at least 28 water birds found in New France. He also mentioned the wild turkey, passenger pigeons and the occurrence of many small birds. Unfortunately, he did not distinguish between the different regions in this section of his report (Biggar 1929:253-4) and it is apparent that he is combining his knowledge from all of New France.

Reptiles and Amphibians

An interesting aspect of the recordings of reptiles and amphibians was the sighting of many sea turtles in the St. Lawrence, although there is no mention of their exploitation by the Native peoples (Cartier 1924:118). Similarly, J. Lalemant comments on two additional types of turtles (1648 JR 33:47-9).

Alternatively, numerous turtles were eaten by the Hurons, according to Sagard (Wrong 1939:232) and large snake skins were used to ornament clothing (ibid.). Boucher (1883:40-1) provided the most information on snakes, saying that they are more common "further up country" and noting that only one, the rattlesnake, was dangerous but that the Iroquois knew a plant poultice remedy for such bites. Boucher also described lizards, toads and frogs of several kinds, apparently repeating information from J. Lalemant (1646 JR 29:219). Boucher described a bullfrog and stated "the Huron Indians eat them and say they are very good" (ibid.:41; see also Wrong 1939:236). It appears from the histories that, except for the bullfrog and some turtles, these classes were insignificant dietary items. However, the Hurons appear to have been in a region with more snakes and they did eat turtles, although these may have had greater significance symbolically and ritually (Brébeuf 1636 JR 10:129-131; Le Mercier 1637 JR 13:193; J.Lalemant 1639 JR 17:157; Ragueneau 1646 JR 30:62-64; Tooker 1967:154-55).

Plants Mentioned in the Ethnohistorical Sources

Cartier's account lists more domesticated plants than are generally attributed to the Indians, such as "pease [sic], mellons [sic] and cucumbers" (1924:183), but all observers stressed the importance of corn, followed by squash, beans, sunflower and tobacco. Cartier's 1534 report of cultivated plants was based on hearsay, what "he had been given to understand" (Biggar 1924:62), but on his 1535 voyage, when he went upriver to the settlement of Hochelaga, he recorded their fields and their corn and bean soup as well as their corn bread. His account suggests that the Stadaconans were primarily fishers, hunters and gatherers, whereas the Hochelagans were a more horticultural people.

Some of the wild plants that Cartier attributed to the Hochelagans on hearsay have not been confirmed as being in the New World (figs and pears), but there are other accounts duplicating his information for plums, nuts and apples (Biggar 1924:63). Likely his figs were actually dried plums, since he gives the Indian word "honnesta" for figs, and he had immediately above translated honnesta as dried plums (ibid.); as well, Sagard said "tonesta" was the Iroquoian word for plums (Wrong 1939:238). Finally, Cartier saw many grapes along the shores of the St. Lawrence (Biggar 1924:142) and there was a red lily, the bulb of which Algonkians ate, at least as a starvation food (Le Jeune 1633 JR 5:103).

Many more edible plants were recorded for the Hurons (Table 2-3). Of these, the various berry bushes (Brébeuf 1636 JR 10:103; Champlain 1922-36:50; Sagard 1939:72, 74, 238) and the fruit and nut trees (Sagard 1939:238) appear to have been the most significant, with roots and herbs being of little importance (ibid.:108). There is mention of eating inner bark and drinking the sap of some trees, but this also appears to have been uncommon (Wrong 1939:108, 82).

The greater number of wild plants mentioned in association with the Hurons than the St. Lawrence Iroquoians reflects, in part, greater contact with the Hurons and thus more chances to observe their uses of plants. However, Sagard suggested that there was a greater variety of flowering plants in Huronia (Wrong 1939:241) and records that Huronia had "fine forests, consisting of great oaks, beeches, maples, cedars, spruces, yews and other kinds of trees *far finer beyond comparison than in the other provinces of Canada that we have seen*" (ibid.:91, emphasis added). Furthermore, within southern Ontario, he said, "the country is warmer and more beautiful and the soil is richer and better the further south one goes" (ibid.). Boucher repeated these sentiments about the differences between the St. Lawrence region and Huronia (Montizambert 1883:22, 28, 33). J. Lalemant wrote that no more fruits were found in the Neutral country than in Huronia, "unless it be chestnuts, of which they [the Neutrals] have plenty, and wild apples, a little larger" (1641 JR 21:197). Thus, from these descriptions, it appears that the area around Keffer was somewhat richer in plants than was Simcoe County, which, in turn, was richer than the St. Lawrence Iroquoian area.

In general, the ethnohistorical sources depict a rich environment, but there were some detrimental aspects. Pests (Le Jeune 1633 JR 6:29, 1640 JR 18:85; Le Mercier 1632 JR 14:105; Starna, Hamell and Butts 1984), droughts (Brébeuf 1636 JR 10:35; J.Lalemant 1639 JR 17:135; Ragueneau 1650 JR 35:85) and frosts (Le Jeune 1633 JR 6:29; Le Mercier 1637 JR 14:47) threatened crops; rain storms hampered fishing (J. Lalemant 1639 JR 17:51, 1642 JR 23:95). Because the Hurons were dependent on horticulture, drought was the most serious of these inclement conditions. Conrad Heidenreich has shown that droughts occurred two or three times every ten years in Huronia (Heidenreich 1971:57-59). While still a serious problem, the impact of reduced rainfall may have been moderated somewhat around the Keffer site where the soils have a higher clay content. The environmental differences between the Toronto and Prescott areas are discussed in chapter 8.

Hunting and Fishing Techniques in the Ethnohistorical Sources

There is much information on Huron hunting and fishing but little on these activities for the St. Lawrence Iroquoians or the region where they lived (Cartier 1924:60, 127; Sagard 1939:57). Radisson wrote about hunting, often of bears, just south of the St. Lawrence and below the eastern end of Lake Ontario. Champlain's accounts of Huron deer drives (Biggar 1922-36:60-1, 83-5; Vimont 1642 JR 22:273) and winter fishing (ibid.:167-8; Ragueneau 1650 JR 35:175) are valuable. Sagard gave more details on river fishing (1939:60) and particularly about the annual fall trips to Georgian Bay (ibid.:186-90). He (ibid.:233) stressed the importance of snow and snowshoes to hunting, which was usually done with a bow and arrow (ibid.:133, 221; Champlain 1922-36:60-1, 85), but snares (Sagard 1939:221, 223), traps (Sagard's *Dictionnaire*; Ragueneau 1646 JR 30:52), nets (Sagard 1939:233) and spears (Champlain 1929:60-1) were also used. Fishing with weirs (ibid.:56), seine nets (ibid.:167-8; Sagard 1939:190, 233), set nets (Sagard 1939:60, 186-90; J. Lalemant 1642 JR 23:95), hooks and lines (ibid.) and spears (ibid.:132) was recorded. Because Champlain and Sagard participated in hunting and fishing trips, they emphasized these, but neither the amount of time expended hunting and fishing nor the proportions of food that these activities provided are clear from the ethnohistorical sources.

Ethnohistorical Information on Seasonal Exploitation of Animals

Good seasonality information exists for fishing in general from the St. Lawrence River. Fishing began in mid-May (J. Lalemant 1646 JR 28:191, 1648 JR 32:87) and lasted through the summer (Cartier 1924:199), with salmon (J. Lalemant 1647 JR 30:173) being replaced by sturgeon (J. Lalemant 1648 JR 32:93), mackerel and other smaller catches (Cartier 1924:199) and, in September, by shad (Roberval 1924:267). Maigre [drum] and carp could be fished just prior to the salmon in mid-May (J. Lalemant 1648 JR 32:87). In 1648, the first salmon was taken at Quebec City on May 18 (J. Lalemant 1648 JR 32:87), but this may have been somewhat early; in 1646, the first salmon was landed by June 11 (J. Lalemant 1646 JR 28:181). In 1648, salmon fishing was over on July 22 and was followed by the exploitation of sturgeons and then eels (J. Lalemant 1648 JR 32:99). In the autumn, fishing ended with the important eel fishery which lasted from August (J. Lalemant 1646 JR 28:239) or September (Vimont 1643 JR 23:307) until the end of October (Vimont 1643 JR 23:307) or early November (J. Lalemant 1646 JR 28:239).

It is known that the Stadaconans were fishers; they habitually went "down to the sea in the fishing season" (Biggar 1924:62, 178). In 1534, Cartier encountered more than 300 St. Lawrence Iroquoians, including men, women and children, who had come in 40 boats, between July 16 and 25, to Gaspé Harbour, to net mackerel, which were plentiful at that time (Biggar 1924:60). The Stadaconans also hunted belugas (Biggar 1924:117) and fished many species off the Ile d'Orléans (ibid.:118) at least in the warm weather months when Cartier encountered them and saw their fishing cabins there (ibid.:127). Although Cartier noted that the Hochelagans had fish to eat (ibid.:150, 166), including eels which they "smoked during the summer, ... [to] live on during the winter" (ibid.:158) and other species, no information is presented on how the Hochelagans, specifically, obtained their fish.

In Huronia, fall fishing predominated (Sagard 1939:232; Brébeuf 1635 JR

8:87-9, 143; Le Mercier 1637 JR 13:115, 137, 1638 JR 15:57-9, 113, 125), with some winter ice fishing (Champlain 1922-36:166; J. Lalemant 1640 JR 19:173; Montizambert 1883:43; Sagard 1939:98) and some summer fishing (J. Lalemant 1639 JR 17:51; Biggar 1929:166). According to Le Mercier, fresh fish abounded in Huronia in September (Le Mercier 1637 JR 13:89) but many sources indicate that the major fishing effort was on Georgian Bay, when primarily whitefish but also some trout, sturgeon and other fish were caught (Wrong 1939:186). This fishery could last until December 8 (Le Mercier 1638 JR 15:133), but usually occurred in October and November (Sagard 1939:185-90). In 1637, already by September 29 many Huron men were away fishing (Le Mercier 1637 JR 13:137). Some weeks after that fishery, einchataon or burbot (Steckley 1986b) were caught (Wrong 1939:232).

The Hurons named the months of October and November in accordance with fishing activities. One phrase for October and for November has been translated as "when the atsihiendo come, run"; "atsihiendo" likely being whitefish (Steckley 1983:12, 13); another name for October describes the method of fishing: "one will cast a net from on the shore" (ibid.) or "one will put a net in the water from the shore" (Steckley 1986b:20).

Over the winter, the Hurons could exchange corn for fish with the Algonkians "as soon as the ice is strong enough" (Le Mercier 1636 JR 13:249) and fish could be caught under the ice with seine nets or lines (Biggar 1929:166-68). Such ice fishing was practiced in March (J. Lalemant 1639 JR 17:197, 1640

JR 19:173-5), although Champlain merely says it occurred in winter (Biggar 1929:167; also Wrong 1939:98), which, in his experience, began with the month of November and lasted until April (ibid.:168).

It is odd that spring fishing was mentioned so infrequently; Le Mercier casually mentioned spring fishing when he commented that by May 17 work on the cabins for the fathers at Ossossané was slow because, most young men had left their villages for trading or fishing (1637 JR 14:57). J.Lalemant (1639 JR 17:197) described the marrying of two virgins to the fishing nets in the middle of March when the season "arrived for fishing with the seine". This infrequency is particularly striking since Steckley (1983:11) has translated the Huron name for April as "when the pickerel come or run". It is possible that spring fishing is under-reported because it was considered unimportant, since it did not involve large movements of people away from the villages and also because it may have been a female activity primarily, although some young males participated in spring fishing (see above). The March fishery could have extended into the early spring but since it is described as ice fishing this is unlikely. Whatever the reason(s), judging from the ethnohistorical sources, spring was not important for fishing; fall was the main fishing season, with ice fishing occurring in late winter. As Sagard wrote, the Hurons "by aid of reason and experience [could] very well hit upon the times for fishing, knowing what fish comes in autumn, what in summer, either one or the other season" (Wrong 1939:230).

From the ethnohistorical records, it appears that fishing for both the St.

Lawrence Iroquoians and the Hurons involved major efforts at particular seasons for specific fish. However, there were differences. With the Stadaconans, the whole population, male and female fished, whereas for the Hurons, fishing was almost exclusively reported as a male activity. The eel fishery took place in the late summer for the St. Lawrence Iroquoians, whereas the Hurons exploited whitefish in the fall. Assuming that the Hochelagans fished eels, they may have had to reduce their harvest activities, whereas for the Hurons the crops were in before the whitefish season began. Thus, in terms of fishing and farming activities, the Hurons' schedule was more advantageously balanced than was the St. Lawrence Iroquoians'.

Unfortunately, little was recorded about the hunting schedules of the St. Lawrence Iroquoians, only that "while the ice and snow last, they catch a great number of wild animals" (Cartier 1924:186). During the winter of 1535-36, a large number of Indians went on a hunting trip, which they predicted would last a fortnight but was extended to about two months. A large number of them returned on April 22 with deer meat. Others had "fresh meat, venison and all varieties of fresh fish" to barter with Cartier every day from at least February to April (ibid.:216-18). These types of winter hunting resemble the Odawa seasonal pattern described by Fitting and Cleland (1969).

The St. Lawrence Iroquoian practice of hunting in midwinter is contrary to most of the reports of Hurons hunting primarily in the fall. Champlain's account of a prolonged Huron fall deer hunt (1922-36:60-1, 80-5), combined with the Jesuits' assertions that winter was the only season when the Hurons were in their villages (Brébeuf 1635 JR 8:143, 1636 JR 10:53; Le Mercier 1637 JR 15:13; J. Lalemant 1639 JR 16:249, 1640 JR 14:125), gives the impression that they hunted mostly in the fall and little in winter. Beaver were taken in the fall (Champlain 1922-36:81; J. Lalemant 1643 JR 26:249) and this is when large groups traditionally went to drive deer into specially constructed pounds or enclosures (Champlain 1929:83-92; Williamson 1990:291), or deer and/or bears into bodies of water (Champlain 1929:60-1). Deer were hunted singly then too (Le Mercier 1637 JR 13:147). Bears could be hunted in spring as well as fall (Le Mercier 1637 JR 14:33). Le Mercier stated that autumn was "the *only* season of game" (1637 JR 13:109, emphasis added).

However, there are some references to winter hunting. According to Sagard, deer and moose were sometimes hunted in winter on snowshoes (Wrong 1939:84) and beaver were "hunted usually in winter chiefly because they stay in their lodges then and their fur holds in that season, while in summer it is of little value" (Wrong 1939:233). This hunting of beaver in winter may reflect a heightened interest in obtaining beaver pelts in the 1600s. In addition, in his description of this activity, Sagard was contrasting summer with winter; he may not have been distinguishing between fall and winter. Brébeuf stated that beaver were out of season in winter (1636 JR 10:173). Ragueneau reported that in 1648, the Hurons went hunting at the end of winter (1648 JR 33:83) but it must be remembered that by this date their subsistence practices had been disrupted by

Iroquois raids throughout Huronia. Both J. Lalemant (1639 JR 17:141) and du Peron (1639 JR 15:183) described Hurons returning from hunting at Lent, although they were likely reporting the same incident of 1637. Ragueneau reported that 300 people from St. Ignace returned from hunting at this time of year in 1647 (JR 33:83-9, 165-7). Thus, from the ethnohistorical accounts, it can be concluded that fall was the primary time for hunting but it also occurred in winter (Tooker 1967:65, 71) and early spring. Summer is the only season for which there are no ethnographic records of hunting.

In summer, Huron women tended their crops and gathered fruits and nuts which ripened from early summer to fall. It is sometimes stated by male ethnohistorians that children helped in these tasks but being accompanied by children may have been a hinderance more often than a help to the women. Steckley's translations of the names for May and the summer months provide corroborative evidence for these activities. Steckley translated the three phrases for May as "when one plants or sows", "when strawberry plants open, when strawberries are in flower" and from a later edition of the dictionary, probably in the 1700s, as "when one will plant trees". For June, the phrases mean "when strawberries are ripe" and for July, "when raspberries or blackberries are ripe". August is "when the little corn is made, formed" or "when the (ear of) corn stands out". By September, "the corn is completed, ripe" (Steckley 1983:12). Wild plants must have been collected and cultivated plants harvested in the same seasons by the horticultural St. Lawrence Iroquoians.

In sum, some differences in the seasonal rounds of the St. Lawrence Iroquoians and the Hurons are reported in the ethnohistorical records. A major one is that mammal hunting occurred primarily during, although it was not entirely restricted to, the winter in the St. Lawrence region and the fall in Huronia. Fishing was a major summer and early fall activity in the St. Lawrence River, whereas fall fishing was most common on lakes in Huronia. Supplementary winter fishing, occurring mostly in March, would have provided the Hurons with added calories, fat and protein just when these might have been getting low in their diet. We have no ethnohistorical records for a similar fishery among the St. Lawrence Iroquoians. Finally, since the Hochelagans and the proto-Huron/Petuns were both horticulturalists growing the same crops, their agricultural activities would have been seasonally similar.

Food Preparation and Consumption

Little information was recorded about the butchering and processing of the prey for either the St. Lawrence Iroquoians or the Hurons. Regarding Indians of the St. Lawrence Valley, Cartier commented on *smoked* eels (1924:158) as did Vimont (1643 JR 23:307). Concerning the Hurons, Le Mercier (1637 JR 14:95) mentioned smoked fish being used in ordinary feasts and certainly fish were dried (Brébeuf 1636 JR 10:101; Ragueneau 1649 JR 34:215). Sagard commented on drying fish (Wrong 1939:185-186, 230), on collecting fish oil (1939:189) and on the hanging of ungutted *leinchataon* [burbot (Steckley 1986b)] (ibid.:95).

Champlain participated in a drive from which oil and a little meat from 120 deer were transported back to the village of Cahiagué (1929:85), a distance of over 350 kilometres, and he saw smoked beaver (ibid.:233). From this information, it is apparent that the St. Lawrence Iroquoians and the Hurons preserved fish in similar ways. Considering that the Hurons hunted mainly in the fall whereas the St. Lawrence Iroquoians hunted in the winter, it is likely that the Hurons preserved more than did the St. Lawrence Iroquoians, who could have relied on the cold weather to keep their meat from spoiling.

Both peoples dried plants for winter and spring consumption. Cartier noted the drying of plums by the St. Lawrence Iroquoians (Biggar 1924:63) and there are numerous references to dried wild and cultivated plants for the other Iroquoians (Wrong 1939:237).

Much more was written about cooking. Cartier commented that the Stadaconans ate their meat and fish "almost raw, only warming it a little on the coals" (1924:61), as did the Hochelagans who "merely smoked" it (ibid.:186). They, like the Hurons, pounded their corn into flour before baking it into loaves or making soup with it, to which beans might be added (ibid.:157-8).

Details on Huron cooking were given by Champlain, Sagard and Boucher, with the Jesuits adding a few extra bits of information. It is clear that corn soup (Champlain 1922-36:128-9; Sagard 1939:71, 106; J. Lalemant 1639 JR 17:17; Chaumonot 1640 JR 18:11), sometimes flavoured with fish, meat or squash (Champlain's *migan* and the others' *sagamité*), was the staple, and that corn loaves, sometimes flavoured with dried fruits, beans or deer fat (Champlain 1929:125-6), were often baked in ashes. Occasionally, dough wrapped in corn leaves was boiled (ibid.:126). The corn cooked in these ways had previously been reduced to flour or meal by pounding the kernels in a wooden mortar (Brébeuf 1635 JR 8:111) or by stone grinding (J. Lalemant 1640 JR 19:235). Stewed deer, bear, fish, dog and human meat was eaten. Except for corn and squash (Champlain 1929:131; Sagard 1939:72, 101, 106), food was rarely roasted. Turtles were an exception. They were usually roasted or cooked in ashes, although they also might be boiled (Sagard 1939:233, 251). Roots were cooked in hot ashes and, in times of scarcity, boiled acorns (Sagard 1939:108), uncooked tree bark (ibid.) and boiled moss (Ragueneau 1650 JR 35:175) were consumed. Again, although the amount of information is unequal, it appears that the same methods of cooking were shared by the St. Lawrence Iroquoians and the Hurons.

"The feasts they [the Hurons] give in the villages and towns are sometimes good but those they give during hunting and fishing are the best of all" (Sagard 1939:186). The latter are not described, but Brébeuf (1636 JR 10:215) distinguished four categories of village feasts. In the early winter, the main delicacy served at these celebrations was fish (Le Mercier 1638 JR 15:117), but throughout the year, deer, bear and often dogs were the main ingredients. Dogs seem to have been associated especially with curing feasts.

In general, food refuse littered the pathways in the Huron villages, where it was scavenged by dogs (Sagard 1939:226), but some bones were treated more carefully. Fish bones were not supposed to be burnt (Sagard 1939:187); neither were the bones or fat of deer, moose and other animals (Sagard 1939:187; Champlain 1929:91-2). It was especially important that dogs not chew mammal bones during hunting or fish refuse near fishing activities (Brébeuf 1636 JR 10:167).

Non-dietary Uses of Animals

Animals were exploited not only for food but also for skins for clothing. Brief descriptions of the scant outfits worn by the St. Lawrence Iroquoians during the summer are given by Cartier and Roberval, while Champlain described the Huron winter garb (1929:132). The Stadaconans "in summer [wore only] a small skin with which they cover their privy parts and a few old furs which they throw over their shoulders" and they tied their hair with a leather thong (Biggar 1924:61, 158). "In winter they wear leggings and moccasins made of skins and in summer they go barefoot" (ibid.:181). Roberval agreed and added a few details:

> They weare skinnes upon them like mantles; they have a small payre of breeches, wherewith they cover their privities, as well men as women. They have hosen and shooes of leather excellently made. And they have no shirts, neither cover their heads (ibid.:268, spelling as in Biggar).

Occasionally dog skin mantles were worn, possibly to signify special status or for a special purpose (Biggar 1924:136).

Both groups relied on animal skins to keep them warm. Thus, skins, particularly those of deer and beaver, might have been as significant a motive for the procurement of mammals, as meat. In general, Huron clothing appears (Tooker 1967:20-22), from the ethnohistorical evidence, to have been more tailored than the outfits of the St. Lawrence Iroquoians. Among the Hurons, mantles or robes were made of deer, bear, beaver (J. Lalemant 1641 JR 21:183) or grey squirrel skins (Ragueneau 1648 JR 33:193) and embellished with animals' tails (Sagard 1939:224). Accessories (ibid.:134; Sagard 1939:145, 233) and cosmetics were mentioned (Champlain 1929:50, 133; Sagard 1939:145; du Peron 1639 JR 15:155). Children often went naked even in winter (Sagard 1939:130). Skins were also used as blankets and wraps for infants (Brébeuf 1635 JR 8:109; Le Mercier 1637 JR 13:99; Sagard 1939:130, 154).

No information was recorded about the manufacturing of tools from skeletal elements. In fact, very little information is provided about such tools. Sagard noted that the Hurons worked wood with beaver incisors (1939:61, 133), pierced their ears with bone awls and then inserted feather quills to keep the holes open (ibid.:127), attached eagle feathers to arrows with a fish glue (ibid.:154), used gar teeth like scalpels to bleed themselves to relieve pain (ibid.:232) and made barbed fish hooks of bone (ibid.:189). According to Le Jeune (1634 JR 6:311, 440), eels were speared with a composite tool which included bone prongs. Among the Iroquois, prisoners' thumbs were cut off with shells (J. Lalemant 1647 JR 31:45). The Hurons made rattles from turtles (Champlain 1929:155; Du Peron 1639 JR 15:179; J. Lalemant 1640 JR 20:23). Du Peron described bone hair ornaments (1639 JR 15:155) and Le Jeune (1639 JR 7:95, 97) a game in which perforated pieces of bone were caught on another bone (a cup-and-pin game). Cartier learned that the Hochelagans cut and ground shells into beads (Biggar 1924:153) and there are many reports of the Hurons wearing bracelets and necklaces of shell which they valued highly (Wrong 1929:133-135; Biggar 1939:144). Finally, in the illustration of a Huron deer hunt from Champlain's *Voyages* of 1619 (reproduced in Trigger 1990:37), it can be seen that the men are driving deer into an enclosure with the aid of noise made by using large mammal femora or humeri to beat on large scapulae which appear to be from some large cervids, possibly moose.

Sexual Division of Labour

The French repeatedly stated that Native women worked harder than men. According to Cartier, the St. Lawrence Iroquoian women "worked beyond comparison more than the men, both at fishing which is much followed, as well as at tilling the ground and other tasks" (Biggar 1924:185). In 1534, Cartier met about 300 St. Lawrence Iroquoian men, women and children at Gaspé fishing mackerel (Biggar 1924:60). In general, from Cartier's account, there does not seem to have been as strict a sexual division in subsistence activities among the St. Lawrence Iroquoians as among the Hurons, as reported by Sagard, Champlain and the Jesuits. The Stadaconans seem to have moved seasonally with both sexes involved in procuring food. Roberval confirmed this (Biggar 1924:268). At Hochelaga, about 100 persons, including men, women and children, came to meet

Cartier on his first visit; males were not given special priority in this important event. Cartier made no distinction by sex about who gave the French fish and bread at that introduction (ibid.:150) and in a summary comment on their life style he stated "this whole tribe gives itself to manual labour and to fishing merely to obtain the necessities of life" (ibid.:160). From Roberval, it appears that males and females wore the same style of clothing (Biggar 1924:268). However, both the Stadaconan and Hochelagan leaders were males and after meeting with the principal chief at Hochelaga, Cartier was offered food by women who had prepared it. Men "alone" made use of tobacco. Thus, while there were certainly important divisions by gender among the St. Lawrence Iroquoians, the subsistence activities often seemed to have been shared by the sexes. Most of the little information available concerns the Stadaconans, however, and it is not clear how many of their customs were the same as those of the more horticultural Hochelagans. There is only the suggestion that these people shared in such activities, especially fishing. This is important since fish formed a major part of the diet.

In Huronia, according to Champlain, women were expected to:

> [take] care of the house, till the soil, sow corn, fetch wood for the winter, strip the hemp and spin it, and with the thread make fish-nets, harvest the corn, store it, prepare the food, attending to the house, [and] carry things from the fields for their husbands (Biggar 1929:136).

Whereas the "men do nothing but hunt deer and other animals, fish, build lodges and go on the warpath" (ibid.:137). Sagard confirmed and enlarged upon this description of the sexual division of labour:

> the women usually do more work than the men although they are not compelled to do so. They have the care of the cooking and the household, of sowing and gathering corn, grinding flour, preparing hemp and tree bark and providing the necessary wood. They dress and soften the skins of beaver, moose and others, make pottery in which they cook their food, meat or fish: men think only of hunting, fishing or fighting (Sagard 1939:101-2).

Du Creux added the care of infants as women's responsibility (1951-2:85).

Apparently, unlike the St. Lawrence Iroquoians, the Huron women rarely went fishing and hunting. Sagard's dictionary includes one phrase with *she* is going fishing compared to four with *he*, and no hunting expressions with *she*. However, in 1648, Ragueneau reported a Huron mixed fishing party of 11 or 12 persons, including at least one wife, one eighteen year old girl and two children (1648 JR 33:91). He also reported a mixed group of about 300 people going hunting at a distance of two days journey from the village of St. Ignace, again in 1648 (1648 JR 33:83-85). Considering the stress the Hurons were under at this time, these might not be typical fishing or hunting practices. Reports from earlier times, such as those of Sagard and Champlain, indicate that fishing in Georgian Bay and deer drives were men's activities, although male children also participated in them.

In addition to the male tasks listed by Champlain and Sagard, Huron men traded "with the French and other neighbouring tribes, such as the Tobacco Nation [Petun], the Neutral Nation, that of the Sault [Ojibwa] and that of the "raised hairs" [Odawa], that of the stinking peoples [Winnebago] etc." (du Peron 1639 JR

15:155). Le Mercier, in 1637, stated that "at this season [July to September] visits [by the priests] among the villages would be almost useless, the women being occupied all day in their fields and the men in trading" (1637 JR 13:11). This agrees with Brébeuf (1636 JR 10:53).

Young people assisted their elders in tasks appropriate to their sex. In addition to helping with field work, girls would twist twine with the women (Wrong 1939:98). A girl of fifteen to sixteen went to cut wood in 1643 (J. Lalemant 1644 JR 23:99) and the collecting of fallen branches for fire wood was a women's task that girls also could do (Biggar 1929:136, 156; Wrong 1939:103). In 1637, Le Mercier reported that the women would spin the hemp that the young men brought to them (1637 JR 13:265), but women also gathered hemp (J. Lalemant 1642 JR 23:55; Wrong 1939:240). The hemp was rolled into twine by the women and girls but it was the men who used it to make fishing nets and snares (Wrong 1939:98, 101, 240; Biggar 1929:136, 166-67). Young boys went on fishing trips (Le Mercier 1637 JR 15:76; Chaumonot 1640 JR 18:27; J. Lalemant 1640 JR 19:169, 225) and hunted with their fathers (J. Lalemant 1643 JR 26:249).

In general, before the extreme disruption of their subsistence activities by the Iroquois and the French, the Hurons appear to have divided their subsistence activities very clearly by gender. Young boys would refuse a mother's request to go for water or wood or to do other household tasks, claiming that these were girls' work (Wrong 1939:132). Le Jeune reported that a man whose wife was sick would only go out in search of supplies at night when no one could see him because the Hurons ridiculed men who did women's work (Le Jeune 1633 JR 5:133). Even Father de Noue was laughed at when he was seen carrying wood (ibid.).

Conclusions

This review of the ethnohistorical information on the Native peoples of southern Ontario has revealed several observations important for a comparison of proto-Huron/Petun and St. Lawrence Iroquoian subsistence.

The most noticeable difference in the material is that there is a much greater quantity of information relating to the Hurons than to the St. Lawrence Iroquoians. Furthermore, most of the St. Lawrence Iroquoian descriptions are of the Stadaconans rather than the Hochelagans. This raises the question of to what extent this St. Lawrence material is relevant to interpretations of subsistence of the people living in the Prescott area and specifically, at the McKeown site. Fortunately, some of Cartier's experiences were with people at Hochelaga and these included observations of their clothing and food as well as of their crops. In addition, since he knew both these St. Lawrence Iroquoian groups, his comparisons are useful. Thus, his conclusion that the Hochelagans were much more sedentary than the Stadaconans can be accepted. He also recorded that both groups made use of eels. It is not clear whether the Hochelagans exploited other St. Lawrence River creatures, but the French enumerated the available animals and recorded their impressions of the relative quantities. At least, we know about the large seasonal fish runs and the availability of some of the other animals. From the descriptions of the Hochelagans' clothing, it can be inferred which land mammals were hunted and, as was true for the sea creatures, there is ethnohistorical information about which terrestrial mammals and birds were in the region at which seasons and in what relative quantities. This type of information cannot be obtained from the zooarchaeological evidence alone.

The main weakness with the Huron data is not so much their quantity but how relevant they are to people subsisting in the Toronto area at least 100 years before the written descriptions were recorded. Fortunately, some of the early European visitors travelled in the Toronto vicinity; Champlain and many of the missionaries travelled south of Huronia. Thus, their comparisons of the regions are based on actual observations. Relying on these reports, it can be accepted that in the 1600s the southern areas, including that of the Keffer site, were richer than Huronia or the St. Lawrence valley in many of the animals and plants that were significant to these peoples' subsistence. For example, deer, beaver, wild turkeys, black squirrels, apples and chestnuts were reportedly more common south of Huronia. Lacking evidence of significant environmental changes between 1500 and 1650, it can be assumed that such differences persisted over that period. Based on this evidence, it can be concluded that the people living at the Keffer site could have availed themselves of wild animals and plants more easily than could the Hurons or the St. Lawrence Iroquoians.

From the ethnohistorical recordings of Native accounts of their ancestry as well as from archaeological research, it is known that the people living in Huronia in the 1600s included those who had migrated there from the north shore of Lake Ontario. Thus, the available ethnohistorical accounts are at least in part about the descendants of people inhabiting the Toronto region. There is a direct link between these peoples, albeit over about four generations, which warrants use of the description of one for interpretations of the other. Some changes in subsistence likely occurred over this time span and once the results of the studies of the zooarchaeological remains have been presented, the exactness of fit between the two sorts of data (ethnohistorical and zooarchaeological) can be determined. This will be done in the concluding chapter.

The ethnohistorical material has revealed differences in the scheduling of procurement activities for people living in the two areas. According to the Europeans, the most important fishery of the St. Lawrence Iroquoians was the late summer and early fall eel run, whereas for the Hurons it was the late October-November whitefish fishery. Considerable spring fishing was reported for the St. Lawrence Iroquoians; fishing was primarily a summer and fall activity for the Hurons. Similarly, the Indians along the St. Lawrence reportedly hunted mammals primarily in the winter whereas the Hurons hunted them mostly in the fall.

Finally, the ethnohistories provide information about gender-specific subsistence activities which are difficult if not impossible to discern from the zooarchaeological material. It was recorded that both the Hochelagan and the

Huron women were the farmers, whereas the men were hunters and fishers. From archaeological studies, it has been established that horticulture became the main subsistence activity in southern Ontario by A.D. 1300 (Trigger 1985b:83-91), and that it was practiced by both the McKeown and Keffer site inhabitants. Thus, while there may have been some changes in the system, it can be assumed that the main pattern of an historical sexual division of labour had been established at least by the time those two sites were occupied. Watson and Kennedy (1991) have argued that women were the gatherers of plants in archaic times and so would have been the developers of horticulture in the Woodland period. While the ethnohistorical sources provide details about the division of labour, the zooarchaeological evidence provides quantifiable evidence concerning the specific animals that were procured and a combination of these sources of evidence suggests differences in the diets according to gender.

In sum, while there are admittedly weaknesses in the available ethnohistorical evidence and caution must be exercised in its use, the written records contain information that is not obtainable from the zooarchaeological material. Combining these two sources of information permits a more complete reconstruction of subsistence. Comparisons of these sources as they relate to the subsistence of the proto-St. Lawrence Iroquoians and the proto-Huron/Petuns will allow a more detailed conclusion concerning the usefulness of ethnohistorical sources to zooarchaeological studies.

CHAPTER 3

PREVIOUS ZOOARCHAEOLOGICAL RESEARCH RELATED TO THE IROQUOIANS

Introduction

Faunal analysis as a research area was rejuvenated in the 1960s by Binfordian perspectives on archaeological research and by the emphasis he placed on economic activities. It also was stimulated by Richard Lee's (1968) studies, particularly the 1966 *Man the Hunter* symposium and the resulting collection of papers edited by Lee and DeVore (1968), which emphasized the close relationship between subsistence and residence patterns, group size and social structure. Binford (1968a) argued for a complimentary independence of archaeology and ethnography. His insistence on scientific methods resulted in important contributions not only to designating the primary function(s) of sites and the selection, transport and use of body parts of prey animals but also to taphonomy and quantification. Because both Binford and Lee studied hunters and gatherers, their results are not wholly applicable to interpretations of horticulturalists' sites. For example, effects of taphonomy are not marked on Iroquoian sites because they are relatively recent (compared to early hominid sites on which much of the discussion of post-depositional factors has been focused) and because the well-drained soils on which most Iroquoian villages are located are not very corrosive to skeletal elements. But "intrusive" bones occur and the effects of the Iroquoians' dogs must be taken into account. The work of Lee and DeVore and Binford influenced researchers such as Hurley and Savage but, as the following review shows, the importance of faunal research to understanding peoples' habits was recognized in Ontario by Wilson as early as 1855.

Unlike the situation in the United States, archaeology in Ontario appears to have begun without G.R. Willey and J.A. Sabloff's (1980) Speculative Period. Because of the writings of the explorers and priests, concerted archaeological work began in Ontario with clerics looking for the historically documented sites of the Jesuit Missions.

Ethnographic Archaeology and the First Museum Collections and Reports: 1840 to 1899

The period of Ethnographic Archaeology (Trigger 1985b:57) began in Ontario (ibid.:60) with the investigations of Rev. Pierre Chazelle in 1842, Rev. Félix Martin in 1855 and Dr. Joseph-Charles Taché from *ca.* 1860-65 in Huronia (Hunter 1900:56). However, throughout this period most sites were ransacked by curio seekers (Dade 1852). These pothunters had no place to curate such finds or to study them until the incorporation of the Canadian Institute in 1851 and the appearance of its publication, the *Canadian Journal* in 1852. In that year, the society published a questionnaire asking about Indian sites, artifacts, human skulls, pictographs and Indian place names (*Canadian Journal* 1852 Sept.:25). This request for information and donations of artifacts as well as its recommendation for respect to be paid to burials, set a new tone for Ontario archaeology, but the response was weak (Killan 1981:8) and no mention was made of plant or animal remains.

A more rigorous approach to data collecting was augmented by the arrival at the University of Toronto, in 1853, of Daniel Wilson who, having done field work in Scotland (1851), brought European methods and finds to the attention of his Canadian contemporaries (1854, 1855a). Editing the New Series of the *Journal*, he reprinted a British paper on the "Value of natural history to the archaeologist", which emphasized the importance of identifying the bones of extinct animals found with human burials (1856:191). He was particularly interested in human remains and in his 1855 directions on their excavation, he stated that:

> the nature and relative position of any relics, such as urns, implements, weapons, &c., should be carefully noted: and among such, particular attention is to be paid to animal remains, such as the bones and skulls, horns or teeth, of beasts, birds and fishes. It is a common fashion among savage tribes to hold a burial feast over the grave of the dead, and such relics may tend to throw considerable light on the habits of the people as well as on the period to which they belong (1855a:347).

Despite Wilson's interests, it remained for his successor, David Boyle, a teacher and bookstore owner (Trigger 1985b:39), who joined the Institute in 1884, to establish a museum of Canadian antiquities and a journal devoted exclusively to archaeology (Killan 1981:13). Boyle instituted the *Archaeological Report of the Canadian Institute* in 1886 (1888a) and continued as editor of the *Annual*

Archaeological Reports to the Ontario Department of Education until 1908.

Boyle's primary interest was in acquiring artifacts for display. In his first *Annual Report* (1888a), he published a circular that was almost identical to the earlier one, changing only item 7 to include bone weapons. Yet, except for worked pieces and especially modified shells, he generally ignored faunal and floral remains. An extraordinary interest in shells by the early archaeologists goes back at least to Wilson (1855b). Boyle's annual reports, from 1888 until 1908, included descriptions of the functions and methods of manufacture of shell, bone and antler artifacts. Those collectors whom Boyle encouraged, including Andrew F. Hunter (1889, 1897a,b,c, 1898, 1899, 1900, 1901, 1902, 1903, 1904, 1907a,b) and George E. Laidlaw (1891, 1894, 1897, 1898, 1900, 1902, 1903a,b, 1904), also disregarded faunal material. The few non-artifactual faunal specimens added to the collections were skulls, mandibles or loose bear or beaver teeth, usually from graves.

Boyle also conducted site surveys and he excavated (Garrad 1986). In searching for village locations, he considered soil type and the proximity of nut-bearing trees, clay and water but made no mention of animal resources (Boyle 1889:12). In 1889 the only faunal remains he saved from a large midden were "three skulls of common deer" (ibid.:15). However, by 1891, he saved "50 bones, various" in addition to a much higher number of worked bones from the Southwold Earthwork (1892:20). Even this minimal attention to faunal material likely reflects the influence of James H. Coyne MA, who was in charge of the excavations. In Coyne's brief description of the material recovered from one of the "ash-heaps" (middens), he noted that despite previous frequent excavations:

> There still remained, however, arrow-heads and chips of flint, stones partially disintegrated from the action of heat, fragments of pottery...., fish-scales, charred maize and bones of small animals, the remains of aboriginal banquets. Within the enclosure, corn-cobs were found by digging down through the mould ... (1893:22-23).

An advantage of the early lack of interest in the faunal remains is that most were left on the sites. Thus, plundered or previously excavated sites should still have most of their archaeological faunal samples intact even though their provenances are probably disturbed. This is almost certainly not true of the other classes of material culture studied by archaeologists.

Coyne quoted Joseph de La Roche Daillon's accounts of the Neutrals' hunting and plentiful prey to support his conclusion that these Indians were hunters and fishers as well as agriculturalists. He was unusual in his consideration of food refuse, as was W.G. Long, who excavated at the Serpent Mounds in 1896. Faced with numerous large shell middens, Long commented that modern, local Indians regarded mussels as a starvation food (Boyle 1897:33). The role of shellfish in Indian diets is still debated by faunal analysts. Boyle noted the early accounts of the Jesuits (as reported by Parkman 1927 [1867]), but was unwilling to accept their accounts of food scarcities. He seems to have believed in the noble savage living in harmony with a bountiful environment.

The next five years witnessed no changes in the accessions or the topics of articles published in the *Journal*. In the report for 1894-1895, Boyle stated that "To study the method by means of which any object of aboriginal manufacturing has been produced is second only in importance to ascertaining the purpose of the object" (1896:29). This summarizes the functionalist approach which Boyle applied to the artifacts made from faunal materials. In his "Notes on primitive man in Ontario" (1895), Boyle included a section on food in which he discussed root crops and maize but not animals. However, his descriptions of artifacts included, for the first time, the skeletal elements from which the tools were fashioned (1895:74). By 1897, Boyle was seeking donated artifacts which "possess particular value as types, or come from some new locality, or are needful for purposes of comparison" (1897:4). He was unaware of the inadequacy of the museum's faunal sample.

By 1899, a greater interest in subsistence was developing. Laidlaw supposed that Indians lived on the products of cultivation, some wild fruits, a little game and a considerable quantity of fish. Names of some of the available fish and a discussion of fishing techniques were included in his article (1900:45), and he also mentioned fishing camps (ibid.:46). Hunter postulated that the fish in the Sturgeon River in north Simcoe County had attracted Indians and noted the problem of distinguishing fishing camps used over many years from village sites (1899:55), but still his main purpose was "to throw light upon the positions of those early missions of which Ste. Marie was the centre;..." (ibid.). It was William J. Wintemberg's report on the "Indian village sites in the counties of Oxford and Waterloo" which revealed the greatest interest in natural resources; in places it almost rings of environmental determinism (1900:86). This is unlike any of the previous reports. However, like them, emphasis was given to artifacts, notably those made of shell. Like Boyle and Laidlaw, Wintemberg, a protégé of Boyle and then of Harlan I. Smith, sometimes attributed functions to the artifacts on a purely speculative basis, but his report is noticeably different in that he supplied the scientific names for the species of the modified shells.

Heightened Interest in Faunal Remains: 1900 to 1911

The report for 1900 reveals the new direction in which Wintemberg was moving. His report in that issue shows that he was not merely recording sites and collecting artifacts for display but also building a chronology (1901:37). Of significance to the development of faunal studies was his recognition that older "pre-Neutral" sites might lack bone relics because these were not preserved (ibid.:39), and his efforts to determine the species of shells accurately. Thus, Wintemberg had Dr. J.F. Winteaves, of the Geological Survey of Canada, examine the shells. This is the earliest record of faunal material from Canada being sent to a specialist for identification (ibid.). Wintemberg had easy access to such expertise because the Anthropology Division of the National Museum of Canada, with which he was affiliated, was then a branch of the Geological Survey of Canada.

The first published Ontario faunal report was by Dr. William Brodie and was on "animal remains found on prehistoric Indian village sites, ... based largely on personal researches over ten such sites situated in the county of York and the township of Pickering, extending over half a century" (1902:44). The provenance data were weak, but the animals were listed in phylogenetical order, identified to species and their habitats were described. A few comments were made also on the suitability of their skeletal elements for tools and on their relative abundances in the sample. Skulls and jaws were emphasized, but a small amount of infra-cranial material was identified. The same year, Wintemberg's publication on fish weirs appeared (1902).

This interest in animal remains affected Hunter who speculated that "perhaps the thick population [in Simcoe County] was due to the good beaver hunting and fishing along the [Sturgeon] river" and that the scarcity of sites along the Coldwater River was due to the fewer beaver and fish in it (1902:62). Still, he ignored faunal remains in his inventory of 75 Medonte township sites, as did Laidlaw in his report on North Victoria county (1902).

The initiatives of Wintemberg and Brodie continued in the *Report* for 1902 (Boyle 1903). Its "Accessions" section reveals that Wintemberg saved some unworked shells and fish scales, although few bones. Wintemberg's (1903) review of the archaeology of Blenheim township included a paragraph each on rivers, fauna and flora. R.T. Anderson, a student at the University of Toronto, saved many more unworked specimens, including long bones and vertebrae. His report on Lake Erie sites had a section on animal remains (1903:85-86) in which, like Brodie, he combined the material and listed the species in phylogenetical order. R. Anderson gave equal importance to infra-cranial and cranial bones and he pleaded for more attention to faunal material:

> One of the most interesting branches of study, and one that has been too long overlooked, is that of the animal remains found in the sites. From a study of the bones in such places, many valuable facts can be learned in connection with the animals used as food, and their relative abundance (1903:85).

Similarly, F.W. Waugh discussed the value of fish bones in "throwing considerable light on the domestic economy of the Neutrals" (1903:74), and the following year, he donated "various animal bones" to the museum.

Despite these statements, the accessions lists and most of the articles continued to be dominated by descriptions of artifacts. Boyle (1904:82-87) argued, against William M. Beauchamp of New York (1904:87-88), that bone combs had been manufactured by prehistoric Indians. Hunter and Laidlaw continued to ignore the unmodified faunal materials they must have encountered. In the 1904 report, Boyle discussed both tooth (1905:20-22) and bone (ibid.:32) tools, and printed a letter from Flinders Petrie supporting the ability of Indians to manufacture bone combs without metal tools. The functional approach to artifact descriptions still dominated, but the debates about when tools were manufactured reflected the developing interest in chronology. In 1905, Wintemberg, who was interested in the chronology of Neutral sites, published "Are the perforated bone needles prehistoric?", followed by a typological classification of bone and horn harpoon points (1906:33-56). Despite the growing attention to bones in the Annual Reports, in 1907, the usual section on "Bone and Horn" was deleted from the "Additions to the Museum" although it was noted that three whale vertebrae were accessioned that year. The report also included Wintemberg's paper on "The use of shells by the Ontario Indians" (1908).

Boyle died in 1911 (Kidd 1952:71), the same year as, after a lapse in publication, the *Annual Report* reappeared, edited by Rowland B. Orr. From then until its demise in 1928, the *Report* contained ethnographic papers with few exceptions. Orr proposed a three age system: wood-bone-stone (1911:64) and noted that there were fewer bones in Canadian and American museums than one would expect. Earlier Beauchamp had supposed that "a wood or bone age...preceded that of stone, leaving few memorials" (1902:247). Perhaps this, combined with the local expertise of Whiteaves, partly explains the greater emphasis on shells than bones in the reports. In 1911, again echoing Beauchamp (1902:252), H. Smith (1911) argued that quantities of bone, antler and shell would be obtained only when qualified experts excavated sites, thus raising the question of sampling effects which is still an important issue in faunal studies. In 1912, the first report on a fishing camp in Ontario was published (McCall 1912), but it concerned net sinkers not fish bones. Similarly, Orr's (1917b) article on fishing was about tools. Nothing directly related to zooarchaeology is found in any of the reports after 1917 (Orr 1917a to 1929), although a few mounted animal skeletons were added to the museum collections.

Wintemberg and Subsistence Studies: 1920 to 1940

The oblivion into which subsistence studies fell in Ontario after 1911 was reversed in the 1920s, primarily by Wintemberg, who was by this time working under Harlan Smith at the Geological Survey of Canada and was aware of the work of Beauchamp and Arthur C. Parker in New York. Beauchamp's reports (1890, 1898, 1900, 1905) like Boyle's, emphasized the functions of shell and bone tools using ethnohistorical information. Parker followed a similar pattern in his work on the Ripley site (1907). The focus of the Ripley site report was the human burials, but animal remains found with them were mentioned and those from village pits were described. As in Ontario, shellfish were presented with their Latin names, whereas the mammals, birds and fish were referred to only by their common ones. There was no indication in this account of the relative proportions of the species or of the specific elements, and no consideration of the subsistence practices of the Erie Indians. H. Smith (1910), on the other hand, gave subsistence the highest priority in his Fox Farm site report titled *The Prehistoric Ethnology of a Kentucky Site.*

Wintemberg was also influenced by Waugh, who had been associated with Boyle and whose *Iroquois Foods and Food Preparation* appeared in 1916. (Waugh was referenced by Wintemberg in his first site monograph which was published in 1928.) Waugh followed the tradition of relying heavily on ethnohistoric and ethnographic accounts. His book is dominated by "vegetal foods", with only ten of the 154 text pages devoted to "animal foods", but throughout there are references to uses of animals and their skeletal elements. A major focus in Waugh's work, which was not present in H. Smith's or

Wintemberg's reports, was information about folklore and rituals related to food. On the other hand, Waugh ignored the manufacturing of tools. Thus, the work of Waugh and Wintemberg was complimentary.

Wintemberg's reports on the Uren (1928), Roebuck (1936), Lawson (1939), Sidey-Mackay (1946) and Middleport (1948) sites followed H. Smith's Fox Farm report format with only minor alterations (Trigger 1978:10-11). The most prominent theme of both archaeologists' presentations was subsistence. A section on local animal and plant resources preceded those on securing food, preparing food, and tools used in acquiring food. Many of these tools had been made from skeletal elements and most were assigned to the sex which it was assumed had used them. After these topics came: warfare; manufacturing; dress and adornment; games, amusements, objects of religion and smoking; miscellaneous items; and decorative art objects. Unlike the Fox Farm report, burials were placed at the end. Wintemberg had been trained in archaeological methods by H. Smith in the field and at the National Museum (Wintemberg 1936:1), but, as noted above, prior to that time, he had already shown his own interest in zooarchaeological matters. In 1919, he published "Archaeology as an aid to zoology" and in 1921 "Archaeological evidence concerning the presence of Gray Fox (*Urocyon sp.*) in Ontario."

Wintemberg's treatment of floral and faunal remains was unusually detailed. In his first major report, he noted the fruit and nut-bearing trees around the Uren site. He gave the number of rows of kernels on excavated corn cobs and compared the quantity of corn found at Uren to that at other sites. In the "Animal Food" section, he provided a figure for the total number of faunal remains before discussing the specific animals in phylogenetical order. Approximate rather than actual numbers (NISPs) and percents were given and often these figures were for the classes as a whole only. Within their classes, species were listed in order of frequency. He commented on the fragmentary nature of the remains, on burnt bones and on chewing by dogs; the first time taphonomy was considered in print in Ontario. Furthermore, the question of whether mouse bones were intrusive or represented food refuse was raised for the first time. Thus, while Wintemberg's records are imprecise by current standards, they are impressive for their time.

Unfortunately, less precise recording marred the later Roebuck monograph (1936), where the ordering of the classes was inverted and no numbers were provided for the species represented. Although the remains continued to be discussed by classes and the species were listed in order of abundance, there is no indication of the actual numbers of any of these remains or of which parts of the animals were recovered. But footnotes with ethnohistorical information were added and more measurements on corn kernels were recorded.

The reason for the slackening of standards for the Roebuck site faunal material is not apparent. For both the Uren and Roebuck site monographs, Gerrit S. Miller, Division of Mammals, U.S. National Museum, and Alexander Wetmore, Assistant Secretary of the Smithsonian Institution, studied the mammals and birds respectively, so the discrepancy did not likely result from analytical procedures.

For all of Wintemberg's research, the fish, bird and mammalian remains were identified by American zoologists. Wetmore consistently identified the bird bones, but the mammal bones from the different sites were not always identified by Miller. Remington Kellog, Assistant Curator of Mammals, U.S. National Museum, identified some from the Lawson site. The shells were analyzed in Toronto by Chief Justice Latchford and later in Ottawa by A. LaRocque of the Geological Survey of Canada. Had Wintemberg perhaps decided that the faunal material from the Roebuck site had not been collected carefully enough to merit precise figures? Since he did not describe the excavation techniques, this possibility cannot be assessed, but this was his first major excavation. With the Lawson site report (1939), quantitative recording reoccurred for both bones and corn. The posthumously published Sidey-Mackay site report (1946) was very detailed for the vegetal remains but, like the Roebuck one, limited in its poor presentation of the unmodified faunal material. Good numbers and measurements characterized the modified skeletal elements in all the reports. Wintemberg's reports contained more subsistence information than others published in the region at the same time (for example, Harrington 1924:249-253). While his work relating to settlement data may deserve criticism (Trigger 1985a), the prominence he gave to subsistence issues was laudable.

Chronology and Subsistence Studies: the 1940s and into the 1960s

Just as subsistence issues were ignored in the *Annual Reports* after Boyle's death, so too the posthumous publications of three of Wintemberg's works (1942, 1946, 1948) marked the end of interest in faunal remains in Ontario for about 20 years. In one of these (1942), Wintemberg applied the Midwestern Taxonomic System (McKern 1939), combining it with Ontario's traditional ethnohistorical approach. Chronology based on pottery styles was firmly established in the Northeast with Richard S. MacNeish's *Iroquois Pottery Types* (1952) and it continued to dominate the field as a result of the publication of James V. Wright's *Ontario Iroquois Tradition* (1966) until the late 1960s. However, two important historical ethnographies with functionalist formats and subsistence information were published in the 1960s. Both Elisabeth Tooker's (1964) *An Ethnography of the Huron Indians, 1615-1669* and Bruce Trigger's (1969) *The Huron: Farmers of the North* are indispensable tools for studying the Hurons. Soon after, in 1971, Conrad Heidenreich's award-winning *Huronia: A History and Geography of the Huron Indians, 1600-1650* was published. These three studies might have encouraged a greater interest in the archaeological study of subsistence patterns. Yet, during this period, middens were excavated mainly in order to recover large quantities of pottery for seriation. Non-ceramic artifacts, particularly the plentiful bone ones, were largely ignored, because they were not seen as sensitive temporal indicators.

Throughout this period, the non-modified faunal remains were ignored, except in a few instances. At the Royal Ontario Museum (ROM), as early as 1959, Walter A. Kenyon (1959:1) acknowledged the assistance of Randolph L. Peterson and Stuart C. Downing from the Museum's Department of Mammalogy, W.B. Scott from Ichthyology and Herpetology, and L.L. Snyder from Ornithology, with the identification of faunal remains from the Inverhuron site. The staff at the ROM also assisted Richard B. Johnston (1968), of Trent University, with remains from the Serpent Mounds, with Peterson and Downing again examining the mammalian elements, James L. Baillie the birds and Edward J. Crossman the fish. That same year, Kenyon published his report on the Miller site and to analyze its faunal sample, he obtained the assistance of C.S. Churcher from the ROM's Department of Vertebrate Palaeontology, Scott and Crossman from Ichthyology and Herpetology and D.H. Baldwin from Ornithology. From these texts, it appears that faunal artifacts and grave goods were still accorded the most attention. In the Inverhuron report (1959), there was an Appendix listing the species sorted by culture and class but there was no indication of the numbers of elements. In the later publications from the Royal Ontario Museum, such lists are lacking.

A similar developing interest in faunal remains existed at the National Museum in Ottawa. J. Wright's prefaces to his major reports in the 1960s (*The Donaldson Site* [1963], *The Ontario Iroquois Tradition* [1966], *The Laurel Tradition and the Middle Woodland Period* [1967], and *The Bennett Site* [1969]), reveal that unmodified fish, mammal and shell remains were identified by Donald E. McAllister, Phillip M. Youngman and Arthur H. Clarke respectively, all zoologists at the National Museum of Science, National Museums of Canada. Bird and amphibian bones were not analyzed (J. Wright 1969:60), but by 1969 the reptile remains "were tentatively identified" by Francis Cook also of the National Museum. However, the results were reported merely as species, listed in order of frequency, and the material from only one site was mentioned in J. Wright's text defining the Ontario Iroquois (1966:39). Despite "a large sample of bone refuse [being] recovered" from the Heron Bay site, only the tools made from faunal material were described (1967:38). These archaeologists' efforts in subsistence studies were hampered by the lack of scholars working full-time on archaeological faunal specimens; there were none in Canada until the 1970s. The same was true for James F. Pendergast, whose 1960s reports on sites in eastern Ontario only describe those animal skeletal parts that were made into tools (1966).

Processual Archaeology and Subsistence Studies: *ca.* 1960 to 1990

In the United States, in the 1950s, Theodore E. White's articles on butchering (1952, 1955, for example) included methods for determining MNIs from faunal remains and estimating meat weights from bones (1953). But, perhaps because his material was large faunal samples from single species of Plains animals and similar samples are rare in Ontario, there was no response to his approach in Ontario for many years (Stewart and Stahl 1977). Since White was a palaeontologist, Paul W. Parmalee, John E. Guilday and Stanley J. Olsen were "the first full-time specialists working in the field of zooarchaeology during the 1950s and early 1960s" on North American material (McMillan 1991:6). These analysts set standards of recording and interpreting faunal remains that were eventually followed in Ontario. S.J. Olsen also published widely-used, illustrated manuals for identifying faunal specimens (1960, 1964, 1968, 1972). Of greater immediate impact in Ontario was Charles E. Cleland's monograph on *The Prehistoric Animal Ecology and Ethnozoology of the Upper Great Lakes* (1966) and his articles on caribou (1965) and fish (1982). He also produced the first report on faunal material from an Ontario historical site (1971). But it was the processual "New Archaeology", promoted by Lewis R. Binford (1962, 1978) in the 1960 and 1970s and the accompanying emphasis on subsistence systems (Flannery 1967) and behavioral approaches (Schiffer 1976), that resulted in faunal remains being considered important again and in their study being undertaken by archaeologically trained people (Cleland 1976).

An influential book reflecting this new emphasis on subsistence was William A. Ritchie's *The Archaeology of New York State* (1965). Like J. Wright's work on *The Ontario Iroquois Tradition* (1966), Ritchie's was organized chronologically. However, Ritchie paid much more attention to subsistence. His first two chapters were titled "The Earliest Occupants - Palaeo-Indian Hunters (c.7000 B.C.)" and "The Archaic or Hunting, Fishing and Gathering Stage (c.3500-1300 B.C.)". A lack of skeletal remains limited faunal considerations in the first chapter, but in the second, he included a report on the "Bone refuse from the Lamoka Lake site" by Guilday, as well as his own comments on fishing (1965:48-50), hunting (1965:50-54), gathering (1965:59) and food preparation (1965:59-62). Guilday's report on the faunal remains from the Frontenac Island site also was incorporated (Ritchie 1965:105-107), as was Guilday and D.P. Tanner's report on the "Vertebrate Remains from the Kipp Island site" (1965:241-242). Unfortunately, when Ritchie reached the Owasco culture of the Late Woodland Stage, he greatly reduced the amount of information he presented on subsistence and this weakness was further accentuated in his discussion of the later Iroquois. Ritchie nevertheless set new standards for examining "whole cultures within the relatively narrow limits afforded by their archaeological survival" (Ritchie 1965:xv) and for use of the conjunctive approach (Taylor 1948).

With the increasing emphasis on the importance of subsistence for understanding archaeological cultures, in 1966, J. Norman Emerson of the Department of Anthropology, University of Toronto, recruited Howard Savage, a retired pediatrician, to analyze the faunal remains from the MacMurchy site. He also became the main force behind Savage's being employed at that university in 1969 to build an animal skeletal reference collection and to do faunal research. At the same time, William M. Hurley began working there, where he, assisted by Conrad E. Heidenreich, a human geographer, began a program in palaeoecology and Ontario prehistory with which Savage was associated. In the early 1970s, Savage apprenticed interested students, of which James A. Burns and myself were the first, in the techniques of faunal analysis. In 1973, he began teaching formal courses in faunal analysis that he continued to offer each year to both graduates and undergraduates until 1996.

Hurley's objectives included:

> reconstructing the local environments at the time of aboriginal occupation, the relationship of the Indians to the natural environment in terms of their subsistence economy, and the detailing of the extent to which they modified their environment (Hurley and Heidenreich 1971:6).

Results appeared in two research reports edited by Hurley and Heidenreich (1969, 1971). These included reports by Savage on the faunal material from the Inverhuron (1969b, 1971a), Maurice (1971b), Robitaille (1971c) and Thede (1971e) sites. In 1969, Savage published an article on the usefulness of faunal analysis to both archaeologists and zoologists (1969a). Savage realized that ideas expressed many years earlier by Wintemberg (1919) bore repeating, as he (1977) tried to interest more archaeologists in the careful retrieval and analysis of faunal material. The idea of the value of faunal research to zoologists was expanded in his "Range extensions of vertebrate faunal species by archaeological site findings" (Savage 1971d).

Through the careful preparation of skeletal reference specimens, the teaching of hundreds of students, each of whom had to produce a faunal report as part of the course requirements, and his publications, many on Ontario material, Savage has been instrumental in promoting most of the faunal work done in Ontario since 1970. Emerson, Hurley, Wright and Savage all influenced William D. Finlayson, who was the first archaeologist in Ontario to employ floatation techniques to obtain good faunal and floral samples (Finlayson and Byrne 1975). Finlayson has consistently accorded subsistence data an important place in his research (1977, 1985; Finlayson *et al.* 1985, 1989). He worked with John H.

McAndrews of the Royal Ontario Museum in carrying out long-term pollen studies of archaeological significance, particularly around Crawford Lake (McAndrews 1980, 1994; McAndrews and Boyko-Diakonow 1988) and with Dawn M. Wright (1991) and myself (1991a,b) on studying the floral and faunal remains respectively, from the Keffer site.

Savage also influenced faunal work at the Archaeological Survey of Canada, National Museum of Man (hereafter ASC). It was on his recommendation that Burns was the first faunal analyst hired by the ASC in 1971 (Burns 1973) and I was hired there in 1972 to analyze material from across Canada (Stewart 1972, 1973a,b). Burns identified the bones from the Dougall site, a fishing camp excavated by J. Wright (J. Wright 1972a), as well as material from the Donaldson site excavated by Finlayson (Finlayson 1977); Neutral site material excavated by William C. Noble (1975); the Cayuga Bridge site fauna, excavated by David M. Stothers (Burns 1977); and samples from the Draper (1979a) and White (1979b) sites. From Ontario sites, I analyzed the Archaic Knechtel and Iroquoian Nodwell faunal material. Material from the former was incorporated into Wright's site report (J. Wright 1972b), and from the latter into his Nodwell site monograph (J. Wright 1974), but the latter was also fully reported in the first published Ontario monograph on faunal material (Stewart 1974). With David L. Keenlyside, of the ASC, I supervised the study of faunal remains from Point Pelee sites (Keenlyside, Boucher-White and Stewart 1974).

At the same time as a reference skeletal collection was being built at the

ASC, plans for another program were being made at the National Museum of Natural Sciences by Anne M. Rick and, in 1972, the Zooarchaeological Research Centre came into being. In 1975, it was renamed the Zoological Identification Centre and in 1981, Stephen Cumbaa was appointed its head, a position he held until 1987, after which the centre was headed by Darlene Balkwill until 1991. At present, Balkwill is Manager of Vertebrate Zooarchaeology, Rick heads the Zooarchaeological Analysis Programme and Kathlyn M. Stewart is the Research Scientist in Zooarchaeology; all three do faunal work, some of which is on Ontario sites (Rick, personal communications 1993). Thus, Toronto and Ottawa remain the major centres of faunal analysis in Ontario, although other institutions established faunal courses and skeletal reference collections through the 1980s and 1990s (Departments of Anthropology at McMaster and Trent Universities and the Department of Vertebrate Palaeontology, Royal Ontario Museum).

Thus Emerson's interests resulted in Savage working at the University of Toronto and reactivating faunal studies in the province. Emerson's teaching abilities resulted in many of his students researching subsistence matters. One of these students was William Noble, who has devoted his efforts primarily to the Neutral area. He has included subsistence information in his reports (1975, for example) and has encouraged his students to do likewise. Rosemary Prevec, in particular, has produced numerous manuscripts on faunal remains from southwestern Ontario, most of which are on file with the Ontario Ministry of Culture and Recreation. (For a listing of her unpublished manuscripts, see

Canadian Zooarchaeology 1992 No. 2; for a published summary of faunal research in the Neutral area, see Prevec and Noble 1983 and Campbell and Campbell 1989. For published, as well as unpublished reports, see Cooper and Savage 1994.) Milton J. Wright's M.A. thesis on the Walker site (1981), excavated under Noble's direction, included an appendix on the faunal analysis undertaken at the Zooarchaeological Identification Centre by Rick, Elizabeth Silieff and Stephen L. Cumbaa. One of Savage's students, Deborah A. Pihl, analyzed the faunal remains from the Hamilton site, a Neutral settlement, for Paul A. Lennox, who summarized her results in his report on the site (Lennox 1981). Lennox had another of Savage's students, Beverley Smith, analyze the faunal remains from the Bruner-Colasanti site in Essex County. B. Smith's findings contributed greatly to the report (Lennox 1982). For Lennox's report on the Hood site (1984), the floral remains were analyzed by Shaun Austin and the faunal remains by Pihl; these zooarchaeological findings were presented in an appendix. In the same volume, Lennox reported on the Bogle I and Bogle II sites, two historic Neutral hamlets. The floral remains were studied by Rodolphe D. Fecteau, who wrote a very interesting geography M.A. thesis on *The Introduction and Diffusion of Cultivated Plants in Southern Ontario* under Heidenreich's supervision at York University. The faunal remains from the Bogle sites were studied by Heather Nicole, another student of Savage.

In eastern Ontario, Pendergast, with assistance from J. Wright (Wright and Wright 1993), has dominated work on St. Lawrence Iroquoian sites. While his early reports were almost exclusively on pottery, more recently, he has supported extensive faunal analyses. His 1981 monograph on the Glenbrook site (1981) included an appendix on the faunal remains by Rick (1981) and the faunal appendix for the Beckstead monograph (1984) was authored by four of Savage's students (D'Andrea *et al.* 1984). In 1988, I studied the faunal remains from three longhouses of Pendergast's McKeown site (Pendergast 1988, 1990; Stewart 1989b, 1992), while in the following year, researchers at Ostéothèque de Montréal Inc. (1989) analyzed the rest of the remains from this site.

Good subsistence studies were undertaken by several researchers under R. B. Johnston (1984) on material from the MacIntyre site, on Rice Lake. The macrofaunal remains (Naylor and Savage 1984) were compared to the microfaunal ones retrieved by floatation (Waselkov 1984). Plant remains from this site were analyzed by Richard A. Yarnell (1984) and the vegetational history of Rice Lake was reconstructed by McAndrews using pollen data (1984, 1994).

It is perhaps not surprising, given the similar zooarchaeological training of most of the currently active faunal analysts in Ontario, that the methods of analysis and the formats of the reports are similar. Diet and seasonality estimates have been emphasized, with less attention being paid to other aspects, such as butchering and cooking techniques, refuse disposal, taphonomy (but see Savage 1972), sampling effects (but see Hamalainen 1983; Prevec 1985; Stewart 1991a) and artifactual and ritual uses of animals (but see Fox and Molto 1994). The nineteenth century interest in bone and shell tools has been revived for the St.

Lawrence area by the current studies of J. Jamieson (1993), but this topic remains understudied (but see McCullough 1978). Perhaps in the current post-processual climate, greater attention will be paid to these aspects.

Enough data have been collected on faunal remains from sites across southern Ontario that comparisons of the various cultures can be undertaken rather than concentrating on single sites. A good beginning in this direction has been made by Chapdelaine (1993), who has used food refuse as evidence to support his hypothesis that Iroquoians across northeastern North America became increasingly sedentary after A.D. 500 as a precondition to year-round sedentariness in agriculturally based villages beginning about A.D. 1300. Recently, the percentage of deer in the faunal assemblages of 50 prehistoric Ontario Iroquoian sites has been discussed in a report comparing findings of the 1986 Wiacek site excavations (Lennox, Dodd and Murphy 1986) with those of the 1990 excavations (Robertson, Monckton and Williamson 1995:40-91). This 1995 article demonstrates the value of comparing zooarchaeological data across many sites and over different time periods. Thanks to the foundations laid by Wintemberg, Emerson and Savage, faunal analysis is now well-established in Ontario and the results of the increasing number of analyses are interesting researchers beyond the province.

CHAPTER 4

IROQUOIAN OSTEOLOGICAL EVIDENCE RELATED TO SUBSISTENCE

Introduction

Osteology has encompassed many types of analysis in Ontario. Of specific interest to the reconstruction of diet and nutritional status has been palaeopathology of bones and teeth, palaeodemography, and chemical studies of elements and isotope ratios found within bones. Osteometry is also of interest in as much as it suggests different amounts of interaction between different groups. However, none of these fields of study has been wholly successful. This is not only because of the Ontario Iroquoian practice of mixing and mingling disarticulated skeletons in ossuary burials but also because there are fundamental problems with the methods and interpretations of palaeonutritional studies. As Wood and Milner (1994) have pointed out, information about a living population is extremely difficult to obtain from the dead (Wood, Milner, Harpending and Weiss 1992). Differences in nutritional status depend on individual frailty, a factor which appears to be impossible to detect in skeletons. When disease afflicts a population, the weakest members might succumb quickly, before any evidence of the disease marked their skeletons. The healthiest members might either not contract the disease or experience only a minor reaction to it, and thus their skeletons, too, would bear no traces of it. Alternatively, both those individuals who contracted the infection but did not die as a result of it and those who died *from it*, but only after a long period of sustaining the illness, would exhibit evidence of it in their skeletons. These different responses to the infection in the living population would be represented by only two groups in the death assemblage: skeletons exhibiting stress and skeletons not exhibiting stress. Bones exhibiting no signs of stress might have originated from the most malnourished individuals and/or the best nourished people in a society (Wood and Milner 1994).

Taking into consideration criticisms of methods used to reconstruct palaeonutrition and demography, particularly those of Wood, Milner, Harpending and Weiss (1992; Wood and Milner 1994) and Bocquet-Appel and Masset (1982, 1985), the information gleaned from Iroquoian skeletons will be assessed in this chapter. A review of research on Ontario bones will be followed by a survey of dentition studies, and the chapter will finish with consideration of analyses of elements and stable isotopes in bones. Although Iroquoian data will be emphasized, some comparisons with earlier material will be made. The first aspect to consider is the available sample.

The Osteological Sample in Southern Ontario

Fortunately, the well-drained, sandy soil conditions of most archaeological sites in southern Ontario impede diagenesis [post-depositional changes or alteration after burial (Lyman 1994b:417) in the composition of skeletal elements], allowing the preservation of bones for thousands of years. The earliest skeletal material from Ontario and Quebec comes from the Archaic period and is dated to

5910 ± 165 B.P. (Katzenberg and Sullivan 1979, cited in Pfeiffer 1986b). Later Archaic material is scattered sparsely across the region in individual interments and cremations (Pfeiffer 1977). Following the Hopewell-influenced Serpent Mounds and LeVesconte Mound burials on the Trent River system, there are small skeletal samples from cemeteries (Molto 1983) and individual interments. After *ca.* A.D. 1300, when ossuary burials became the norm, at least among the proto-Huron/Petuns and the proto-Neutrals, the samples become much larger. Mullen and Hoppa's (1992) date of 1100 ± 60 B.P. on two femora from the Rogers ossuary, near Brantford, might indicate that large ossuary burials were somewhat earlier. Katzenberg thinks that the common burial of a few humans in "the pit component of the Serpent Mounds site is an early manifestation of the practice [of ossuary burial]" (Katzenberg 1992:23). However, it was generally from *ca.* A.D. 1300 to 1650 that large numbers of individuals were being secondarily interred in communal pits.

The inhabitants of the Keffer village were part of this tradition. At Keffer skeletons were excavated from within the village, from the primary cemetery area located at the eastern edge of the village (Spence 1986, 1987, 1989) and from an ossuary found southwest of the village, as can be seen on Figure 4-1 (Boyle 1889). In addition, disarticulated elements were found scattered across the site (Spence 1987).

The small number of St. Lawrence Iroquoian skeletal samples are from individual interments (Dawson 1860, 1861; Knowles 1937; Pendergast 1983).

Unfortunately, none of those accidentally uncovered on the McKeown site could be exhumed; this was a condition conceded to the local Native people in order to be able to excavate on the site (Pendergast 1988). However, as at other Iroquoian villages, some human bones were encountered within the McKeown house floors.

Although skeletal sample sizes increase after approximately A.D. 1300 (J. Wright 1966), from a palaeonutritionist's perspective, the mortuary practices adversely affected the skeletal evidence. A major limitation results from the exclusion of some individuals and some elements of many individuals. For most skeletons, deposition in an ossuary was a secondary burial, generally occurring many years after death (Brébeuf 1636 JR 10:143; Biggar 1929:161; Wrong 1939:211) and primary interment or placement on a scaffold (Brébeuf 1636 JR 10:269). When primary burials were exhumed, some elements might be overlooked and thus not included in the ossuary. At Keffer, four primary burial pits contained small elements that were not exhumed prehistorically with the rest of the skeletons (Spence 1987:26-7). More significantly, since often whole skeletons are found in house floors during archaeological excavations, as for example, at the Keffer (Spence 1987) and Ball (Knight and Melbye 1983) sites, it is evident that not all individuals received secondary burial in ossuaries. The variety and frequency of non-ossuary burials is being realized only now, as whole, or large portions of, village sites are excavated (Sutton 1988). From ethnohistorical sources, it is known that remains of people who were slain, drowned, frozen or committed suicide (Brébeuf 1636 JR 10:39, 146, 182), as well as those of very young and very old individuals (ibid.:143, 273), were excluded from the ossuary. At Keffer, infants were left buried in house floors (Saunders and Spence 1986). Similarly, three infants, one of whom apparently died at birth, were left interred in house floors at the Benson site (Ramsden and Saunders 1986). Infant burials in longhouses are also known from the McKenzie site (Saunders 1986) and at least 12 other Iroquoian sites (Kapches 1976). Most examples are from proto-Huron/Petun sites, but infant longhouse interment was also found at the proto-St. Lawrence Iroquoian Roebuck (Wintemberg 1936; Kapches 1976) and Steward (Kapches 1976) sites. Remains of tortured captives generally were not included in their captors' ossuary either. Sometimes they might be buried in individual graves as evidenced at the *ca.* A.D. 1400 van Oordt site (Molto *et al.* 1986), but often their remains were discarded in middens like other animal refuse. Human elements are excavated from middens often and these may or may not be from members of the local population. Thus, as a consequence of numerous factors, an ossuary sample is incomplete for any one population.

Conversely, because people from different villages were invited to the Feast of the Dead or of the Kettle (Brébeuf 1636 JR 10:143, 283-303) in order to bury their dead together (Biggar 1929:161-62; Wrong 1939:211), ossuaries might include human remains from a number of villages (Sutton 1988:44-5). As well, since some villages expanded, including both McKeown and Keffer, it is likely that their ossuaries included skeletons from the added populations. Even within a stable village population, some members were originally enemies, at least in the sixteenth and seventeenth centuries. According to the ethnohistorical sources, prisoners, especially women and children but occasionally adult males too, could be adopted into the society of their captors and become full fledged members of their adoptive villages (J. Lalemant 1639 JR 17:101; LeMercier 1638 JR 13:33). As adopted family members (Trigger 1990:59), their corpses would presumably have been included in the ossuaries. Thus, it must be concluded that ossuary samples likely include some "foreign" bones.

The most serious disadvantage of ossuary samples, however, is that the elements of individuals are intermixed. Except in a few cases where articulated skeletons are found or bundles of bones that were deposited together can be detected during excavation, individual skeletons cannot be reassembled (Pfeiffer 1980). As was discussed by J. Anderson (1964:29) in his study of the Fairty ossuary, it is populations of elements rather than of Iroquoian people that osteologists study. This has been reiterated by Saunders and Melbye (1990:62) and Pfeiffer and Fairgrieve (1994:49). Furthermore, many elements are broken, particularly the fragile skulls (Webb 1972) which are the most important elements for osteological analyses, and often the teeth have fallen out of their sockets. Osteological and palaeodemographical methods must be modified to take account of the Iroquoian burial practices.

Despite the limitations, "this concentration of interments through time and space makes Ontario Iroquoian ossuaries valuable for skeletal research because they represent relatively homogeneous biological units" (Saunders and Melbye

1990:62). Most of the remains in them are from people who inhabited the local village. Those bones brought from neighbouring villages are likely from people who were within the common breeding pool. Only a minority of the foreign bones are likely from more distant adopted enemies. In addition they represent people who died within a short period, often only a decade (Katzenberg 1992:25; Pfeiffer and Fairgrieve 1994:51).

A Brief Review of Osteology in Ontario

Ontario osteology began very slowly and many of the early studies were focused on "racial" affinities and genetic distances between populations. As was true for zooarchaeological studies, Daniel Wilson was the first person seriously to research human skeletal material in Ontario (1853, 1856a, 1862, 1883 and 1884) with his publication on "The Huron race and its head form" (1853). Wilson's information was used for comparative purposes in Knowles' (1937) detailed report on the skeletons from the Roebuck site (Wintemberg 1936). Yet Knowles' report appeared 84 years after Wilson's and another 25 years was to pass before the publication of the next comprehensive physical anthropology report on the Ontario Iroquoians. In 1962, J. Anderson published on the skeletal material from the Late Woodland Bosomworth site. He followed this report with others: the Saugeen culture Donaldson site (Wright and Anderson 1963); the Late Middleport Fairty ossuary in York County (1964); the Serpent Mounds, including both the Point Peninsula burials in the mounds themselves and the Late Woodland, Pickering phase pit burials (1968b); and the Pickering phase Bennett site (Wright and Anderson 1969). He incorporated many other incidental skeletal finds in his article on "Skeletal anomalies as genetic indicators" (1968a). J. Anderson's work switched the emphasis in osteology from using craniometrics in order to investigate the racial origins and affinities of the Ontario Iroquoians to studies of populations. These studies combined morphological traits with measurements of infracranial bones as well as skulls (Patterson 1984:40-1).

J. Anderson's (1964, 1969) procedures were adopted by most of the osteologists completing reports on Ontario material after 1968 (Molto 1983:68). Unfortunately, most analyses were undertaken primarily to discover the genetic relations between different Iroquoian groups rather than their nutritional status, but some information was collected on pathologies and dentition that might be related to nutrition. Of particular interest for the present study are reports on the Keffer skeletons (Boyle 1889, 1907; Spence 1986, 1987, 1989) and the nearby Tabor Hill (Churcher and Kenyon 1960), Fairty (J. Anderson 1964), Garland (Webb 1969) and Kleinberg (K. Wright 1977; Saunders and Melbye 1990) ossuaries. Tabor Hill and Fairty pre-date Keffer; Garland is contemporaneous and Kleinberg is likely slightly later. A little farther north, but contemporaneous with the Keffer site, is the Uxbridge Ossuary (Pfeiffer 1983, 1986a). All these ossuaries had at least 20 crania for study (Molto 1983:81). Smaller samples were available from the Pickering phase Miller ossuary (Ossenberg 1969) and from the McKenzie site, located near Toronto on the Humber River and dated *ca.* A.D. 1520 ± 15

(Saunders 1986). The McKenzie site remains came primarily from a cemetery but a few were from house floors. For the St. Lawrence Iroquoians, burials from the Dawson (J. Anderson 1972) and Roebuck (Knowles 1937) sites might relate to the McKeown people. Reports on other large ossuaries from the Neutral area (Glen Williams, Carton and Orchid, for example) and historic Huronia (Ossossané and Maurice, for example) are not as useful for a comparison with the Keffer and McKeown site villagers.

Results of Ontario Osteological Analyses Related to Nutrition

The common practice of cremation results in very small skeletal samples from the Archaic period in Ontario but the palaeopathology of some Archaic skeletons has been described by Pfeiffer (1977, 1985). The primary goal of Pfeiffer's detailed study of nine Archaic samples from the upper Great Lakes region was to determine group interaction or isolation, but she was also interested in pathology. She found that "over 70% of all pathological cases described appear[ed] to be traumatic in origin. Cases of primary infection, congenital abnormalities and *nutritional disorders* [were] rare" (ibid.:1977:276, emphasis added). Occurrences and expression of arthritis were slight (ibid.).

Cortical remodelling was examined in six adult femora from the Archaic Hind site and the cortices were found to be thinner than those of "Caucasians" in the same age group (Pfeiffer 1985:4-6). Remodelling is affected by nutrition and when this is poor, a loss in bone mass, or osteoporosis occurs (Price, Schoeninger and Armelagos 1985:439-440). Minor deficiencies may not affect bone mass but prolonged or severe stress will be observable. Pfeiffer was cautious in her interpretations, noting that the thinning might reflect genetic differences, some chronic nutritional factor, or a reaction to specific activities.

Some of the more common protohistoric human skeletal material has been examined. Pfeiffer and King (1983) radiographed elements from the protohistoric Uxbridge Ossuary which has a radiocarbon date of A.D. 1490 ± 80 (Pfeiffer 1986a:24) and from the post-contact Kleinburg ossuary which is dated on the basis of trade goods (Pfeiffer and King 1983:23) to *ca.* A.D. 1585-1615 by Melbye (Molto 1983:94). From the former, 90 adult metacarpals were examined and from the latter, selecting adult elements, 96 femoral shafts, 22 lumbar vertebrae and 130 metacarpals were studied. Pfeiffer and King (1983:26) found that 26.7% of the Uxbridge bones and 25.6% of those from Kleinburg were osteoporotic and concluded that remodelling was "markedly deficient". Pfeiffer concluded that these findings probably "reflect the presence of chronic dietary insufficiencies, complicated (perhaps) by the presence of infectious diseases" (Pfeiffer 1986a:26). The reduction of cortical mass in bones from both ossuaries has been interpreted as evidence of nutritional deficiencies due to the adoption of maize horticulture (Pfeiffer and King 1983; Saunders and Melbye 1990). Nevertheless, Pfeiffer and King (1983:27) concluded that "the low values for adult bone formation in the Kleinburg and Uxbridge samples are not clearly explained by any single dietary variable" (Pfeiffer and King 1983:27). More recently, it has been reported that the use of single-photon absorptiometry has indicated a decrease in adult Iroquoian bone density over time (Southern 1990), but this finding needs verification and, if confirmed, the cause would still be nebulous.

Others have noted the association of cortical thinning and agriculture. Saunders and Melbye (1990) studied skeletons from the Kleinburg and Ossossané (dated to May 13, 1636 by Brébeuf's accounts) ossuaries and found that these populations exhibited cortical thinning; increased stress was noted particularly in the weaning-aged children. Femora from two adult individuals from the Mckenzie site had thinner cortices than would be expected for their assessed morphological ages (Saunders 1986:23). Thin cortices were also found on two other skeletons prompting Saunders to note that the condition might reflect a population difference from the New England Whites used as a comparative group (ibid.). Many participants in the "Paleopathology at the origins of agriculture" conference found cortical thinning in early agriculturalists (Cohen and Armelagos 1984). Thus, it appears that remodelling could be an indicator of stress and that increased stress accompanied agriculture, but I suspect that samples should be compared from within the same gene pool and that individual differences due to heredity, age, pregnancy and lactation for females, past illnesses and amounts of strenuous activity, in addition to diet, would affect the results. Furthermore, for the Ontario material, it appears that thin cortices may be a "normal" condition since examples of cortical thinning have been found at the Archaic Hind, the protohistoric Uxbridge and Kleinburg and the historic Ossossané ossuaries. It certainly appears to have been common around A.D. 1500 (Southern 1990).

Melbye (1985) considered the increase in pathologies in the Iroquoians, as contrasted with earlier Archaic populations, to be a consequence of sedentism and raised the interesting question of "burden limits", the number of non-productive individuals a society can maintain. He considered the evidence for tumours and cleft palates in skeletons to be testaments to the Iroquoians' tolerance of physical disfigurement. He argued that congenital disturbances such as "cases of congenital absence, bifid ribs, congenital fusions, vertebral body defects, numerical variation in vertebrae, spina bifida and spondylolysis" (ibid.:10) were more common in horticultural populations than among hunters and gatherers because the burden limit of the former was higher than that of the latter.

Melbye found evidence of trauma common in both Archaic and Iroquoian skeletons. His conclusion that "we may infer that people in Archaic populations were receiving relatively more trauma [than the Iroquoians] even though the actual frequencies are lower" (Melbye 1985:10) because in sedentary populations "all forms of pathology have a better opportunity of being represented in terms of number of cases and in terms of severity" (ibid.:9), foreshadowed Wood *et al.*'s critical essay (1992). Thus, Melbye introduced both a caution and an important new use for palaeopathology, to reveal evidence about a population's tolerance of its sick or disabled members.

Levels of evidence of trauma may reveal other things about populations. Pfeiffer and Fairgrieve found that interpersonal conflicts predated contact, as one might have presumed, but they also noted that "Iroquoian fracture frequencies range from low at Fairty to high at later sites" (1994:54). This change, they suggest, might be due in part to poor quality cortical bone. It can supposed further that poorer cortices reflect poorer nutrition but the increase in trauma might also indicate increased social pressures arising from more crowded living conditions.

Melbye found evidence of infections from the Archaic to the historic periods, but noted that the first appearance of syphilis and tuberculosis was in horticultural populations. A high incidence in tuberculosis was found at the Uxbridge ossuary (Pfeiffer 1984, 1986a) and also at the earlier Glen Williams ossuary, dated to *ca.* A.D. 1400 (Hartney 1981). In addition, J. Anderson (Wright and Anderson 1969) reported a severe case of tuberculosis from the A.D. 1260-1280 (Wilmeth 1978) Bennett site. Evidence of endocrine and metabolic disturbances were so rare among the Ontario Iroquoians that generalizations could not be made. However, there is "some slight evidence of rickets (vitamin D deficiency) and slightly more evidence of iron deficiency" (Melbye 1985:10). Porotic hyperostosis (Angel 1967), expressed as a sieve-like exposure of trabecular bone as a result of an expansion of this inner marrow-producing bone and a reduction of the outer compact bone (Martin *et al.* 1985:265), has seldom been reported for Ontario Iroquoian skeletons. It may have been common in some populations (Fairty and Kleinburg) among juveniles, a group which is under-represented in many ossuaries (Larocque 1991 cited in Pfeiffer and Fairgrieve 1994:55). Traditionally, porotic hyperostosis (as *cribia orbitalia*) was thought to result from insufficient iron in the diet or inherited anaemia (Cassidy 1980; Goodman *et al.* 1984), but it has been shown that reduced iron absorption by the body is a defence against bacterial infections (Stuart-Macadam 1992a, 1992b; Stuart-Macadam and Kent 1992). Thus, the evidence of iron deficiency in skeletons might signify disease and hence acquired anaemia rather than inherited or dietary anaemia (Mensforth *et al.* 1978; Stuart-Macadam and Kent 1992; Kent and Lee 1992). Increased exposure to disease should be expected in larger and denser populations such as those associated with agriculture. However, the limited evidence of such bone remodelling on Iroquoian skulls suggests that infectious diseases were not common among these people. Their semi-sedentary settlement system and the practice of both males and females leaving villages for long periods of time each year probably inhibited the spread of germs. Goodman (1994:166-168), however, has criticized the idea that anaemia is an adaptive response. He argues that it is a sign of nutritional deficiency which evidence has shown results in many functional costs to the body: less resistance to disease, a lowered work capacity and reduced cognition. These explanations could both be true. Some anaemias might be the results of disease while at the same time the condition encourages disease.

Of particular interest are the human remains from the Keffer site. In 1888 Boyle test excavated an ossuary located close to the Keffer village and recovered 50 (Boyle 1889:20) to 80 (Boyle 1907:16) adult crania. Although Konrad (1973) thought that Boyle had completely excavated the site, Spence (1987:28) argued convincingly that most of the ossuary is likely still unexcavated. Boyle estimated that there might have been 800 (1907:16) to 1000 (1889:20) individuals in the ossuary when they excavated, but prior to their digging the pit had been opened "superficially" "once or twice" (ibid.). In addition to these 50 plus ossuary crania, skeletons and parts of skeletons have been recovered from a primary burial area located just outside the palisade and from within the village for a total of 30 individuals in 28 burial features (Spence 1987:29, 1986, 1989).

Little analysis has been completed on St. Lawrence Iroquoian skeletons. The Roebuck site excavations (Wintemberg 1936) uncovered 84 individual burials from graves in and around the village, and using Knowles' information, Pendergast has written on their burial practices (1983). Ten individuals thought to have been excavated from the Dawson site (Pendergast and Trigger 1972) have been studied by J. Anderson (1972). Crania and dentition from the Dawson site, Westmount (also on Montreal Island), the Mandeville site (at the mouth of the Richelieu River) and Place Royal (in Quebec City) have been studied and compared to remains from the Syers and Keffer ossuaries in Ontario (Larocque 1986).

Interaction among Iroquoians as Suggested by their Crania

Larocque concluded that there was considerable variability among St. Lawrence Iroquoian populations but that there was even more heterogeneity among the Ontario skull shapes and facial sizes than among the crania from

Quebec (ibid.:63). This might reflect more interaction and gene exchange among Ontario Iroquoian villagers than among the groups spread along the St. Lawrence River.

Molto (1983) and Webb (1972) studied ossuary crania in their investigations of biological relationships among Woodland peoples. Webb placed Keffer in his "Developmental Iroquois" group with Fairty, Garland, Pits, Syers and Innisfil, after the "Early Prehistoric Serpent Mounds" and before the "Northern Historic" (Ossossané and Christian Island) and the "Southern Historic" (Carton) groups. He found that the Developmental group was rather heterogeneous in its skull characteristics, particularly measurements, which were investigated using multivariate statistics. Molto, emphasizing the non-metric features of skulls, primarily from 17 collections each with at least 20 crania available for study, found those with the closest affinity to the Keffer skulls were from the Uxbridge ossuary (Molto 1983:212). He concluded that the Iroquoian groups of south-central Ontario were interacting intensively with each other between *ca.* A.D. 1400 and 1600 and that they were involved to a greater extent with the proto-St. Lawrence Iroquoians, as represented by the Roebuck site skeletal remains, than with the proto-Neutrals in the Niagara peninsula, represented by the Orchid ossuary skeletons (ibid.:213):

> Interestingly, Keffer, which is the closest site to Kleinburg spatially, is very divergent from Glen Williams, but, like Kleinburg, is very close to Tabor Hill, Uxbridge and even Syers, the most easterly site in this central region. The fact that Keffer is not as close to Kleinburg as expected, may reflect the stronger

> historical influence of Kleinburg with the more westerly located groups like Glen Williams, whereas the historical roots of Keffer are south and east of them (ibid.:215-6).

If the interaction included the exchange of food items as well as genes, then differences in diets between the proto-Huron/Petuns and the proto-St. Lawrence Iroquoians might have been reduced by exchanges involving food items not native to each region. However, the greatest amount of exchange appears to have been among the proto-Huron/Petuns themselves, which suggests that the greatest trade in food items likely would be within this group too.

Teeth from Ontario Sites as Indicators of Diet and Stress

Wear

Wear and dental pathology in pre-Iroquoian and Iroquoian populations has been researched by Patterson (1984, 1986) and Pfeiffer (1977, 1985). Unfortunately, as Pfeiffer found, "it is difficult to compare wear data across research studies because of the application of different quantification schemes" (1985:4). Subjectivity in recording the degree of wear could introduce biases as well (ibid.). However, since mastication is the main factor in attrition, such data can be used to estimate the diet (Harmon and Rose 1988). Non-dietary activities, such as softening skins by chewing and wearing labrets, must be considered for some populations, but there is no historical or physical evidence of such practices among the Iroquoians.

Patterson collected data on wear, caries, alveolar abscessing, periodontal disease and enamel hypoplasia. He also recorded antemortem tooth loss in two categories: chipping and fractioning but the differences are of degree only and rather subjective. Patterson's samples were from the:

> LeVesconte Mound whose temporal setting is just prior to the emergence of effective maize horticulture (circa third century A.D.); the Bennett site, dated just prior to the Middle Ontario Iroquois cultural horizon (late thirteenth century A.D.), during which time some investigators suggest that the Ontario Iroquois became heavily dependent upon maize horticulture (e.g. Noble 1969, 1975; Wright 1966; Tuck 1978); and the Kleinburg ossuary, which is representative of a late proto-historic Ontario Iroquois population (approximately A.D. 1600) (Patterson 1986:5).

For palaeonutrition, Patterson's data on the variation in wear patterns and his conclusions that less wear in the later periods reflects softer foods and/or cooking are perhaps the most useful of his findings. Patterson argued that dental characteristics reflected diet and that some characteristics, particularly antemortem trauma and wear, both of which declined over time, could be used to assign skeletons to their time periods. These declines were attributed to changes in the diet from that of hunters and gatherers to that of horticulturalists. The reduced wear and trauma, combined with increased longevity of the Ontario Iroquoians, does seem to be best explained by the consumption of softer, boiled foods with less grit (Melbye 1985).

Considerable attrition was noted on the teeth of the ten skeletons from the St. Lawrence Iroquoian Dawson site by J. Anderson (1972). Since these people were reportedly horticulturalists, the amount of wear should have been less than that of earlier populations, according to Patterson. This apparent anomaly might merely highlight the subjectivity in recording wear; J. Anderson's "considerable attrition" might equal Patterson's "low to moderate attrition". On the other hand, there could in fact be greater wear in the St. Lawrence Iroquoian teeth as a result of differences in diet.

Caries

In contrast to wear, caries are pathological, being caused by bacteria occurring naturally in the plaque on the surface of the tooth. These bacteria use carbohydrates, but not fats or protein, and thus diet directly relates to the prevalence of caries (Larsen 1983). The preparation of foodstuffs high in carbohydrates, such as corn, into sticky porridge would result in increased caries (Cook 1984). Diets high in calcium and phosphate levels retard carious invasion (Powell 1985), but individual differences in saliva acidity and enamel structure affect the occurrence of caries. Although various formulae have been constructed for comparisons of caries (Powell 1985), quantitative studies are weakened by both the underlying individual variability and sample reduction resulting from tooth wear and loss.

Comparisons within a population or region would provide the most reliable inferences. Unfortunately, such information is limited concerning the Iroquoians. Caries associated with wear were noted for two Archaic populations in Ontario (Pfeiffer 1985). Patterson (1986) found that Middle Woodland people were characterized by low tooth loss, few caries and moderate to severe wear patterns, whereas Late Woodland people had moderate tooth loss, moderate attrition and moderate to high numbers of caries. Proto-historic Iroquoians had high tooth loss, low to moderate attrition and rampant caries. In addition to limited data, recent suggestions by Dean Snow (1994a,b, 1995) that the Iroquoians may have migrated into Ontario at the beginning of the Late Woodland period (after 900 A.D.) or earlier, around 600 A.D. (Snow 1996), also call into question the extent of genetic continuity over time. Despite the uneven data and observer differences, Pfeiffer and Fairgrieve (1994) agree with Patterson's claim that caries increased over time.

Caries were also high in the two St. Lawrence Iroquoian samples. Knowles' (1937) study of the 84 Roebuck site individuals showed that about 25% of the permanent teeth and just over 17% of the deciduous teeth had carious lesions. Antemortem tooth-loss was also common and might have resulted from caries; similarly, abscesses were frequent. These conditions led Knowles to conclude that the Roebuck people had more caries than the Serpent Mounds people because corn was the staple food at Roebuck (1937:52). Among the ten Dawson site skeletons, caries affected 10.5 percent of the teeth and antemortem tooth loss was at 14 percent. These features were thought to reflect an incipient horticultural diet, similar to that described by Cartier for the Hochelagans (J. Anderson 1972). Thus, it appears that comparisons of tooth wear and caries between populations reveal consistent differences over time and ones that correlate with the introduction of agriculture. Further, Larocque found that Quebec crania differed from Ontario samples most notably in the much higher incidence of caries in Ontario (1986:64). This might reflect a greater dependency on corn in Ontario with more hunting and fishing in Quebec.

Hypoplasia

The predominant developmental disturbance in teeth is abnormality in the formation of enamel (Goodman and Capasso 1992). Small surface pits to transverse grooving into the enamel layer can be observed occasionally with the naked eye (Goodman 1988) but more clearly radiographically (Rose *et al.* 1985). This condition is termed hypoplasia and, *in extremis*, Wilson's Bands. "Although enamel hypoplasia cannot be attributed to a specific pathological condition or nutritional deficiency, ... they are at least indirectly associated with nutritional inadequacy" (Rose *et al.* 1985:284; see also Lallo *et al.* 1977). Because teeth begin to form *in utero* and continue to form until about age seven (Huss-Ashmore *et al.* 1982) or fifteen (Patterson 1986), hypoplasia reflects childhood disturbances (Cook and Buikstra 1979; Huss-Ashmore *et al.* 1982). Although descriptions of hypoplasia suffer from subjectivity because the depressions develop gradually (Buikstra and Cook 1980; Rose *et al.* 1985), hypoplasia reflects childhood stress and since children's skeletons are often poorly represented in prehistoric samples, particularly Iroquoian ossuaries, such dental defects might provide otherwise rare information. Furthermore, unlike the similar Harris lines in bones, evidence of enamel hypoplasia persists throughout life.

Does hypoplasia increase with the introduction of agriculture? A positive correlation was found at the Dickson Mounds by Goodman, Armelagos and Rose (1980) and by Lallo and Rose (1979), in Ohio by Sciulli (1977, 1978 cited in

Rose *et al.* 1985) and by most of the contributors to the "Pathology at the origins of agriculture" conference (Cohen and Armelagos 1984). However, Patterson (1986) found the same moderate to high incidence of enamel hypoplasia in all his Ontario samples, from the Archaic to the protohistoric periods. Neiburger (1990) offered an explanation for these contradictory results: enamel hypoplasia is a poor indicator of dietary stress. Neiburger agreed that hypoplasia could result from nutritional stress, but he listed seven other non-dietary causes: hereditary, individual frailty, individual trauma such as late circumcision, tonsillectomy or tattooing, ingestion of toxic substances such as excessive fluoride, injury to the tooth, high fever and lesser insults to the developing tooth such as braces. In their response to Neiburger, Ogilvie and Trinkaus (1990) acknowledged that caution is necessary in interpreting causes of hypoplasia and implied that it should be considered along with other indicators. Goodman (1994) and Armelagos (1994) both agree, contra Neiburger, that enamel hypoplasia is a consequence of stress and a good indicator of nutritional stress. Likely the same situation exists for enamel hypoplasia as with porotic hyperostosis; that is, the enamel defects are associated with the rise of agriculture because increased population densities led to greater stress from diseases.

The research on Iroquoian hypoplasia is contradictory. On the basis of Patterson's (1984) observations, it must be concluded that hypoplasia increased from the Archaic to the postcontact periods in Ontario. Gagné's (1990 cited in Pfeiffer and Fairgrieve 1994:57) evidence from Uxbridge is consistent with

Patterson's but Larocque's (1991) reanalysis of teeth from Glen Williams and Kleinburg show much higher incidences of this trait than Patterson recorded and Larocque found high incidences in the Ossossané teeth too. Thus, while Patterson's figures indicate a slight increase over time, Larocque's support the opposite trend: a decrease over time. This disparity highlights the problem of subjectivity in recording this enamel modification, as Pfeiffer and Fairgrieve (1994:56) noted.

Sexual Differences Relating to Diet in the Osteological Material

Unfortunately, most osteological studies either do not separate the findings according to sex or their sample sizes are too small to make meaningful interpretations relating to sexual difference in diet. For the St. Lawrence Iroquoians, the Roebuck human remains were of two sorts: 84 skeletons from graves and approximately 339 scattered bones from at least 34 individuals (J. Jamieson 1983:166) from middens. Knowles (1937) and J. Jamieson (1983) interpreted the midden specimens as being those of tortured captives. The grave skeletons were sorted into 43 adults and 41 non-adults. Surprisingly, only four of the adults were identified as males whereas 39 were females. The female long bones were slightly shorter than the male counterparts (Knowles 1937:19), a difference which almost certainly reflects sexual dimorphism rather than differences in diet. Caries were common, with 30 percent of the teeth exhibiting this feature. But for the three male skulls the percentage was almost 26, whereas for the females it was higher: over 35 percent for older women, almost 46 for middle-aged women, 24 for those under middle age and almost 18 for young women (ibid.:12). Perhaps the Roebuck women experienced more caries and abscessing because they consumed more maize whereas the males ate more meat, but the sample is small.

The Dawson collection was mixed after excavation and J. Anderson (1972) was not able to determine which elements originated in the same individual. The seven skulls were found to be from four males and three females. It is of interest that only 10.5 percent of the teeth exhibited caries (J. Anderson 1972:319), which is certainly below that of the proto-Huron/Petun samples for which there are such percentages. Unfortunately, the distribution of the caries by sex is not presented. However, accepting osteologists' position that the prevalence of caries reflects diet, this finding suggests a slightly different diet for these St. Lawrence Iroquoians than that of the proto-Huron/Petuns.

Similar limited data by age and sex exist for the proto-Huron/Petun samples. Patterson's detailed study on the teeth from three samples, including the Bennett site with 15 individuals and the Kleinberg ossuary with a minimum of 561 individuals (Patterson 1984:230), sorts the descriptions of the teeth by age categories but not by sex. He observed that caries from the Kleinberg ossuary affected over 29 percent of the deciduous teeth and 40.6 percent of the permanent dentition (ibid.:283).

Spence's (1987, 1989) reports on 30 individuals from 28 burial pits at

Keffer show that the majority were infants and young children (16 of 23 aged individuals) and that these were almost equally divided by sex, as were the seven adult skeletons. The totals were 12 males and 11 females. Two immature individuals exhibited hypoplasia on their deciduous teeth (Spence 1987:19) and one tubercular adult male lumbar vertebra was found in a midden (ibid.:26), but no information is presented that relates directly to diet. Although the teeth were measured for sex determinations, caries and wear were not reported for each sex. (Further reports on these non-ossuary burials as well as on the scattered human remains located in the houses and middens are planned.)

The four different collections of human bones from the McKenzie site included two infants carefully excavated from one house floor and at least 16 individuals from primary and secondary bundle burials in a cemetery (Saunders 1986). Males and females were equally represented in the eight individuals assigned to sex. Dental caries had an overall incidence of 27.3%, similar to their frequency in other Late Ontario Iroquoian samples. Saunders did not publish information on caries by sex, but from her individual descriptions of the skeletons, it can be determined that of four sexed skeletons with teeth, the female's teeth were more worn and had many more caries than those of the three males. One male, aged 15.5 years, had no caries at all but another buried with that adolescent had 15 caries in 25 teeth. The female had nine teeth with caries out of a total of 12 intact antemolar teeth.

There is limited evidence that *cribia orbitalia* might have been more common in males. "Females seem to be less affected than males at Fairty (15% as opposed to 22%) and Ossossané (13% as opposed to 17%). However males and females are equal in the Kleinburg ossuary" (Pfeiffer and Fairgrieve 1994:55).

Mortality and Morbidity Studies

Studies of prehistoric Iroquoian mortality (Jackes 1986; Pfeiffer 1983, 1986a; Saunders and Melbye 1990; Saunders and Spence 1986) face greater problems than those for most prehistoric populations because estimates of age and sex must be made on disarticulated remains. In general, the mandible is used to arrive at the minimum numbers of individuals represented and sexual determinations are based on the pelvis and the cranium. Since ageing can be done using dental eruption (Pfeiffer 1983:10) or, occasionally, calcification (Saunders and Spence 1986:45), age data can be directly related to mandibular MNI data. But such ageing applies only to juvenile individuals, a cohort which is greatly under-represented in Iroquoian ossuaries. Limb bones can be used for ageing older individuals (Merchant and Ubelaker 1977 quoted in Saunders and Spence 1986:45-6). While it is possible that the aged limb bones came from the same individuals as the sexed crania and pelvises, a perfect correlation is unlikely.

Having arrived at age and sex figures, the Iroquoian palaeodemographer is faced with the dilemmas outlined by Bocquet-Appel and Masset (1982, 1985), particularly the problems of sorting the adult population into smaller age brackets. Jackes' (1986) solution was to emphasize those individuals under 25 years old but as a consequence her life tables were distorted. Jackes acknowledged this and concluded that: "Ontario generally provides disappointing material for demography ..." (1986:43). I agree. However, having constructed population estimates and life tables, Jackes concluded that population in southern Ontario had very low mortality rates compared to other areas in North America until around A.D. 1600, when she found evidence for the doubling of child mortality rates and assumed similar increases for adults. She attributed the increase to the introduction of European diseases. Jackes did not include the Keffer skulls in her study but, following her reconstruction, these should exhibit low mortality rates compared to the historic material. Yet this is not necessarily so; the Fairty remains were in the high mortality group (ibid.:38) despite their *ca.* A.D. 1400 to 1500 date.

Some support for Jackes' conclusion about increased mortality rates comes from Saunders and Melbye's (1990) study of children's bones from the Kleinburg and Ossossané ossuaries. At both, deaths were common for the two to three year olds. The researchers suggest that this reflects stress at weaning. The Kleinburg subadults showed few adolescent deaths, resulting in a low mortality profile, whereas the later Ossossané skeletal population exhibited a high mortality profile with substantial adolescent deaths (ibid.:68). The small Mckenzie sample (n=18) was composed of two newborns, one 0 to 6 months old, three under four years, one under five years, one under 8, two between 13 and 16 and eight adults (Saunders 1986). Thus, children appear to have been at high risk in this non-ossuary sample dating to *ca.* A.D. 1500.

Studies of mortality have been further complicated by the findings of Milner, Humpf and Harpending (1989) that differences in fertility affected mortality profiles greatly. They concluded that age distributions of a prehistoric skeletal sample yield less information about mortality than about fertility. This supported an earlier conclusion by Johansson and Horowitz (1986) that mean age at death was related to the growth rate of the population. These findings could be useful for the present study, if the correlation can be accepted, since increases in fertility may account for the success of the proto-Huron/Petun as compared to the St. Lawrence Iroquoians. Unfortunately, the criticisms of Wood *et al.* (1992, 1994) concerning selective mortality and individual frailty to the risks of disease and mortality apply whether it is the mortality or the fertility rate that is being investigated. Furthermore, the Iroquoian practices of burying children and adults in different locations biases estimates of fertility and child mortality; these must await the development of more accurate procedures and the excavation of more infants' skeletons, which can be associated with excavated adult remains. Finally, Warrick (1990) has shown that population did not increase from *ca.* A.D. 1400 to 1630, after a dramatic increase in the 1300s. This implies a lowered and then a near-zero growth rate, which correlates with birth spacing practices recorded by Brébeuf (1635 JR 8:127).

Because the Iroquoians were semi-sedentary, generally moving their villages only every 10 to 50 years, contact with their own wastes and food refuse would have been greater than that of more nomadic hunters and gatherers, although still less than that of permanently settled peoples. As well, the spread of pathogens due to large population concentrations would have remained high, even though they moved the locations of the villages, because the population remained together. "Not only was population density high in precontact villages like Draper, but also the longhouses themselves were tightly packed..." (Saunders *et al.* 1992:119) and the farthest, often internal, refuse dumps were within eight meters of the houses (ibid.). Their practices of bringing enemy captives back to the home village and of extensive trading would have aided the introduction of pathogens to the resident village populations (Kaplan 1988). Trading with large populations to the south would have made the Ontario Iroquoians susceptible to illnesses originating in those areas, whereas trade with the more dispersed and more mobile Algonquians might have been more detrimental to Algonquians than Iroquoians. The Uxbridge people were heavily infected with tuberculosis, and yet, according to Pfeiffer, they appear to have had the same 25-year life expectancy at birth as did the people at Fairty and Ossossané (Pfeiffer 1986a). Such an unlikely finding, that the extreme morbidity caused by tuberculosis had no noticeable effect on mortality, lends support to the criticisms of the methods used for establishing life tables and mortality figures.

Chemical Element Studies: *Strontium in Iroquoian Skeletons*

As has been shown above, the gross morphology of bones or teeth often is not definitive, so it is understandable that new approaches through analyses of trace elements and stable isotope ratios were heralded with great enthusiasm (Buikstra and Cook 1980; Gilbert 1985). A significant attraction of these new methods is that they reveal information about normal diets rather than about stress or disease (Ambrose 1992; Schoeninger and Moore 1992). However, these chemical analyses too have weaknesses.

Element studies of Iroquoian skeletal materials have been undertaken for strontium by Katzenberg (1984). Since strontium declines in proportion to calcium up the tropic levels (Toots and Voohries 1965; A. Brown 1973, 1974; Schoeninger 1979, 1985), those people consuming mainly plants should exhibit higher levels of strontium than those eating mainly meat. Prior to presenting her own data, Katzenberg reviewed 10 previous strontium studies on human skeletal material. Five showed no consistent patterns in strontium amounts (Boas and Hampel 1978; Gilbert 1975; Stedt 1979; Elias 1980; Blakely and Beck 1982); one showed weak associations between strontium and dietary changes (Szpunar 1977); one predicted, correctly as was later shown, that eating molluscs might increase strontium content in bone (Schoeninger and Peebles 1981) and only three definitely supported the validity of strontium studies (Brown 1973; Price and Kavanagh 1982). Furthermore, Katzenberg noted that Sillen's (1981) study over a large area was negative, that Schoeninger's 1981 contrast of Iranian and Israeli samples failed because most variation occurred within the Iranian population and that Schoeninger's 1982 study found no correspondence between shifts in strontium values and morphological changes between archaic and modern skeletons. Despite this situation. Katzenberg undertook a study of five sites from southern Ontario and concluded that strontium values increased with agriculture. The five sites were: Serpent Mounds, Serpent pits, Fairty ossuary, Kleinburg and Ossossanė (Katzenberg 1984:33).

Katzenberg's results, which included readings from ribs, must be reevaluated. It is now known that strontium is affect by diagenesis (Lambert *et al.* 1985; Price *et al.* 1985; Tuross, Behrensmeyer and Eanes 1989) and that cancellous elements, such as ribs, are more affected than denser bones (Francalacci 1989; Kyle 1986; Hanson and Buikstra 1987; Grupe 1988). Also in diets composed of many items, as was the Iroquoians', strontium readings can reflect specific food sources. Two of these are freshwater fish and molluscs, which alter strontium readings in ways that are not at present well-researched (Schoeninger and Peebles 1981; Burton and Price 1990; Sealy and Sillen 1988). However, in favour of Katzenberg's strontium studies are that she prepared and studied the bones herself, that she used elements from populations that were likely genetically related, although the Serpent Mounds and pits materials probably were not as closely related to the others as those others were to each other (Molto 1983; Patterson 1984), and that these populations were obtaining their food from the same general ecological area in a temperate climate. Thus, whatever the diagenesis and cleaning factors (Hancock *et al.* 1989; Lambert, Xue and Buikstra 1989, 1991; Lambert *et al.* 1990; Sillen and LeGeros 1991), these should have affected the samples equally. Katzenberg found the highest strontium levels among the early

Late Woodland Serpent pit and mound bones with gradual decreases in the Fairty, Kleinburg and Ossossané specimens:

> These findings suggest that with the adoption of maize horticulture, populations became less dependent on strontium rich foods, such as nuts and molluscs, and more dependent on low strontium foods such as maize and squash. It is also possible that animal protein, in the form of fish and mammals increased in importance, relative to plant foods ... (1984:ix).

Comparisons of differences within a single skeletal population, like an ossuary, should be even more reliable and might reveal gender differences in diet. Unfortunately, ribs are usually not identifiable to sex and most of the sample in Katzenberg's study, therefore, cannot be used to investigate sexual differences in diets. Of 18 ribs from four females and 14 males in the Serpent Mounds, the strontium mean value of the males (172.34 ppm) was significantly less than that of the females (187.18). But these differences might not reflect differences in diet. As Katzenberg noted, pregnancy or lactation can increase strontium levels (ibid.:104-5). Yet, it is also possible that females in hunting and gathering cultures eat *more high strontium* foods, such as molluscs, nuts, legumes and leafy vegetables, whereas males consume more less strontium rich food, such as meat. Accepting the Serpent Mound evidence, based on small sample sizes and questionable techniques, it can be argued that gender dietary differences have a long history in Ontario Native cultures.

Stable Isotope Studies: Carbon and Nitrogen in Iroquoian Skeletons

Contrary to strontium, carbon isotopic ratio values have an enrichment factor as one moves up the trophic chain from plants to animals and humans (Price, Schoeninger and Armelagos 1985). In theory, the ratios of the different carbon and nitrogen isotopes in human bones reflect the isotope ratios in the plants and animals consumed (Bender *et al.* 1981; DeNiro and Epstein 1978a, 1978b, 1979, 1981; van der Merwe 1982; Vogel and van der Merwe 1977). Stable carbon isotope ratios are reported in terms of $\delta^{13}C$, which indicates the ratio of ^{13}C to ^{12}C in a given sample relative to that in an agreed standard, which is a marine fossil known as PDB (van der Merwe 1982:596). Plants have more negative values ($\delta^{13}C$ values are expressed in negatives) than the herbivores which feed on them and the herbivores' values in turn are more negative than those of the animals and humans which prey on them. Furthermore, maize is a C_4 plant that photosynthesizes using a different pathway than that used by most of the wild plants in Ontario, which are C_3 plants. "Values for C_3 foliage yield an average of -26.5 o/oo, relative to the PDB standard whereas C_4 plants average -12.5 o/oo" (van der Merwe and Vogel 1978:815). Thus, maize has a less negative ^{13}C to ^{12}C ratio than most native North American plants. Because of these differences and because maize is the only C_4 plant likely to have been ingested by prehistoric people in temperate North America, the introduction of maize into the diet should be evident in human bones.

Similar to stable carbon isotope ratios, those of stable nitrogen are reported as $\delta^{15}N$ which is the ratio between ^{15}N and ^{14}N in a sample compared to air, which is used as the standard and defined as 0 o/oo. Air has less ^{15}N than most biogenic materials and hence bone collagen $\delta^{15}N$ values are positive. Plants such as legumes which fix atmospheric nitrogen have isotopic values which are similar to air and lower than those of plants which assimilate inorganic nitrogen from the soil or water. Thus, nitrogen isotope ratios can be used to distinguish nitrogen-fixing plants, such as beans, and the animals or humans that feed on them, from terrestrial food chains using non-nitrogen-fixing plants which obtain their nitrogen from nitrates and nitrites in the soil (Price 1989:5; Sillen *et al.* 1989:506). Before the intensive use of fertilizers, legumes probably had $\delta^{15}N$ values of around 1 o/oo, whereas non-legumes were around 9 o/oo (DeNiro 1987).

Both carbon and nitrogen isotope analyses have been done on Ontario skeletons. Schwarcz, Melbye, Katzenberg and Knyf (1985) and Katzenberg and Schwarcz (1986) studied samples dating from A.D. 400 to 1650. They concluded not only that they had demonstrated an increase in maize consumption but also that they could estimate how much of the diet consisted of maize, based on isotope ratio readings. Their four major conclusions were:

> (1) Pre-agricultural peoples generally consumed a diet rich in C_3-type plants as well as animals which had browsed on plants of this type.
> (2) Between AD 400 and 1100 there was a marked increase in the C_4 content of the human diet; this was the period of introduction of maize as a cultigen. Data from this area taken together with that from the U.S.A. indicates that the increase in maize utilization was gradual.
> (3) At the time of its highest level of consumption, maize (plus other C_4 plants) constituted no more that 56% of the diet (in terms of proportion of carbon atoms), and probably less than 50%. Some degree of "recycling" of C^{13}-rich carbon probably occurred through the consumption of meat of corn-eating animals (e.g. dog).
> (4) There was no significant shift in $\delta^{15}N$ of bone collagen of

> humans during this time period. This demonstrates that the main sources of protein in human diet did not change. In particular, beans do not appear to have constituted an important protein source (1985:203).

These same conclusions were reiterated the next year but the authors, more cautiously, omitted the percentage figures for maize in the diet (Katzenberg and Schwarcz 1986:19). By 1995, these researchers had concluded that such estimates might not be valid (Katzenberg *et al.* 1995:337). Their 1985 study was limited by a lack of material dating between A.D. 400 and 1500, a weaknesses which was addressed by 1995 (Katzenberg *et al.* 1995). The results from skeletons from six sites dating to this period showed that maize consumption had increased gradually between A.D. 400 and 1250.

But isotope ratio results can be easily compromised. Ingestion of meat and fish affects the amounts of carbon assimilated (Buikstra and Milner 1991) and, from ethnohistorical and zooarchaeological findings, it is known that the Iroquoians continued to consume meat and fish into the historical period. The suspicion that consumption of freshwater fish affects human bone isotope ratios (Price, Schoeninger and Armelagos 1985) has been confirmed. Katzenberg (1989) demonstrated that the consumption of walleye could increase the $\delta^{13}C$ value of human bones, as could eating dogs. More recently Katzenberg *et al.* (1995:343-4) have argued that consumption of the oil-rich burbot at the Varden site might explain the human bones' relatively high $\delta^{13}C$ readings, which were like those of pre-maize sites even though the Varden site dates to *ca.* A.D. 900. Similarly

Buikstra noted that some of the carbon in prehistoric human bone might "reflect the consumption of flesh derived from maize-eating herbivores or omnivores such as bison, dog, deer, turkey, bear, beaver, raccoon, woodchuck, and goose" (Buikstra 1992:88-9). Except for bison, these were common components of the proto-Iroquoian meat diets (Stewart 1974, 1991b, 1992; Latta 1976 quoted in Katzenberg 1984). Finally, individual frailty and nutritional states affect digestion, including the absorption of carbon and nitrogen.

The δ^{15}N values obtained by Katzenberg and Schwarcz (1984) were unexpectedly high considering the ethnohistorical evidence that the Iroquoians consumed beans. Schwarcz, Melbye, Katzenberg and Knyf (1985) reasoned that the addition of beans to the Iroquoian diet should have caused a decrease in the ^{15}N value of human collagen because legumes have lower ^{15}N/^{14}N ratios than those in meat and fish. Because such a decrease was not found, they argued that meat and fish remained the main source of protein from 2300 BC to A.D. 1640. This may well be true, but their speculation that beans may not have been eaten is unacceptable because there are ethnohistorical reports of the consumption of beans and because corn and bean deposits have been found in pots (Wright and Wright 1993). It is more likely that the nitrogen results were unreliable, as Ambrose (1991) has argued. Alternatively, the high δ^{15}N ratios Katzenberg found for walleye and pickerel might explain the high δ^{15}N ratio in the Iroquoian material (Katzenberg 1989:327), since such fish bones have been identified in the food refuse from many Ontario sites. In the sample of human bones dated between

A.D. 400 and 1500 studied recently by Katzenberg *et al.* (1995), $\delta^{15}N$ values showed decreases in specimens dated after A.D. 1350, which the authors suggested indicated a decrease in animal protein in the diet, but they noted that the use of "nitrogen isotopes as a palaeodietary indicator is more problematic" even than carbon isotopes (Katzenberg *et al.* 1995:337).

Studies on differences in diet according to the consumer's age or sex have been done on bones from the same site and thus the problems associated with comparisons across time and space do not confuse the results. The Roebuck remains may show more maize consumption by females than males, but the sample is very small (Knowles 1937). Of the four Surma burials analyzed for isotopic quantities, the single known female had a less negative $\delta^{13}C$ reading than the other three, two of which were male. This suggests that the female was eating more corn than the males (Katzenberg *et al.* 1995:343). The largest study is on 29 individuals buried in the MacPherson Neutral Iroquoian village which dates to A.D. 1530-1580 (Katzenberg *et al.* 1993). The high $\delta^{13}C$ values in children compared to adults at this site prompted the conclusion that the weaning diet was high in maize. The presence of circular caries on two of the 3-4 year old children corroborates the high carbohydrate diet conclusion. No significance differences in $\delta^{13}C$ ratios were found according to sex (ibid.:273). Similarly the children under five showed higher $\delta^{15}N$ ratios than the rest of the population, whereas there was no significant difference in these values by sex (ibid.:274). Recently Katzenberg has reported that for Iroquoian samples:

> sex differences in stable carbon isotope ratios, that would indicate differences in the consumption of maize are small and are rarely statistically significant. Similarly, differences in stable nitrogen isotope ratios, indicative of animal protein in the diet, are usually small (1995:123).

Dietary differences or uniformity according to sex and age may be determined when more data have been amassed.

But there are still numerous problems with isotopic analyses. First it is not known how frequently bone collagen is replaced in a person, with estimates ranging from 10 to 30 years (Chisholm 1989). Replacement results in isotopic readings reflecting the diet at the end of a person's life only. Data on the amount of variation by sex and age are equivocal (Armelagos *et al.* 1989). As well, most people eat a wide variety of foods from different ecological zones and from both land and water-based animals. Some prey, such as migratory birds and fish, feed in widely differing habitats throughout the year. Attempts to determine dependency on particular dietary sources may therefore be unrealistic (Heaton *et al.* 1986; Lee-Thorp *et al.* 1989; Ambrose 1991). Estimates of the percentage of a specific food in a diet based on isotopic analysis probably cannot be accurate. Within ecozones, there are variations in the carbon isotope ratios depending on where the sample is taken (van der Merwe and Medina 1991) and there can even be variations within a single plant (Tieszin 1991). Water stress and low temperatures can lower $\delta^{13}C$ values (ibid.). For North American studies, it is of special interest that different species of corn have different $\delta^{13}C$ values (Buikstra and Milner 1991; Tieszen and Fagre 1993). Ambrose (1991) concluded that the possible effects of climate and physiology on isotope ratios of mammalian herbivore collagen raise serious questions regarding the utility of isotope studies.

A further limitation is that all parts of the diet may not contribute to the formation of the collagen (Sillen *et al.* 1989). Poor nutrition affects digestion and the combinations of foodstuffs alter their absorption rates. Animals on high quantity meat diets do not synthesize much carbon from plants (Tieszen 1991). Assuming the same is true for humans, the collagen from humans consuming significant amounts of animal protein will not reflect increases in the consumption of C_4 plants (Buikstra and Milner 1991). Thus the first uses of corn by hunters and gatherers would be invisible. Finally, there are problems with diagenesis and preparing the specimens for isotopic studies that must be considered (Ambrose 1990; Ambrose and Norr 1992; Chisholm 1989; Chisholm *et al.* 1983, 1993; DeNiro *et al.* 1985; Hancock *et al.* 1989; Hare *et al.* 1991; Moore *et al.* 1989; Sillen *et al.* 1989).

Conclusions

Despite some problems with the osteological evidence, tentative conclusions about Ontario prehistoric populations can be made from these data. From the early comparisons of metric and non-metric features, particularly of crania, it appears that the Native peoples of southern Ontario were interbreeding and that more matings occurred between the proto-Huron/Petuns and the proto-St. Lawrence Iroquoians than between the former and peoples farther to the west.

Larocque's conclusion that there might have been more gene flow among the proto-Huron/Petun peoples than among the proto-St. Lawrence Iroquoians allows the supposition of greater interaction in general for the former population. Such contact may have reduced physical hardships for individual villagers when local conditions for obtaining food were stressed. In addition, information about good food sources and healing practices may have been exchanged more readily among the proto-Huron/Petuns.

Secondly, dental studies revealed changes over time and differences between contemporaneous groups. Dental attrition, although a characteristic weakened by observer subjectivity and the possibility that it is affected by factors other than diet, appears to have been more pronounced among proto-St. Lawrence Iroquoians than proto-Huron/Petuns. This might reflect different diets, with the proto-Huron/Petuns perhaps ingesting proportionately more cooked maize than the proto-St. Lawrence Iroquoians. Based on wear patterns, it appears that their diet might have been more similar to that of hunters and gatherers. Caries were noted for two Ontario Archaic populations (Pfeiffer 1985) but, in general, the teeth of Ontario hunters and gatherers exhibited few caries. The pattern of increasing caries and tooth loss with decreasing wear from Ontario Middle Woodland to proto-historic teeth (Patterson 1986) corresponds to changes in other regions and likely reflects the adoption of maize as a major component of the diet by *ca.* A.D. 1300. The higher incidence of caries among the proto-Huron/Petuns than among the proto-St. Lawrence Iroquoians supports the idea that the former relied on maize more heavily than did the latter.

Thirdly, there seems to be evidence for increased mortality rates after A.D. 1200, although morbidity, particularly tuberculosis and arthritis, has a longer history. Katzenberg has argued that there was an adjustment to increased sickness and mortality associated with more compacted living conditions around A.D. 1200. By A.D. 1600, as exemplified in her comparisons of the skeletons in the Fairty and Kleinburg ossuaries, people appear to have "adapted to high-density living as seen by their lower incidence of infection and improved survivorship during childhood" (Katzenberg 1992:29). Trauma occurred in all populations, but as Melbye (1985) suggested there may have been greater tolerance of injured, sick and deformed individuals in the sedentary populations. Such an increased tolerance would have been possible only in a society where more than enough food for its productive members was available. Caring for disabled persons would increase both individual longevity and the population totals. It would be interesting to know whether the incidences of pathology and trauma had proportionately equal frequencies in the proto-Huron/Petun and the proto-St. Lawrence Iroquoian populations but such data are not available at present.

Fourthly, chemical analyses present findings which coincide with the ethnohistorical and palaeobotanical evidence that much maize was eaten by proto-Iroquoian groups, who also ingested a wide variety of other food stuffs. There is weak evidence in this material for young children and females consuming a higher proportion of maize in their diets than adult males, who possibly ate a higher proportion of meat. However, the use of beans was not reflected in the stable nitrogen isotope ratios and this result must be seriously questioned.

CHAPTER 5

ZOOARCHAEOLOGICAL AND OTHER METHODS USED TO COMPARE PROTO-HURON/PETUN AND PROTO-ST. LAWRENCE IROQUOIAN SUBSISTENCE

Introduction

Zooarchaeology has a long history (Brewer 1992). As I outlined in chapter 3 and elsewhere (Stewart 1993), it began in Ontario in the mid-nineteenth century with brief observations of faunal remains noted by amateur historians searching for Jesuit missions and artifacts. About 75 years later, laundry lists were compiled by archaeologists and then by zoologists who were willing to assist their archaeological colleagues. White's 1950s publications on butchering and estimating meat weights (1952, 1953a, 1953b, 1954, 1955), combined with the paradigm switch to the processual approach of the New Archaeology promoted by Binford (1962), resulted in a resurgence of interest in the animal bones found on archaeological sites. This in turn led to interdisciplinary approaches, as questions of taphonomy, quantification and interpretation of the masses of faunal refuse were addressed.

Common goals of zooarchaeological analyses are reconstructions of 1) palaeoenvironments and 2) human subsistence systems. The former is particularly significant in early hominid and Palaeo-Indian studies, whereas the latter dominates zooarchaeological research on more recent periods in North America and will be emphasized here. However, human activities occur within specific ecological settings and the resulting faunal refuse is altered by natural forces, making environmental studies important to all subsistence research. The traditional methods of faunal analysis (i.e. Chaplin 1971; Daly 1969; Grayson 1973; S.J. Olsen 1964, 1971; Parmalee 1985; Payne 1972a; C. Reed 1963; Wing and Brown 1979), in which it was assumed that skeletal remains excavated from archaeological sites accurately and completely represented the animals exploited by the site's inhabitants, have been modified. In order to make meaningful interpretations, the analyst must separate naturally from culturally derived bone and natural from cultural alterations on the culturally derived material (Behrensmeyer and Hill 1980; Gifford 1981; D. Thomas 1971). The study of the transformations of animal bodies after death, as they leave the biosphere to become part of the lithosphere, was termed "taphonomy" by J.A. Efermov (1940). Zooarchaeologists' primary interest in taphonomy has been as a means to eliminate those factors which are background noise in the determination of human subsistence patterns. Recognizing taphonomic effects is often difficult, especially because problems of "equifinality" exist (Gifford-Gonzalez 1991; Haynes 1988a, 1988b; Lyman 1982, 1987b; S.L. Olsen 1989; Sutcliffe 1973, 1977). In Iroquoian material, for example, grooves made by small rodent incisors can be confused with use wear patterns on bones. Fortunately, in southern Ontario, the climate and neutral soils are not as destructive to skeletal elements as is the case in many other site locations. Following Grayson (1984:16) and R. Lee Lyman (1994a), I use the terms "element" for a complete bone and "specimen" for a part of an element.

For optimal interpretations, the faunal sample must be carefully excavated and documented. S.J. Olsen's early (1961) recommendation that shaft fragments be discarded has been countered with studies emphasizing the value of such pieces (Sadek-Kooros 1975; Todd and Rapson 1988). Screening through small gauge meshes (Clason and Prummel 1977; Payne 1972b; Shaffer 1992; Shaffer and Sanchez 1994) and the use of floatation are essential for the collection of small bones or fragments of bones from large animals and most bones from small animals (Struever 1968; Prevec 1985). In general, floatation greatly increases the quantity and the variety of fish specimens and thus can affect interpretations significantly (Stewart 1991a). However, floatation can result in tremendous quantities of small specimens which are very time-consuming and difficult to identify (Ball and Bobrowsky 1987). At McKeown, floatation was discontinued in the field because it was felt to be too time-consuming during the field season. However, the matrices from all the features in all the houses were saved and I have analyzed the float sample from those of the one house selected for comparison with one of the Keffer houses. Similarly, the largest midden at Keffer, Midden 57, had about a third of its matrix floated, but only small samples from a few house features, including the one used for comparison with the McKeown house were floated.

Basic Methods of Identification

Once the zooarchaeological sample has been carefully collected the analyst begins by sorting the faunal material into the zoological classes from which the pieces originated (Stewart 1995:2-5). General characteristics of the limb elements can be used to separate most of these quite readily. Figure 5-1, which is only slightly modified from one developed by Dr. Howard Savage at the University of Toronto, is a summary of these characteristics. Skulls, which are fragmented normally in archaeological contexts, can be difficult to identify to class, as are fragments of rib shafts, vertebral processes or limb bone diaphyses. In this study, "fragments" of mammal elements are defined as any piece equal to or less than 30 mm long in any plane, whereas "portions" are longer than 30 mm in at least one plane. Because most fish, bird, reptile and amphibian elements are small, the dividing measure adopted for specimens from these classes was 10 mm. For the shells, fragments were defined as 20 mm or less in length. Contrary to some recommendations to select only the most easily identified specimens for study (S.J. Olsen 1961), I have examined *all* the fragments and portions in the selected units from both sites. The infracranial bones of dogs, wolves and coyotes generally cannot be distinguished but, contrary to earlier zooarchaeological folklore, fish vertebrae are distinctive, often even to species. By carefully noting the zoological features of each faunal specimen, most can be accurately classed and many can be recognized to lower levels of the phylogenetic scale.

Identification beyond class requires access to an adequate skeletal reference collection. In my analysis of the material from the Keffer and McKeown sites, each specimen was examined at least twice before the data were entered into the IBM mainframe system of the University of New Brunswick. Each vertebrate faunal specimen was identified to as low a zoological taxon as possible using my own reference skeletons and the osteological collection of the Department of Ornithology at the Royal Ontario Museum. Savage's collection at the University of Toronto was also consulted, particularly for identification of the turtle and snake specimens and some of the fish bones. The invertebrates were identified for McKeown only, using published keys and illustrations. The scientific names for invertebrates were taken from these sources (Burch 1962; Clarke 1981; Emerson and Jacobson 1976; and Morris 1973).

When identifying faunal specimens to as low a taxon as possible, it is important not to go beyond what can be demonstrated to be so. For diverse faunal samples, such as those excavated from Iroquoian sites, usually only about 25 to 30 percent of the zooarchaeological remains can be assigned to their species. This figure is higher for single species exploitation sites, such as buffalo jumps, but it must be accepted that for many faunal samples, large numbers of specimens will be identified only to class. Some will not be identified even to their class. This was true of 2.5 percent of the faunal sample from the Keffer longhouses (very little float) and almost 20 percent of the McKeown houses' sample (a large float component).

Some bones which could not be identified beyond the class level, could be described as being from a large, small or medium-sized animal of their class. For southern Ontario, large mammals are those equal in size to or larger than a timber wolf (*Canis lupus*); small mammals are the same size as or smaller than a muskrat (*Ondatra zibethicus*) and the medium-sized ones fall in between. Large birds are those equal in size to or greater than a herring gull (*Larus argentatus*); small birds are equal to or smaller than an American robin (*Turdus americanus*), a category which includes most of the perching, song birds. There was not a wide variation in the sizes of the fish specimens, although in general the archaeological specimens were slightly larger than the modern skeletons in my reference collection. There were no really large fish bones but some tiny vertebrae might have come from smelts (family Osmeridae). The reptilian remains were primarily from the large snapping turtle (*Chelydra serpentina*) or from one of the medium-sized species. The few snake vertebrae ranged from large or medium-sized at Keffer to medium to small at McKeown. There was only one large amphibian represented, with the majority of the bones being from medium to small frogs or toads. The shells were quite uniform in size, similar to the modern sample I collected from the shores of Lake Huron for comparison.

Additional zoological features have been recorded for each specimen. Since most zooarchaeological specimens are portions or fragments of the original element, bones are described in general terms as the proximal 1/4, proximal 1/2, middle quarter or half, distal 1/4, distal 1/2 of the whole element. Occasionally specimens are described more specifically by naming element parts (e.g. distal epiphysis). The same general terms were used for teeth and antlers but tooth roots and antler tines were also noted.

The specimen's position on the body was recorded as right, left or axial when determined and, where possible, the general skeletal age of the specimen (immature, young adult, adult, old adult and, occasionally, years or months old) was noted. Such information is useful for estimating the minimal number of individual animals (MNI) represented in the total number of specimens (NISP) identified to each species. A bone was defined as "immature" when the epiphyses had not begun to fuse to the diaphysis at the time of death. "Young adult" bones were those in which fusion of the epiphyses to the diaphysis had begun but was not completed at death and thus the line of union was evident still to the naked eye. "Adult" specimens were defined as those in which the epiphyses had fused to their diaphyses leaving no evidence of the process on the outer surface. A few specimens showed extra bone growth, ossified cartilage attachment areas or other morphological changes to the bone structure indicative of ageing and these were labelled "old adult". For the dentition, deciduous teeth were considered immature and permanent teeth, adult. The amount of wear on the crowns was recorded and for some species, for example the whitetail deer (*Odocoileus virginianus*), this feature was useful for more precise ageing, as was the age of eruption of the specific teeth. Similarly, root closure of the cheek teeth of beaver give ageing information. Fish skeletons do not mature in the same way as those of the other classes and so similar age groups could not be used. Instead, using Richard

Casteel's (1976) terminology and Alphonso Rojo's (1987) methodology, the number of rings of fish vertebral centri were counted when possible to arrive at the age at death; the widths of the terminal rings were compared to earlier rings to give the seasons of death. Lighter, broader rings are formed during the growing season, whereas during the cold season, the cells contain less liquid and so are small, producing a denser, darker ring band. The age categories refer to the skeletal maturity of the animals rather than to their sexual growth. Many reach their full body size before all their bones are completely fused. Furthermore, it is single elements or parts of elements that are aged and even within one bone the degree of fusion can be different at its two ends. When possible, the sex of the animal (e.g. a deer frontal bone with antlers must be from a buck) was recorded. Other natural features, such as medullary bone in bird long bones (Rick 1975), erosion, animal chewing (canine or rodent) or ingestion, and pathology or healed fractures, were recorded also.

Obviously most zooarchaeological remains reflect human procurement and butchering practices but some specimens exhibit other human modifications. Much has been written on the various sorts of evidence of butchery: cut marks, chopping marks, straight edges across bone of varying densities and fracture features can be observed in archaeological material. The relatively infrequent examples of these features in the Keffer and McKeown sites' zooarchaeological samples were recorded. Effects of heating, such as charring (a black colour), calcination (a grey-blue or white colour) or brown staining can be seen commonly on Iroquoian refuse. These colour variations are related to the degree of heat and/or the length of exposure to it, with greater heat or exposure time resulting in changes from brown through black to grey/blue (Shipman, Foster and Schoeninger 1984; Spennerman and Colley 1989). A few McKeown invertebrate shells were ashy grey and very chalky in consistency and therefore were assumed to have been burnt. Evidence of use on some of the skeletal specimens or the more obvious artifacts made from skeletal elements usually occur in archaeological refuse as well. Most such artifactual pieces had been sorted out of the Keffer and McKeown samples prior to my analysis. Any which I found have not been included in this subsistence study. Artifacts made from skeletal parts might have been made from elements extracted from carcasses at the site being studied, but they might have been transported to the site being studied from an earlier village. Thus, some artifacts might not reflect food consumed during the occupation of the village on which they were discarded or lost.

After the initial observations were recorded, each specimen was re-examined. In general, after an analyst has gone through a faunal sample completely, morphological variations specific to the animals comprising that sample are known and thus, by re-examining the specimens, some of those which were not identified initially will be recognized. The verified identifications and observations were entered into a computer for storage and manipulation, which was accomplished using SPSS programs (SPSS, Edition 2, 1986). For this, I enlarged considerably the coding manual prepared by Burns for the mammalian remains from the Draper site (Finlayson 1985) and devised codes for the other classes. The scientific names for fish were taken from Scott and Crossman (1973); those for mammals were from Peterson (1966) and the bird names follow Godfrey (1986). Reptile and amphibian nomenclature was from Cook (1984).

Before any conclusions are drawn from zooarchaeological data, however, the analyst must consider how the sample was formed and then how to quantify the observations in a meaningful way.

Faunal Accumulation Models

Before the mid 1970s, little attention was given to the formation of faunal samples. Raymond Medlock (1975) can be credited with developing the first model for archaeological bone accumulations. Prior to Michael Schiffer (1976), Medlock acknowledged that both cultural and natural processes (Schiffer's C and N transformations) affected the original deposit of skeletal specimens and that post-depositional processes such as decay, disturbance, intrusion and removal altered the original deposit to produce the "archaeological deposit". Surprisingly, Medlock did not refer to the earlier work of Clark and Kietzke (1967) who realized that their palaeontological collections were not proportional to living populations of animals, called the "life assemblages". Their palaeontological model lacked the many complications added to archaeological samples by human activities, but it is excellent for the natural causes of sample size reductions, even though their terms are obscure.

These two models were followed by R.H. Meadow's (1980), which treated the human alterations to the sample more clearly than had Medlock, and by Richard Klein and Kathryn Cruz-Uribe's (1984), which is the one used here. In their model, the **life assemblage** is the community of live animals and the **death assemblage** is "the carcasses that are available for collection by people, carnivores or any other agent of bone accumulation" (ibid.:3). As recent debates in physical anthropology have made clear (Bocquet-Appel and Masset 1982; Wood *et al.* 1992), the death assemblage is not a miniature version of the living assemblage from which it originates, and the life assemblage cannot be reconstructed from its death assemblage because the variable fragility of bones by species, relative bone sizes and densities, rates of predation and scavenging, age at death and weathering are all factors that distort natural death assemblages (Behrensmeyer 1991; Grayson 1981; Klein and Cruz-Uribe 1984; Lyman 1982, 1994b; Meadow 1980; Medlock 1975). Furthermore, the death assemblage itself cannot be reconstructed. All the possible carcasses available for collecting are part of the death assemblage and these are unknown.

The death assemblage provides the universe for the **deposited assemblage** which is "the carcasses or portions of carcasses which come to rest at a site" (Klein and Cruz-Uribe 1984:3). Most of these presumably represent human activity but some might be deposited on an archaeological site by animals or other natural factors. Those resulting from human hunting might reflect the age and sex proportions in the living animal populations, but it is much more likely that some animals were easier to capture than others and/or that hunters consciously selected their prey according to age and/or sex.

For zooarchaeological samples with large numbers of specimens from single species, mortality profiles can be configured in an attempt to determine selection of specific aged animals, evidence of the particular type of hunting practiced (ambush versus chase) or evidence of scavenging (Klein and Cruz-Uribe 1984; Lyman 1987a; Stiner 1990). Lyman (1987a) concluded that an MNI of 30 was the minimal requirement to construct mortality profiles for taxa where newborns had a life expectancy of about three years. Such MNIs are rare in Iroquoian samples and were not obtained for any of the mammal species represented at the Keffer or McKeown sites. There are numerous additional limitations to the construction and interpretation of mortality curves (e.g. Milner *et al.* 1989). Because of these weaknesses and the small samples for even the most common animals in the faunal material collected from the Keffer and McKeown sites, mortality profiles have not been constructed. Instead the number of specimens that can be aged have been included in the text along with the discussion of each represented animal and comments are made on these figures concerning indications of selective hunting. Such profiles are reconstructed based on the elements which survived on the site until the time of excavation. Those elements which survive comprise the **fossil [archaeological] assemblage**, which in many instances is only partially excavated to produce the **sample assemblage** for analysis. This in turn might not all be analyzed; the analyzed zooarchaeological material is often only a sample of all that was excavated. (For models of transformation processes between the assemblages, see Andrews and Cook 1985; Behrensmeyer and Kidwell 1985; Gifford 1981; Lyman 1994b)

Once it has been established that humans were responsible for a sample assemblage, the particular elements represented become significant for subsistence interpretations. Elaborating on White's work (1952, 1953a, 1954, 1955), Dexter Perkins and Patricia Daly (1968) coined the term "Schlepp effect" for the practice of leaving the heaviest elements at the kill/butchering site and transporting only the lighter parts back to the living site. Distance between the two sites was considered the important factor in the transportation decisions. Since Binford's (1978) work among the Nunamiut, emphasis has been placed on the relative nutritional values of animal parts as a dominant factor in such decisions (Jones and Metcalfe 1988; Metcalfe and Jones 1988). Binford considered the relationship between nutritional values and human actions and arrived at three transportation strategies: bulk, gourmet and unbiased. Bulk maximizes the quantity returned to the living site and gourmet maximizes quality. In the unbiased strategy, the anatomical parts are carried to the living site in direct proportion to their utility values. Refinements have been made on these ideas (Thomas and Mayer 1983; Grayson 1989; Lyman 1984, 1985, 1992), but the discovery that utility curves can reflect natural, differential density destruction rather than cultural selection has weakened their significance (Grayson 1989; Lyman 1984, 1985, 1992). For these reasons, and again because the material from the Keffer and McKeown sites does not contain large quantities from single species, utility graphs have not been plotted in this study. For this Iroquoian material, sorting mammal and bird bones to individual elements or parts of elements resulted in too few entries for comparisons to be made. Instead, the number of specimens by body regions have been tabulated and there are comments on the few instances of apparent over-representation of some body regions for a few species. The body divisions used are: skull, fore limb, hind limb, indeterminate limb, thorax, rump + tail, and axial. Obviously, the limb categories do not apply to fish remains and turtle specimens which are listed instead as: skull, rump and tail, axial, carapace and plastron.

In addition to the transportation strategies, secondary butchering practices can greatly affect the deposited assemblage. Further reduction of a dismembered animal (Lyman 1987b; Shipman and Rose 1983) can result in particular parts being destroyed and in many being broken into smaller pieces and thus made both more susceptible to erosion and more difficult to identify. Splitting bones for marrow extraction (Bonnichsen 1979; Yesner and Bonnichsen 1979) or chopping bones into small pieces for grease production (Binford 1978; Leechman 1951) contributes to their destruction. Fortunately, evidence of these practices is infrequent in the Iroquoian material; there is little evidence even of cut marks on the specimens.

Excavation techniques at the two sites central to this dissertation were similar. After removal of the topsoil with heavy equipment, the Keffer middens were trowelled and the back dirt was sieved through 6 mm mesh screens with some samples being floated, particularly in Midden 57. The living area was shovel-shined and then trowelled with the back dirt being screened; there was floatation of the matrix of a very few House 20 features. Similarly, the McKeown living area was trowelled and the back dirt screened through a 6 mm mesh, after the removal of the disturbed topsoil with heavy equipment. The soil from some features was floated in the field,with the remainder being processed later by the Wrights (Wright and Wright 1990). Thus, as Shaffer and Sanchez (1994) have demonstrated, some small elements and small animals are likely under-represented at both sites in contexts where the soil was not floated. Floatation aids in the retrieval of small specimens (Struever 1968; Prevec 1985), so much so that its use can alter the rank order of the vertebrate classes, as it did for the largest Keffer midden (Stewart 1991a). At McKeown, floatation greatly increased the number of indeterminate specimens and put fish well ahead of mammals as the most commonly represented class. It also resulted in the collection of hundreds of tiny fragments, or rather flakes, of shell, all of which could have come from a single element. For McKeown, all the excavated material has been identified but for Keffer there has been a further selection of part of the excavated assemblage for analysis.

A very important feature of these faunal sample formation models is the continual reduction in the quantity of material as a result of which inferences made to higher levels incur greater weaknesses (Gifford-Gonzales 1991). Unlike early hominid studies, where reconstructions of palaeoenvironments and hunting versus scavenging determinations are paramount, in Iroquoian research establishing diets and seasonalities of subsistence activities dominate. Reconstructing the upper two levels in these models (life assemblages and death samples) has not been an aim of Iroquoian zooarchaeology and will not be in the present study either.

Quantifying the Remains

Whether skeletal specimens are being studied for information about natural or human conditions, the sample must be quantified. Assuming careful excavation of well-preserved samples and accurate identifications, the dilemma facing the zooarchaeologist is how to quantify the data. I accept Grayson's (1979) argument that the two highest levels of the accumulation model are unobtainable and that all quantification methods have limitations, but some sort of abundance measures remain critical for comparing samples (Klein and Cruz-Uribe 1984). The first decision is whether to weigh or count the specimens.

Weighing

Weighing has the advantage of being much faster than counting and for this reason it was tempting to merely weigh the shell fragments from the McKeown float sample. But, because there are such discrepancies in weights by animal classes for specimens of identical volume, and even within species due to sex, age and individual variations, this method gives false impressions of the relative amounts of material by class (Casteel 1978). For example, one mammal bone often weighs more than hundreds of fish bones and even within classes, a beaver element weighs more that a rabbit element of equal volume. Since both the Keffer and McKeown excavated zooarchaeological samples included remains from seven classes, these discrepancies would apply. Differences in preservation by bone density add to these inequalities. These problems and others related to weighing are discussed under "meat weights" below.

Counting

At present most analysts working on Iroquoian samples count the bones. Since each specimen must be examined in the identification process, it is not difficult to tabulate their numbers and such recording is recommended because it enables comparison with most other faunal studies. For these reasons, the Keffer and McKeown site faunal specimens have been counted, including the tiny shell "flakes".

NISPs

The most commonly used count is the number of identified specimens per species (NISP). Grayson (1979, 1984) argued that this simple counting method suffered from the fewest weaknesses, but he emphasized that there are problems with NISPs, most particularly, interdependency among specimens. On Iroquoian sites, large bones are usually broken, whereas those of smaller animals do not exhibit as much breakage. Thus, the NISPs of larger animals are increased when the pieces of broken bone can be identified. Alternatively, the NISPs are decreased when extensive breakage or other treatments obscure their distinguishing features (Marshall and Pilgram 1993). It is improbable that these two processes would exactly cancel out each other. Animal sizes affect NISPs in an additional way: as noted above, complete carcasses of large mammals are often butchered at the kill sites, whereas smaller animals are transported whole to the living sites, resulting in a deflation of NISPs for larger animals in the village samples. From ethnohistorical sources, it is known that this was true for deer slain by the Hurons in the early seventeenth century and that their large fish catches were prepared at fishing camps. Also larger elements might be broken for marrow extraction or to fit them into cooking pots, whereas bones of smaller animals might not receive much, if any, such secondary butchering. An even more critical problem with NISPs is that some species have very easily recognized elements even as only small fragments, while other species have bones which are difficult to identify (Grayson 1984:21). For instance, in Iroquoian samples, the bowfin specimens are easily recognized, whereas duck bones are difficult to assign to species. I doubt that there is any way to quantify such discrepancies mathematically. In addition, comparisons between species suffer from the inequality in the number of bones in complete skeletons by species and these numbers decrease within individuals of all classes, except fish, with age. Since birds mature rapidly, usually within two to three months in Ontario, this class is represented by adult specimens almost exclusively, whereas the more slowly maturing mammals often contribute many immature and young adult bones to the samples. This inflates the mammalian totals relative to those for birds. Differences in skeletons among the classes also introduce biases. Considering adult skeletons, to which age category most of the

Keffer and McKeown specimens belong, an average mammal has about 203 elements; a bird has slightly fewer; fish show great diversity, but an "average" osteichthyes has many more elements than a mammal (chapter 6); turtles have fewer elements, even when the segments of the carapace and plastron are counted individually, as do frogs and toads. Ratios could be determined for the average number of bones in a complete skeleton for each class and then the NISPs could be weighted accordingly, but other factors, particularly differential preservation, affect the number of bones by classes as well. For example, mammal bones generally withstand erosion and heat best because they have dense, strong cortices, whereas fish bones, lacking such cortices, are fragile and deteriorate more readily. Bird bones, particularly limb elements have been shown to resist decay better than similarly-sized mammal bones (Nicholson 1996:526, 529). Relative sizes of the bones also influence their chances of preservation; larger and denser ones generally last longer and thus, in general, mammalian remains are favoured (Lyman 1984). Even within a single animal, differential preservation of elements occurs because of structural differences and or differential treatment of body parts (e.g. Lubinski 1996). Despite these factors, the NISP provides a basic record of what was analyzed, and, of the current methods of measuring abundance, incorporates the fewest biases.

MNIs

Another index, used almost as commonly as NISP, is the minimum number of individuals (MNI). Since White (1953a) introduced this concept, several methods of deriving MNIs have been devised. Usually in Iroquoian faunal studies, identical bone elements and parts of elements, sorted to side and age, are totalled to arrive at the fewest number of individual animals sufficient to account for the specimens in the zooarchaeological sample. The repeated suggestion of pairing elements to arrive at MNIs (Bokonyi 1970; Casteel 1977; Chaplin 1971; Krantz 1968; Turner and Fieller 1985) is impractical, as it ignores the fact that paired elements are not identical, even in the same individual (Wild and Nichol 1983). Since pairing bones is the basis for the Petersen Index (Fieller and Turner 1982), this index cannot be satisfactorily implemented. Also, it is flawed because it assumes that bones from both sides must be from the same population (Klein and Cruz-Uribe 1984) when this might not be so (Turner 1983). Furthermore, many skeletal elements are not paired. Finally, pairing requires the occurrence of relatively complete specimens, whereas most Iroquoian samples, including those from both the Keffer and McKeown sites, are dominated by fragments.

As Klein and Cruz-Uribe (1984:27) have argued, when fragments of bones are ignored, the MNI is depressed and when they are counted as whole bones, the MNI is inflated. Klein and Cruz-Uribe recommend that the fragments be recorded as portions of whole bones and added to the complete elements, giving a mixed fraction total for each element. Fragments should be included, especially since they make up such a large proportion of Iroquoian zooarchaeological samples, but discrete features, such as foramen or muscle scars, can be used to assign the fragments to taxon, side and age categories and then these numbers can be added to those of the complete elements to determine the MNIs. Those shaft pieces lacking such defining characteristics cannot be identified to their species and so would not contribute to the MNI in any method. At Iroquoian sites, if whole elements only, even including epiphyseal ends and complete diaphyses, were studied, the mammalian and avian samples would be greatly reduced. The reptilian and amphibian samples would be only slightly affected, but such element counts could not be applied to the fish and invertebrates which lack limb bones and epiphyseal bones. Thus, their figures would be incomparable with those for the other classes.

Aggregation of specimens as a source of error in establishing MNIs was over-emphasized by Grayson (1984). While values certainly do change depending on how the sample is divided or aggregated, this "problem" can be overcome by giving the MNIs for the sample as a whole as well as for discrete units. For example, for Iroquoian villages, one might want to determine the MNIs for each longhouse, or in villages that expanded or contracted (as did both Keffer and McKeown), the MNIs for each of the occupation phases. Sub-dividing a faunal sample on the basis of sound archaeological interpretation can produce more representative MNIs. Obviously, for a stratified site with cultural deposits separated by sterile layers, the MNI for the whole site is not very meaningful. For Keffer and McKeown, MNIs will be given for both the individual houses compared and for the aggregated houses from each site. Grayson (1978, 1984) demonstrated that the MNIs are dependent on the NISPs in a mathematically predictable way. Since "in most cases, ..., as the sample size for a given tax increases, the chances of drawing the most abundant elements decrease, the relationship between MNI and NISP is curvilinear..." (Grayson 1984:62). Thus, he concluded that MNIs do not offer new information and recommends NISPs "as the best unit we have available for measuring the relative abundances of vertebrate taxa in archaeological and palaeontological sites (ibid.:92). Stressing aggregation problems, Grayson recommended that only NISPs should be used as the measure of abundance.

An additional weakness of MNIs for Iroquoian samples is that its use often results in only a single animal being determined for a majority of the species represented. Since even a "laundry list" indicates that at least one member or parts of one member of each represented species was on the site, MNIs of one do not add information. Furthermore, if all the species produce MNIs of one, this index has little comparative value. Fortunately, this extreme was not true of the Keffer or McKeown site faunal samples, although MNIs of one did predominate.

A major attraction of MNIs is that they refer to individual animals rather than to the disarticulated specimens in an excavated sample. Just as whole pots rather than sherds are preferred by ceramic specialists, so too whole animals seem to be a more satisfying unit, particularly for subsistence interpretations. A related positive aspect of MNIs is that the inequality in the numbers of elements in whole skeletons is circumvented. One catfish can be compared to one whitefish, despite the fact that each whitefish has more elements in its skeleton than each catfish.

NISP figures could leave a false impression of a greater abundance of species which have greater numbers of bones in their skeletons. As well, MNI are less affected than NISPs by different amounts of fragmentation by species or between archaeological samples because MNIs are based on unique features in the specimens and these are not increased by breakage. Finally, by giving both NISP and MNI frequencies, the rankings of species by these methods can be compared and may reveal distinctive butchering or transport practices for some species. The relationship between NISPs and MNIs for animals deposited on the site as whole carcasses will be different from that for animals from which only selected body parts have been transported to the living site. Thus, NISPs and MNIs each have both limitations and useful attributes and therefore both have been determined for the Keffer and McKeown faunal remains.

MNEs and MAUs

After Binford (1978) observed that arctic Nunamiut hunters selected parts of caribou rather than whole carcasses for transport and consumption, he devised the minimal number of elements (MNE) and the minimal animal units (MAU) indices (Binford 1984b:50-51). MNE is the total number of examples of a particular anatomical element, irrespective of their positions within the skeleton. The MAU is the MNE divided by the number of times that element occurs in a complete skeleton. These indices, like MNI, solve the problem of interdependence which occurs with NISP. As Grayson noted (1984:89), there can be problems in deciding how many segmental units are represented by unpaired elements such as vertebrae or phalanges. MNEs and MAUs are interesting refinements to the MNI index (Marshall and Pilgram 1993), but they are most useful for sites dominated by large animals which are difficult to transport whole. They are not as valuable for Iroquoian samples which typically have large numbers of remains from medium-sized mammals in their samples. However, the MAU is useful when specimens have not been identified to side and it was used to arrive at MNIs for amphibians at the Keffer and McKeown sites.

In this study of Iroquoian faunal samples, NISPs and MNIs are given for each species represented and MNEs and MAUs are used occasionally. When considering the figures derived for these indices, it should be remembered that NISP represents the maximum number of individuals possible to account for the faunal remains of a species, while the MNI is the minimum number of individuals required to account for the remains deposited on the site. The true number of original individuals producing the zooarchaeological sample lies somewhere in between the NISP and MNI figures.

Meat Weights

While MNIs eliminate the interdependency problems associated with NISP, it is obvious that one deer is not equivalent to one squirrel in the diet. Attempts have been made to determine the relative dietary importance of the various sized animals by calculating the amount of meat each provides. One method, skeletal mass allometry, uses the weight of skeletal elements to estimate the meat weight of the animals. This has been attempted for invertebrates (Reitz, Quitmeyer, Hale, Scudder, and Wing 1987), fish (Casteel 1974, 1978; Barrett 1993), and mammals (Purdue 1987). Recently, this method has been applied to an Iroquoian village zooarchaeological sample (Needs-Howarth 1995) and it was concluded that this method, combined with caloric estimates, provides a more realistic quantification method than those based on NISP or MNI. But there are many problems specific to the allometry method in addition to those it holds in common with NISP or MNI-based meat weight figures. (These latter methods are described below.) Particularly troublesome to allometric estimates are studies showing that bone weights are affected by taphonomic factors and that post-depositional weight changes vary by class and by skeletal element (Lyman 1984, 1994b), as well as by different burial environments in which they are found. Secondly, allometric formulae "treat bone weight as if it came from a single individual" (H. Jackson 1989:604), which is not true of most archaeological samples and which results in a larger distortion with larger samples. Different sized individuals of the same species present a problem for this method as well. In addition, as Binford demonstrated years ago (Binford 1978, 1984a), different elements support different amounts of nutritional substances, a significant factor which is ignored in allometric meat weight estimates. As H. Jackson discussed, "allometric equations for different taxa respond differentially to sample size, so that relative biomass or meat weight estimates produced by the mass allometry method are in part a product of the size of the archaeological sample" (H. Jackson 1989:607). With archaeological bones, there is also the complicating factor of differential treatment of the skeletons and parts of skeletons by humans in procurement, preparation, consumption, and disposal. Considering these methodological weaknesses, allometry has not been used to establish meat weights in this dissertation.

Meat weights based on the number of animals represented in a sample suffer from fewer problems than skeletal mass allometry and are simpler to derive. Perhaps for both these reasons, such estimates are used more often than those based on allometry formulae. For each species represented, usually its MNI, but occasionally its NISP (Driver 1995), is multiplied by the average weight of edible flesh on one individual. In this study MNI weights have been calculated for all species and NISP weights for the mammals and fish (chapter 8). In practice, there are problems with this procedure beyond those associated with MNIs and NISPs in general. Average weights for many species vary across their ranges, by age, by sex and by seasons. Furthermore, the edible flesh weights for most wild species have not been established. Instead, proportions of the average total body weights (sometimes but not always live weights) are used to calculate the edible flesh weights. There are weaknesses with this because different people eat and avoid different animal parts and because the proportions often are based on those derived from European butchering practices of animals raised and fattened for consumption (White 1953a). As a result, some of the early proportions given for wild North American mammals are likely too high (Stewart and Stahl 1977). However, as long as the same proportions and the same average total weights are used for both the Keffer and McKeown zooarchaeological samples, any errors in the estimates will be constant for both sites.

For the comparison of the Keffer and McKeown samples, in most instances I have been able to use average live weights from animals found in eastern Canada and sometimes more specifically in southern Ontario or the Great Lakes region. Most weights for mammals are taken from Peterson (1966) or Cleland (1971) rather than using White's (1953a), which were from more central or western animals. Bird weights were more difficult to find; I have relied most heavily on those reported by Cleland (1971), but other sources are occasionally used and are noted in the discussion of the Keffer (chapter 6) and McKeown (chapter 7) zooarchaeological samples. In general, Mackay's (1963) and Scott and Crossman's (1973) descriptions have been used for average fish weights.

The same proportions of edible flesh have been used for the Keffer and McKeown material, except in special, noted circumstances. I am using White's (1953a) 50 and 70 percent of the live weight for mammals and Cleland's (1971) 80 percent for birds, with a few exceptions. For fish, I am using 80 percent of the total weight which is the proportion Cleland (1971) used, but less than that proposed by Wing and Brown (1979) and used by Friesen and Arnold (1995). These figures apply to adult animals. Wherever it has been possible to increase the MNIs by adding younger specimens, the meat weight proportions for immature individuals have been arbitrarily set at 75 percent of the adult weight, unless I could be more specific in ageing and thus arrive at more appropriate weights. Remembering that skeletal maturity lags behind the attainment of full body size, the young adult individuals in the zooarchaeological samples have been considered equal to the adult individuals for the meat weight calculations. Figures have been tabulated for each species and then totalled for amounts contributed by classes and by the zooarchaeological sample as a whole. These meat weight totals are then compared to the number of human families on the site and the floor area inhabited by them.

Mammalian Meat Contributions

Of the mammals, deer, beaver and bears were significant contributors to the diet at both the Keffer and McKeown sites. The usable meat per individual adult deer has been estimated at 100 pounds or 45.5 kg (White 1953a:397) and deer have a high meat poundage proportion even in their leanest seasons. Deer attain much of their adult size by their second summer, with smaller increments in their third and fourth summers. Their highest weights are reached in their fifth year, with a levelling off or a slight decrease in later years (Severinghaus and Cheatum 1956). Males weigh more than females and the 45.5 kg average weight is on the conservative side. Adult beaver would have contributed about 17.5 kg of meat, whereas bears would have been much greater contributors. Black bears in eastern Canada average 136.2 kg (Peterson 1966:221). Using White's (1953a) estimate of 70% being edible, which might be slightly inflated (Stewart and Stahl 1977:268), each adult yields about 95.3 kg of meat. Even cubs, such as the McKeown one, would provide considerable flesh as well as useful coats.

Several medium-sized mammals were hunted by the people at the Keffer and McKeown sites. The adult muskrats, weighing between 810 and 1,580 grams (Peterson 1966:169), could have provided about one kilogram of usable meat each (Cleland 1971:20). Porcupines would be good catches. According to Banfield (1974:233), adults weigh from 3.3 to 9.5 kg, averaging 6.4 kg, but Peterson's (1966:188) weights for porcupines in eastern Canada are higher, ranging from 4.6 to 13.8 kg. Cleland lists the usable meat for porcupines at 3.2 kg, but White (1953a:398) gives 4.5 kg as the average adult contribution. Since eastern porcupines are large, White's meat poundage figure was used. Woodchucks are common on many Ontario sites. At the Nodwell site, for example, they were the most frequently identified mammal (Stewart 1974). According to Banfield (1974:107), woodchucks average 2.5 kg as adults but they can increase to 3.5 kg in the fall. Peterson (1966:116) gives a range of 1.8 to 5.4 kg, which averages to 3.6 kg for adults. Using this figure, each adult woodchuck would provide about 2.5 kg of edible flesh (White 1953a:398) and the immature individuals about 1.9 kg. Adult hares might contribute about 1.0 kg of meat (Cleland 1971:20), which is slightly higher than the figure quoted by White (1953a:398), but in eastern Canada hares can weigh 2.3 kg (Peterson 1966:87). Raccoons would have provided considerably more. Adult raccoon weights average 8.6 kg for males and 7.5 kg for females (Banfield 1974:314) and they range up to 13.6 kg in eastern Canada (Peterson 1966:226). According to White (1953a:397), each adult yields 7.9 kg of meat. The much smaller marten weighs between 425 and 1,500 grams (Banfield 1974:316; Peterson 1966:252), with the higher weights occurring in eastern Canada. According to Cleland (1971:20), an adult marten contributes almost one kilogram of meat. (White gives no estimate for marten.) Each red squirrel, weighing between 140 to 250 grams (Peterson 1966:114), would contribute only about 136.5 grams. Like the red squirrel, eastern chipmunks contribute very small amounts of meat because they weigh only 75 to 115 gr (ibid.:121). Thus, they added only about .07 kg each.

Most of the remaining poorly represented species, such as the vole, mice, grey squirrel and mink, would contribute similar small amounts. Exceptions are the fisher, which on average weighs about 3.1 kg (ibid.:256) and could contribute about 2.2 kgs of meat, the red fox which weighs between 2.7 and 7.3 kg (ibid.:211) for a meat contribution of 1.8 kg, the river otter which weighs about 9.1 kg (ibid.:273) for a meat yield of 5.7 kg and the wolf which weighs between 27.2 and 45.4 kg in eastern Canada (ibid.:200) and so might have about 13.6 kg of edible flesh. According to White (1953a:398), on average a lynx provides about 6.8 kg of meat. Of the smaller species, the mink would have added 0.5 kg (Cleland 1971:20). The grey squirrel weighs 340 to 680 gr (Peterson 1966:108), averaging 510 gr, and so would contribute about 375 gr. The tiny voles and mice average 44 gr (ibid.:161) and 19 gr (ibid.:140-43) and so provide little meat.

With such small mammals the question of whether they represent part of the diet or are merely intrusive in a site should be considered. When skeletal elements for most of an individual are found together, or when the bones are located in a feature which is an animal burrow, they should be disregarded in dietary calculations. However, the small rodent specimens found at the Keffer and McKeown sites were deposited like the other faunal refuse. Furthermore, the ethnohistorical sources include statements that such small animals were consumed by the Iroquoians. For these reasons, the mice, shrew and mole remains found in these sites have been considered food refuse. This raises another issue concerning these creatures. Considering the few calories gained by consuming them, they are not worth hunting for food (Feit 1973). But according to ethnohistorical information, the Huron houses were infested with vermin. Thus, mice could be killed inside the houses and their carcasses thrown into the cooking pots with little energy being expended.

Fish Meat Contributions

On some sites the distribution of fish head to body bones provides information about fish handling procedures. However, in any sample, skull bones might predominate simply because in a complete fish skeleton, there are many more skull than infracranial elements and because the former are easier to identify than the latter. That the natural disparity is great for catfish explains the high proportion of zooarchaeological skull bones for *Ictalurus*. Despite this, for most of the species with more than 50 specimens assigned to a body part, the proportions are fairly even between the heads and the infracranial areas. At McKeown, even the American eel, which might have been expected to show evidence of having been prepared elsewhere, has specimens which are almost equally from the skull and the infracranial region. Therefore, for calculating the fish meat weighs, it will be assumed that in most instances, whole fish were carried to the site. As was done for the mammals, a proportion of the total fish weight (80%) will be used for determining the meat contributions of the fish species.

The most common fish species found on most Ontario sites are medium sized. However, at Keffer the relatively large whitefish was the most frequently identified species. Whitefish average about 2.0 kg, but they might have been much larger even as little as 50 years ago (MacKay 1963:121, 129). Using MacKay's total weights (ibid.) and assuming 80% as the edible portion, Cleland's (1971) figure of 4.72 kg of usable meat per whitefish is an acceptable approximation.

Although suckers were not identified beyond family, they were contributors at both sites, being particularly frequent at McKeown. Weights of the white and slightly smaller longnose suckers (Scott and Crossman 1973:538, 531) range from 0.45 to 0.9 kg (MacKay 1963:164), averaging 0.7 kg, and so they provide about 0.5 kg of meat each. This figure is slightly under the 0.8 kg used by D'Andrea *et al.* (1984:234) and less than Cleland's (1971) estimate. Considering that redhorse suckers are slightly larger, with most of them being 356 to 457 mm long (Scott and Crossman 1973:563-86), the 0.8 figure will be used for the meat contribution per individual sucker.

In the perch family, there might have been some selection of the slightly larger sauger/walleyes over the yellow perch. Yellow perch weigh on average about 0.2 kg (ibid.:758-9), although much larger fish have been caught and "in the

Great Lakes, the weight may exceed a pound" (MacKay 1963:228). In general, they provide about 0.16 kg of meat [0.1 kg according to D'Andrea *et al.* (1984:234) and Cleland (1971:20)]. Saugers, weighing under 0.9 kg (Scott and Crossman 1973:764), provide about 0.7 kg of edible flesh per fish. Walleyes are larger. They usually weigh less than 7 kg, although much larger fish have been reported (ibid.:767, 772). These can range up to 25 pounds (11.5 kg) in Ontario (MacKay 1963:235). The average from weights tabled for Lake Ontario walleyes by Scott and Crossman (1973:771) was 2.75 kg, allowing a meat contribution of 2.2 kg, which is just slightly under that used by Cleland (1971:20). When these walleye and sauger meat estimates are used, the average *Stizostedion* meat contribution is 1.5 kg per fish.

Both the bass and the pumpkinseed are moderately sized, with most individuals weighing under 2.2 kg (Scott and Crossman 1973:728, 734, 713) and so contributing about 1.76 kg of meat. The largemouth bass might contribute 1.1 kg based on an average size of 1.4 kg (ibid.:737).

The northern pike is a larger fish (ibid.:356), reaching weights of more than 20 kg in Ontario (MacKay 1963:196). However, most of the archaeological pike bones were only slightly larger than those of my 1.93 kg reference skeleton, so an average weight of 2 kg will be assumed for these fish. Thus, each would contribute about 1.6 kg of meat. This is much less than Friesen and Arnold's (1995:26) estimate for this species, but is close to the 1.1 kg used by Cleland (1971) and D'Andrea *et al.* (1984:234).

Other large bones were those of the channel catfish, which was poorly represented at both sites. In Ontario waters, these catfish can weigh as much as 14 kg and "in the Great Lakes those weighing 10 pounds [4.54 kg] are of common occurrence" (MacKay 1963:182). Such a fish would provide 3.63 kg of meat but Cleland (1971:20) used 1.5 kg and B. Smith (1975:63) even less. Since few McKeown specimens were large, an estimated average of 2 kg of edible flesh from channel catfish will be used for that site, but a larger figure is employed for Keffer because the channel catfish bones from there were larger. However, most of the zooarchaeological catfish specimens at both sites were from bullheads that weigh between 0.23 and 0.45 kg in Ontario (Scott and Crossman 1973:597; Mackay 1963:188), and so contribute about 0.27 kg of meat on average. These figures are for yellow bullheads, which are slightly smaller than brown bullheads (Scott and Crossman 1973:602). Considering this and the fact that the former species was not as common in the faunal samples as the brown bullhead, an average meat weight figure of 0.4 kg seems reasonable. This figure is the same as that used by D'Andrea *et al.* (1984), less than that used by B. Smith (1975:63) and more than Cleland's (1971:20).

For American eels, the large females can be 762 to 1016 mm long and weigh 1.32 to 1.59 kg while "the males seldom exceed 610 mm in length" (Scott and Crossman 1973:627). Weights can reach 7.5 kg but the average size is "significantly smaller" (Junker-Andersen 1988:101). Using 1.5 kg as an average weight (ibid.:112), the usual meat contribution of this fish would be 1.2 kg.

The most infrequently represented archaeological species were some of the largest. Gar, lake trout, freshwater drum and bowfin are all relatively large fish. According to B. Smith (1975:55), a longnose gar yields 1.1 kg of meat. Members of the salmon family, particularly the trout, average about 2.0 kg. Like whitefish, drums were reportedly much larger in the past, but the bones identified from the Keffer and McKeown sites were not large. Therefore taking an average weight of 1.4 kg (Scott and Crossman 1973:815), the meat provided by each drum would be about 1.12 kg, a figure similar to that used by B. Smith (1975:55). For the bowfin, average weights of 0.9 to 1.4 kg are reached in Lake Erie (MacKay 1963:48), although heavier amounts are attained. Using an average of 1.3 kg, this fish would provide 1.1 kg of meat.

Small, poorly represented fish include some type of chub, the rock bass, a temperate bass (*Morone* sp.) and a crappie. The chub and the rock bass average about 0.23 kg (Scott and Crossman 1973:510, 706). The morone bass and the crappies are about 0.51 kg in weight, with the latter being slightly larger than the former (Scott and Crossman 1973:687, 691, 742-3). Thus, these species would provide little edible meat; 0.18 kg for the chub and rock bass and 0.41 for the morone bass and crappies.

Adding the estimated meat weights for all the species, the total edible fish flesh for both sites can be determined. When the MNIs based on vertebrae rings are added for the McKeown sample, the totals are given in brackets. However, this larger figure will not be used in comparison with the Keffer site because vertebrae rings were not examined for all the fish from that site. Thus, the more conservative, lower figure will be used for the McKeown discussion.

Bird Meat Contributions

The basically mammalian and fish diet was supplemented with meat from other poorly represented animals, including birds. Of the birds, wild turkey at Keffer and Canada goose at McKeown were the biggest contributors of meat. Estimates of the extirpated turkey's size vary from 5.5 (White 1953a:398) to 6.5 kg in the fall and winter (Williams 1981:14). Estimates of the proportion of these weights which are edible flesh are 70 (White 1953a) and 80 percent (Cleland 1971:20). Using an average of 75 percent and an average total weight of 6.0 kg, each turkey would provide 4.5 kg of meat. Each Canada goose, according to White (1953a:398), yields 2.54 kg of usable flesh, which is 70 percent of the total weight. However, Bellrose gives slightly higher weights for the interior group, which is the one found in the locality of the McKeown site (Bellrose 1976:141), and Cleland (1971:20) uses 2.9 kg for Canada geese in the upper Great Lakes region, claiming all birds are about 80 percent edible meat. This higher figure will be accepted for the geese found at both sites. White does not give any estimate for the common loon, but Cleland's (1971:20) figure of 1.8 kg for an adult is reasonable, although there are large size differences within this species (McIntyre 1988:132). The common merganser would have provided about 1.2 kg (Bellrose 1976:454), the goldeneye duck and greater scaup about 0.8 kg (ibid.:427) each and the oldsquaw 0.7 kg (ibid.:385). Passenger pigeons and ruffed grouse would have provided 0.4 (Cleland 1971:21) and 0.5 kg (Bump *et al.* 1947:91) of meat, respectively. Finally, the bald eagle and screech owl, which were found only at Keffer, would have added 3.6 kg for the bald eagle (Cleland 1971:21) and only 0.1 kg for the owl (B. Smith 1975:190).

Reptilian and Amphibian Meat Contributions

The few turtle shell pieces, the snake vertebrae and the amphibian bones likely represent food refuse even though they lacked evidence of butchering or burning. Tooker reported the eating of turtles, frogs and toads in the 1600s (1964:66) and Waugh reported that frogs, snakes, turtles and turtle eggs were eaten by the Six Nations Iroquois in historic times (1973:135-136). The painted turtle, the only turtle found in the houses, at both sites would have provided only about 0.1 kg of meat and each frog even less (B. Smith 1975:183). The occurrence of numerous invertebrate shells, some of which had been heated at McKeown, suggests that clams also contributed to diet, as they did in the historic period (Waugh 1973:140). These poorly represented species might have had greater significance than their numbers indicate due to their seasonal availability (birds migrating in spring, for example) or their easy capture (the invertebrates) when stored food became depleted.

Utility Indices

Binford's utility indices for explaining the occurrence of nutritionally rich elements on sites, such as his meat (MUI), marrow (MI), white grease (WGI) and general utility indices (GUI, MGUI) are best suited to sites of large mammal hunters whose subsistence was derived from a limited number of species. Even when simplified (Metcalfe and Jones 1988; Jones and Metcalfe 1988) and refined (Marshall and Pilgram 1991), these indices require large numbers of animals or animal parts from single species to be used effectively. However, the ideas behind meat utility indices are significant to Iroquoian faunal studies. For example, at Keffer parts of some animals, such as deer and whitefish, appear to be over-represented and the nutritional value of these parts is considered (chapter 6).

Richness and Diversity

MNIs have recently been used in investigations to measure the richness and the diversity (Cruz-Uribe 1988; Grayson 1984; Meltzer *et al.* 1992) of the faunal remains on a site. "In studies of taxonomic richness, analysis is focused on the number of taxa, often species, that have contributed to the faunal assemblage, and on comparing assemblages on the basis of the number of taxa they contain" (Grayson 1984:132). Obviously sample size will affect both the richness and the diversity, which refers to the number of taxa represented combined with the number of specimens in each taxon. Cruz-Uribe (1988) concluded that species with MNIs of at least 25 are needed for valid diversity and richness calculations, but Meltzer *et al.* (1992) have shown that even these numbers are not sufficient to negate sample size distortions. Few, if any, Iroquoian faunal samples have such high MNIs and certainly such totals were not found at either Keffer or McKeown.

Thus, the mathematical tests for diversity and richness are not applicable to them. However, richness and diversity are still interesting concepts for comparisons between sites and might be suggestive even when they are not mathematically precise.

Methods for Estimating the Consumers

While NISP, MNI, MNE, MAU, richness, diversity and meat poundage figures of sites are of interest in themselves, estimating the size of the human populations which depended on the identified resources makes these figures more significant to subsistence studies. There are different and controversial ways of arriving at population estimates for prehistoric villages. For this analysis, I am not attempting to establish an absolute number of individuals, rather I am considering the number of hearths as a measure of the number of nuclear families inhabiting a longhouse. Hearth counts have been used in this way by many Iroquoianists (Finlayson 1985; Johnson and Jackson 1980; Ritchie and Funk 1973; Varley and Cannon 1995; Warrick 1990; J. Wright 1974) and they are the best single source of information for estimating populations of Iroquoian sites (Trigger 1981:32; Warrick 1990:90). An average nuclear family size, such as Finlayson's estimate of six individuals (1985:109) or J. Wright's (1974:71) and Dodd's (1984:272-4) of five was not used in this analysis, but it was assumed that whatever the actual number was, it was constant for families at the McKeown and Keffer sites. It has also been assumed that each central hearth was shared by two families, based on numerous historical observations (Thwaites 1896-1901:15:153; Wrong 1939:94).

In addition to establishing the ratio of hearths to faunal remains, these can be compared to the maximum floor area of a house, derived by multiplying the total maximum length by the mid-length widths as defined by Dodd (1984:239). Living area has been used less frequently than hearth counts (Pearce 1984) because of the many problems involved in establishing a normative relationship between it and population (Warrick 1990:91-3). However, it might be useful where overlapping of houses makes designation of hearths to specific buildings impossible. Fortunately, none of three McKeown houses used in the current research had post hole patterns suggesting that their original lengths were either extended or contracted. However, all three had one end with fewer features than the rest of their floors, suggesting a porch or storage cubicle region. However, the overlapping of the various house stains confused such evidence, especially for House 13, which appears to have had a small porch area at its northeastern end and might have had one at the other end too. House 10 shows a porch at its north end only and House 2 at its southwestern end only. Acknowledging these similarities and the ambiguity for House 13, the maximum house lengths, including the porches, will be used to establish the maximum living floor area for all three buildings. Maximum house lengths and mid-house widths were also used for the Keffer longhouses. Although there are differences in the faunal remains by houses at both the Keffer and McKeown sites (Stewart 1992), which is typical of many Iroquoian villages (e.g. Stewart 1974), all the refuse and hearth numbers from four (Keffer) or three (McKeown) average houses from each site have been aggregated to obtain larger samples. As well, material from one house from each site has been analyzed separately. Thus, the remains from four Keffer houses (Houses 12, 13, 19 and 20) are considered as a combined unit and those from House 20 are considered alone. Similarly, remains from three McKeown houses (Houses 2, 10, 13) are aggregated and those from House 2 are discussed as a separate unit.

In addition to the number of nuclear families, the length of time that the houses were occupied might influence their zooarchaeological samples. While the density of features in a house floor might reflect duration of use, such densities do not reflect time alone (Warrick 1990:269). Another method of deriving longevity has been devised by Warrick (1988, 1990:265-293), using the density of post hole stains in the walls of longhouses. In this method, the number of post stains per meter in the side wall of a longhouse is compared to the number in the wall when it was initially constructed. This ratio can be compared to known rates of decay of the various woods and the duration of the house can be determined. Warrick provides a graph for doing this (1988, 1990). This method was applied fairly easily to the McKeown site, where the original post densities could be determined from sections of walls which exhibited no repairs (chapter 8), but at Keffer the post patterns were more confusing. As a result, for this site, Warrick's average figure of 3.5 posts per meter in the original construction of prehistoric Huron longhouses was used as the base density for the Keffer occupation estimates.

Longer duration might result in greater numbers of faunal specimens accumulating in the longhouses. But such an assumption ignores the fact that refuse was removed and dumped in middens. However, during the winter, refuse might have been deposited in empty storage pits within the houses and it is during winter that the houses were used most. Assuming some skeletal pieces were missed during cleaning, the accidental inclusion of these in house floors and features would probably increase over time. In the comparison of the Keffer and McKeown zooarchaeological samples, it is assumed that food debris was cleaned out of the houses with similar frequency and efficiency. Thus, the majority of the remains in the houses represent food refuse from the final period of occupation. If future studies determined how often longhouses were cleaned, then the number of days or months of eating responsible for the faunal refuse found with a house could be stated more precisely. Despite Schiffer's (1972) plea almost 25 years ago for more research concerning primary and secondary refuse deposition, this is still an issue for Iroquoian sites.

Conclusions

From this review of zooarchaeological methods and accumulation processes, it is apparent that faunal remains are affected by many natural and cultural factors. For all sites, excavation and identification techniques can be controlled and inferences drawn from the excavated sample using NISP, MNI and occasionally other indices, such as MNE and MAU. For subsistence research, these can be used to estimate the meat weight contributions of the various species.

For Iroquoian sites, the archaeological sample should include most of the deposited sample because post-depositional erosional factors, such as soil acidity and time since deposition, are minimal. However, dogs affected the samples at least at Keffer, probably by both adding and eliminating bones. In an experiment to study the effects of scavenging dogs on faunal remains, Walters (1984) has shown that the losses can be great. Even without dogs, zooarchaeological samples can be altered by other scavengers and fish losses can be large (Wing 1994:310). The deposited sample, formed by butchering and transportation practices as well as by some non-human agencies and then altered by the mild taphonomic processes, cannot be completely reconstructed. However, most of these factors are thought to be similar between the two main village sites used in this study.

Beyond the deposited sample is the death sample which remains unknown, as is the life sample which is not accurately reflected in zooarchaeological material. It cannot be assumed that the Iroquoians hunted all the species available to them or that their catch was proportional to the populations of the living animal communities. However, some of the contrasts in the remains from the Keffer and McKeown sites reflect differences in the locally available species and the diversity in the catchment areas will be considered in my comparison of the subsistence of these two peoples (chapter 8).

Some of the quantification methods, developed primarily for large game hunter and gatherer sites, can profitably be applied to those of the horticultural Iroquoians, but others are less appropriate. For this study of proto-Huron/Petun and proto-St. Lawrence Iroquoian subsistence, both NISP and MNI will be used most, but since they are easily derived from the basic data and can show butchering practices or cultural preferences, MNE and MAU indices will be considered. However, as is the case for most Iroquoian samples, the element totals usually will be too low to make these indices useful. Because attempts to pair specimens result in numerous errors, this procedure and indices based on it have not been used. Binford's utility indices are of limited applicability to Iroquoian faunal samples which are often dominated by fish remains and by great species diversity in all classes. However, they can be useful regarding the dominant large mammal species on a site, such as deer, bear and beaver. Evidence of differential treatment by body parts has been found for some fish species also. The ideas of diversity and richness are explored in comparing the zooarchaeological samples from the two sites.

The significance of the zooarchaeological remains from these sites are considered in relation to the number of families which depended upon them for a number of years. In this analysis the macrofaunal remains from two average-sized houses excavated at the two sites are compared. Macrofaunal remains were used for this comparison because, while numerous microfaunal specimens were analyzed from House 2 at McKeown, very small samples of floated material were available for the Keffer houses. Only 34 faunal specimens were recovered by floatation from House 20 and two middens excavated in 1988. Extensive floatation at Keffer was done in Midden 57, but unfortunately, no middens were excavated at McKeown. Thus, in order to compare like entities, the macrofaunal house remains from these sites have been compared in detail, although the microfaunal material was studied and is reported here too. In addition, after discussions of all the zooarchaeological material studied from the sites, samples excavated from the houses only are described because the sites will be compared (chapter 8) using these similar units. Thus, there are three sets of faunal remains from each site for comparison: the total site sample, the aggregated houses sample and the sample from a single house.

The scientific names of the species represented are included only after their initial mention in the dissertation. In the text, the species are discussed in the order of their frequency in the samples, starting with the most commonly found ones. This is based on the assumption that the more common ones were the most important to subsistence. In the tables, however, the species usually are listed in phylogenetical order. Once the zooarchaeological samples have been described in detail for each site, they will be compared and contrasted in order that some conclusions about similarities and differences in the subsistence of the peoples inhabiting them can be reached.

CHAPTER 6

THE ZOOARCHAEOLOGICAL SAMPLE FROM THE KEFFER SITE

Introduction

The Keffer site (AkGv-14), located just north of Toronto in the Town of Vaughan (Figure 6-1), has been known for decades as a prehistoric Indian village site. In 1889, Boyle reported excavations into the Keffer ossuary and the finding of one large vessel from the village area (Boyle 1889:19-21). This short excursion by about eight men, which lasted for about two days, was summarized in 1908 (Boyle 1908:16). The first archaeological work on the village was by Mr. A.J. Clark, an avocational archaeologist, in 1925 (Archaeological Survey of Canada, National Museum of Civilisation, Archives). His bequest to the National Museum included a small collection of artifacts and a detailed sketch map of the site (Figure 4-1). Others visited the site (Konrad 1973) but it was not until 1984, when the then Museum of Indian Archaeology (London) was awarded a contract to relocate and assess the site, that it received serious study. In 1985, a large salvage operation on the ploughed, northern part was undertaken by William D. Finlayson (Finlayson, Smith, Spence and Timmins 1985; Finlayson, Smith and Wheeler 1987) and in 1988, he excavated the largely undisturbed southern portion.

The site, located on two elevations, was comprised of at least 26 middens and 19 houses surrounded by palisades (Figure 6-2). Human burials occurred both within and outside the palisades.

> By comparing pottery decorations and shapes to pottery from other Huron sites, ... we were able to determine that the site was occupied possibly in the very last of the 15th century and certainly in the first two or three decades of the 16th century (Finlayson *et al.* 1987:19-20).

It was estimated that there were over 20,000 zooarchaeological remains. I have analyzed 9,243 of these from the site's largest midden (57) as well as those from two smaller middens (71 and 77) and from Houses 12, 13, 19 and 20. In total, 12,132 faunal specimens were examined from these features (Table 6-1).

The Natural Habitat of the Keffer Site

The north shore of Lake Ontario is at the northern extreme of the Carolinian Biotic Province which "forms the middle section of the great deciduous forest lying along the Atlantic Coast of North America" (Dice 1943:16). Biogeographers have described the precipitation in this glaciated province as fairly evenly distributed throughout the year, though more falls in summer than winter, and the climax forest is one of diversified hardwoods with beech-maple forests dominating in the northern parts (ibid.:17). Dice's Carolinian Biotic Province corresponds to Rowe's (1972) Deciduous Forest Region, which contains mainly nut-producing trees such as oak, beech, hickory, chestnut and walnut. Many of the trees in this region are also found around the McKeown site, in the Great Lakes-St. Lawrence Forest Region. Trees in common to these two areas include: sugar maple, beech, white elm, basswood, red ash, white oak and butternut, but there are also

> other deciduous species which have their northern limits in this locality [the Carolinian Biotic Province]. Among these are the Tulip-tree, Cucumber-tree, Pawpaw, Red Mulberry, Kentucky Coffee-tree, Redbud, Black Gum, Blue Ash, Sassafras, Mockernut Hickory, Pignut Hickory, Black Oak and Pin Oak. In addition, Black Walnut, Sycamore and Swamp White Oak are confined largely to this region (Hosie 1975:21).

These modern forests replaced Late Wisconsin mixed coniferous forest of pine and hemlock and the earliest post-Wisconsin spruce forests (Karrow and Warner 1990). There is a gradient across both time and space with the vegetational changes occurring first in southwestern Ontario and later in the St. Lawrence region (Karrow and Warner 1990:29-30). But, as Dice noted, "there are considerable differences from place to place in the climax" (Dice 1943:17).

Located on a tributary of the Don River, the Keffer site is underlain by shale bedrock which is exposed only in a few places, including two on the Don River south of the site, and some sandstones and limestones (Kerr and Spelt 1965:14). The latter contain chert nodules, a raw material preferred by the Iroquoians for tools. Overlying this in the site's vicinity is a till plain, called the Peel Plain, which is cut by two major rivers: the Humber and the Don (ibid.:figure 2:17). A "slope of the interlobate moraine lies north of the Peel plain" (Chapman and Putnam 1969:289) and the Trafalgar moraine and adjacent till plain are to the south. The Peel plain has clay soils at a general elevation of from 500 to 750 feet above sea level with a gradual slope towards Lake Ontario.

> East of Maple the slope is smooth, faintly drumlinized, and scored at intervals by valleys tributary to the Rouge, Don and Humber river systems. West of Maple the surface is morainic, most of it a ground moraine of limited relief (ibid.)

The soil in the general vicinity of the site is an Oneida clay loam. On the actual site, there is a clay soil on the upper portion, while the lower portion has a sand soil (Finlayson 1989:1).

Rivers have cut deep valleys in the plain but there are no depressions with swamps or bogs. This lack of wetlands results in severe limitations for waterfowl in the area, as is evident on the Canada Land Inventory Maps (Canada, Department of Regional Economic Expansion 1971d).

> Although now almost completely deforested there is evidence that this plain carried a hardwood forest of high quality and great wealth of species. In the better drained parts grew sugar maple, beech, white oak, hickory, basswood, and some white pine. The depressional areas carried elm, white ash and white cedar (Finlayson 1989:1).

Such vegetation would provide very good to excellent habitats for deciduous forest animals such as ungulates (Canada, Department of Regional Economic Expansion 1971c) and turkeys. Field creatures would live along the river banks and the river itself would be inhabited. Native agriculture would have altered the natural ecology by producing large fields for domesticated crops and thickets at the edges of the forests. Once a field was abandoned, a succession of plant communities and their animal inhabitants would follow. Since Iroquoians moved frequently but not over great distances, various ecological communities would be found fairly close to any village (Monckton 1994). But animals restricted to marshlands and climax coniferous forests should not be expected in the faunal remains in large quantities.

The climate of the Toronto region is dominated by systems moving from west to east. Annual precipitation averages about 77 cm, distributed fairly evenly throughout the year. Temperature changes noticeably with cold spells in winter and heat waves in the summer. Spring is usually late, with the possibility of frost until almost the end of May (Kerr and Spelt 1965:22-26). This may have been the most difficult environmental condition for the Iroquoians. However, the area's long fall allows late planted crops time to mature.

In general, the soils, rainfall and temperatures of the Peel plain are excellent for agriculture (Canada, Department of Regional Economic Expansion 1966). From the preliminary analysis of some of the site's float samples by Charles Turton, it is known that the Keffer inhabitants had corn, beans, squash, sunflowers and tobacco and that they fed their fires with beech and maple branches as well as with wood from non-climax trees (Finlayson *et al.* 1985).

Methods of Excavation and the Faunal Sample

In 1984, in order to determine the site's perimeter, seven trenches were excavated. In 1985, salvage operations began with the trowelling of middens in the ploughed fields, followed by the removal of the plough zone with heavy equipment to reveal the settlement features. Middens were excavated in one meter squares and dry screened through a 6 mm mesh. Arbitrary 10 cm levels were replaced by natural strata where appropriate (Finlayson *et al.* 1987:10-12), as in Midden 57, where ceramics from three strata suggested deposition over several decades (D. Smith 1991:25). In 1988, the living-floor areas were shovel-shined and dry screened. Longhouses were trowelled and matrices from their features screened. House 20 was excavated entirely and only a very small proportion of House 19 was left unexcavated. The unploughed portions of Houses 12, 13 and 15 were excavated in 1988, most of the rest of their floors having been dug in 1985. These houses were in the lower part of the site where the soil was sand. Zooarchaeological samples from the unploughed, lower portion of the site are emphasized in this study. Only a small portion of House 15 was undisturbed and its 15 faunal remains are not included.

Small amounts of matrix from all three middens and from House 20 were floated (Table 6-1). The largest floatation samples were from Midden 57. The purpose was to obtain botanical material, but floatation also increased the faunal sample greatly and changed the proportions of the classes drastically (Stewart 1990, 1991a). Thin fish bones and scales retrieved by floatation indicated that preservation was very good. Only 68 faunal specimens were eroded (0.6% of the total) and these were not greatly altered; all could still be identified at least to class. Clearly, erosion was not a significant taphonomic factor.

Osteophagia, the chewing of bones by animals, was rare too (Table 6-2). Likely the canine marks on 276 specimens were made by dogs; since most of the canine-chewed specimens identified beyond class were deer foot bones, this part of the carcass may have been considered appropriate "dog food". Deer phalanges exhibiting pitted surfaces and missing parts likely had passed through dog digestive tracts (Klippel, Snyder and Parmalee 1987). The generally low frequency of osteophagia suggests that this taphonomic effect was weak in this sample.

Furthermore the evidence of osteophagia suggests that no particular species was affected disproportionately. The specific animals showing this modification are of interest considering historic period taboos against dogs chewing particular bones. Of the mammals, canine marks were noted on snowshoe hare, woodchuck, beaver, muskrat, dog, fox, black bear, raccoon, whitetail deer and moose specimens. Among the birds, there were chewed bones of ruddy duck, wild turkey, grouse and common crow. Two bones from the trout family and three painted turtle shell pieces complete the list of chewed specimens identified beyond class.

Similarly, the incidence of pathological specimens was rare (only 0.1 percent of the sample). Healthy wild populations would benefit the human populations dependent on them. In sum, skeletal remains of healthy animals appear to have been discarded on the neutral soils of the Keffer site and, except for a minimal amount of osteophagia, to have suffered few taphonomic effects.

The Faunal Remains

All five vertebrate classes were represented in the Keffer faunal remains (Table 6-3). Only 286 or 2.4 percent were not identified to class. The majority of these were from either small-to-medium sized mammals or medium-to-large birds. That about a third of the zooarchaeological sample was identified at least to family (Table 6-4) attests to the excellent state of preservation. Most noticeable is the high percentage of fish bones (Table 6-1). Because this class appears to have been very significant to the Keffer people, the 7,412 fish remains (61.1% of the total sample) will be discussed first, beginning with the species with the highest NISP. In the descriptions of the zooarchaeological data which follow, all the analyzed remains from the site will be considered but emphasis will be given to the aggregated sample from the four houses and to those from House 20, since these are the most useful units for comparison with the McKeown site material.

Fish Remains

Even though ethnohistorians, using the primary documents of Europeans who contacted the Hurons in the early seventeenth century, concluded that fish were very important in the Huron diet (Tooker 1967; Trigger 1990), zooarchaeological studies on Iroquoian sites, the majority of which lacked floated samples (e.g. Stewart 1974), revealed only small proportions of fish. The Keffer site's proportionately high fish numbers is one of the major contributions of the study of this site's zooarchaeological remains.

The fish were the expected types, with at least 15 species from ten families (Table 6-5). There were even more species but the lack of a complete reference collection prohibited positive identification beyond family of some specimens. This particularly affected the bass (family Centrarchidae) and suckers (family Catostomidae). The majority of the unidentified fish remains were long, thin elements such as ribs, spines, arches and pterygiophores. Detailed study of the 176 fish scales might result in additional species but the scales likely came from the same species as the bones.

Whitefish (genus *Coregonus*) was the most frequently encountered species

(NISP=574), contributing a third of those fish specimens identified to genus or lower, considering both house and midden deposits (Table 6-5). The subfamily Coregoninae of the family Salmonidae includes the lake whitefish, round whitefish and ciscoes. As Scott and Crossman noted, identification, particularly within the genus *Coregonus*, is exceedingly difficult (1973:230). From the sizes of the archaeological specimens, it appears the majority were from lake whitefish. Some of the few small *Coregonus* specimens might have been from one of the five species of Lake Ontario ciscoes, which are all fairly small fish, but it is possible that these were from young whitefish. The site MNI for whitefish is 13, based on left opercular bones. For the four houses, the MNI is four, again based on left opercular bones. From House 20, a single whitefish was represented by many vertebrae.

The catfish family ranked second with 417 Ictaluridae specimens (Table 6-4). Because a reference channel catfish (*Ictalurus punctatus*) was acquired only toward the end of the analysis of the Midden 57 material, most of the catfish bones from this midden were identified only to genus. Identification of brown bullheads (*I. nebulosus*) and channel catfish in the 1988 sample showed that, while both species were present, bullheads were much more frequent. One channel catfish bone from Keffer was large; the rest were from small-to-medium sized fish. The MNI for brown bullheads from the site sample was 17 based on left opercular bones; the MNI was seven for the four houses based on right operculi and in House 20 three left operculi were the most frequently duplicated element.

For channel catfish, each of these three faunal samples had a MNI of one. There were six additional left operculi, identified to genus only, bringing the smaller catfish MNI on the site to 23 individuals. Apparently, the people at this site exploited catfish frequently, fishing bullheads rather than channel catfish as a rule. The very small madtoms and the stonecat (all genus *Noturus*) were not represented in these remains, but the slightly larger black (*I. melas*) and yellow bullheads (*I. natalis*) might be in the specimens identified only to family.

The subfamily Salmoninae (salmon and trout) was third on the site with 325 specimens (Table 6-4). Trout from the genus *Salvelinus* were recognized and appeared to be much more common than trout from the genus *Salmo*, but it is difficult to distinguish the bones of this subfamily to species. However, 27 specimens of lake trout were identified. Most of the trout bones were from small or medium-sized fish and considering their seasonal habitats and availability (Figure 6-3), a majority of these were likely brook trout. At least five trout (*Salvelinus* sp.) were represented by their left hyomandibulars; two of these were from the houses, with House 20 accounting for two individuals by itself (Table 6-6). The lake trout was represented by a single individual in the aggregated houses, but none was in House 20. No evidence of the Atlantic salmon (*Salmo salar*) was found, even though this species occurred in Lake Ontario before A.D. 1900 (Scott and Crossman 1973:193).

There were 155 remains on the site from the Percidae family (Table 6-4). Some were yellow perch (*Perca flavescens*). More were walleye (*Stizostedion* *vitreum*) and/or sauger (*S. canadense*) which could not be distinguished due to a lack of reference material (Table 6-5). No yellow perch were represented in the house deposits but the perch MNI was three for the entire identified sample, based on right cleithra. Similarly, no *Stizostedion* specimens were from the houses, but their MNI for the site was six based on articular bones from both sides of the head. Since walleyes are more adaptable in habitat than saugers and because the former are larger, it may be that walleyes were caught more often. The remaining species of the perch family, the numerous small darters (genera *Percinal* and *Etheostoma*), were not represented in the faunal remains.

The Keffer fishers caught at least three members of the sunfish family (Centrarchidae): the rock bass (*Ambloplites rupestris*), the largemouth bass (*Micropterus salmoides*) and the pumpkinseed (*Lepomis gibbosus*). Bones of the rock bass and the largemouth bass came from middens only (Table 6-6). The rock bass had a MNI of two based on two right operculi whereas the MNI for the largemouth bass was one. Remains identified only to the genus *Micropterus* were found in the houses, including House 20, but their MNI was only one. Most of this family's identified remains were pumpkinseed. The pumpkinseed MNI for House 20 was one; for all the houses, it was three, and for the site sample, five, based on left operculi and urohyals. Crappies, smallmouth bass and some sunfish native to southern Ontario were not identified.

The sucker family (Catostomidae) was the next most frequently represented one in the Keffer sample with 64 bones (Table 6-4). This is a large family of 10 genera and about 65 species, most of which are North American (Scott and Crossman 1973:523). Because the reference collection was incomplete for this family, the archaeological bones were identified to family only. However, many of the archaeological pieces were very similar to suckers of the genus *Catostomus* and considering the natural distributions of the species in this genus, it can be assumed that these were either longnose (*C. catostomus*) or white suckers (*C.commersoni*). The majority of the sucker species belong in the genus *Moxostoma* and some of the Keffer specimens were likely from these redhorse suckers. The sucker family was represented by at least three individuals on the site, since there were three right preoperculars. A single sucker was represented in the material from the four houses and from House 20.

It appears that the Keffer inhabitants made limited use of the American eel (*Anguilla rostrata*). The 55 bones of this species were less than one percent of all the fish remains (Table 6-5) and the site MNI was only one. One individual was represented in House 20 also.

Pike bones were not common in Midden 57 but excavations in 1988 increased their NISP for the site with the addition of 36 northern pike (*Esox lucius*) specimens (Table 6-6). The northern pike's MNIs for each of House 20, the four houses and the total sample was two, based on two left cleithra.

Of the remaining three species identified, bowfin (*Amia calva*) was the most common (Table 6-5). A single bowfin was represented in House 20, in the four houses and in the total sample. Freshwater drum (*Aplodinotus grunniens*) and longnose gar (*Lepisosteus osseus*) were even less frequent than bowfin. Both were represented by single individuals in the combined house samples, but there were no drum specimens in House 20 and no gar remains from any house.

Summary Comments on the Fish Species

The fish can be sorted into five groups based on their NISPs and MNIs (Table 6-5). First and by itself is the whitefish. Following it were catfish and trout species, which were sufficiently common to be considered important to the Keffer inhabitants. Perch and sunfish form the next group with walleye, sauger and several bass species. Following it, is a group of the suckers, American eel, pike and bowfin. The least significant species, with four or fewer examples, were freshwater drum and longnose gar.

As far as is known, there were no sturgeons (family Acipenseridae), herring (family Clupeiformes), smelts (family Osmeridae), mooneyes (family Hiodontidae), minnows (family Cyprinidae), cod (family Gadidae), sticklebacks (family Gasterosteidae), Serranidae family bass, or sculpins (family Cottidae) from this site. Although members of all these families inhabit southern Ontario waters, some, like the sculpins and minnows, are very small fish and so were likely not sought by the Indians. Smelts may have been represented in the few very small vertebral centri that were identified to class only, but it appears that the Keffer people were not exploiting the other families.

The dominance of fish bones in the total sample undoubtedly in part reflects the ease with which fish elements break, resulting in high totals of unidentified fragments. As well, most fish have more bones than other animals. In addition to these natural biases, floatation increased the fish representation. On the other hand, fish elements preserve worst, are consumed first when exposed to fire, and can be ingested when small. It is difficult to balance these factors, but it seems safe to conclude that fish were very significant to the Keffer people.

Mammalian Remains

Following fish in quantity were Mammalian remains (Table 6-1). At least 27 species were represented (Table 6-7), excluding human (*Homo sapiens*). Similarly, a few obviously intrusive specimens (two sheep bones, a cow bone and a domestic cat specimen) are ignored in this discussion.

The zooarchaeological remains from Keffer support the stereotype that Native people were deer hunters. The deer (*Odocoileus*) NISP was 436 and of these 317 were whitetail deer (*O. virginianus*). Further, it can be assumed that those identified to genus only were whitetail, since this is the only deer native to southern Ontario. Combining these *Odocoileus* remains, deer account for 31.6 percent of those mammal remains identified to genus. These figures are close to those for dog but, because deer are larger, they would have provided much more meat. The whitetail deer MNI from the middens is six adults, based on teeth. Five, right, lower, permanent, first molars were recovered from Midden 57, one of which was still in its mandible. According to Severinghaus (1949), this tooth erupts completely at six months, shows no wear until seven to nine months when the wear is slight, and is moderately worn at around 11 months. The five lower molar teeth used for the MNI were either slightly worn (two) or moderately worn (three). However, there was a very worn right lower third premolar and since this tooth erupts later than the other premolars and so must show wear at an older age, it allowed an increase in the MNI to six. When the remains from the four houses are aggregated, the MNI for deer is four, based on left petrous bones and adult teeth, but this can be increased to five considering the immature animal in House 19. Finally, in House 20, three deer were represented, with one of these being very old and another immature (Purdue 1983).

Although deer MNIs are too few to support mortality profile construction (Table 6-23), the specimens give the impression of selection for adult animals. The following age categories were represented: immature, 58 specimens; young adult, nine; adult, 160; and old adult, three. There are a number of factors affecting these figures, particularly the different ages of fusion of the diaphyses in a single individual. For example, in Midden 57, six of the immature bones were vertebrae. Because epiphyseal vertebral plates are the last elements in the body to fuse, some of the 112 adult bones from this midden could have been from the same skeletons as these vertebrae. Secondly, adult specimens should be more common because each deer lives longer after the fusion of its bones. But each immature skeleton has approximately three times as many elements as it will have once growth has ceased. In order to equate the adult and immature elements, the immature totals should be divided by at least three. When all these factors are considered, there is little evidence for the hunting of either very young or very old deer, supporting the suggestion that adults were selected. This is augmented by the teeth wear evidence. One tooth was not worn at all and only fifteen were very worn, with the rest falling in between. There were only eight deciduous teeth out of a total of 92 aged teeth. These eight originated in animals that were killed when they were less than 21 months old (Severinghaus 1949:209), but deer grow fast (Peterson 1966:324-5). Thus, deciduous teeth can be found in deer that have reached sexual maturity and in some instances, adult weight.

At least three of the deer from Midden 57 were adult males, as evidenced by two right frontal bones with antlers attached and one with a pedicle for the shed antler. Similarly, antler pieces were found in Midden 77 and House 20. In the house, these were attached to pedicles or shed, suggesting a MNI of two bucks. However, a shed antler could be picked up as raw material and cannot be used to indicate capture of the animal.

Combining the remains identified as dog with those recognized to the genus *Canis* only (Table 6-7), it is apparent that almost 30 percent of the remains identified to genus were from this one. Unfortunately, it is difficult to distinguish between the species of this genus unless the skull or teeth are present. Infra-cranial bones can be positively identified as dog (*Canis familiaris*) only when they are from an adult which is smaller than an adult wolf. The two wolves found in southern Ontario now are the timber wolf (*Canis lupus*) and the brush wolf or coyote (*Canis latrans*), but the latter entered southern Ontario after A.D. 1900 (Peterson 1966:197) and neither wolf was identified in the zooarchaeological material. Thus, it is highly probable that all the *Canis* remains were from dogs.

Aboriginal dog remains have been the subject of many studies. As B. Smith noted, the interest has been primarily concerning the earliest evidence of dogs and the development of temporal and geographical varieties (B. Smith 1975:102). Haag (1948) studied archaeological dog remains and concluded that there were seven types which increased in size from south to north and from Archaic to Woodland periods. The Keffer *Canis* remains were from dogs slightly smaller than a coyote and smaller than my reference skeleton which came from a male weighing 18 kg. The Keffer dogs appear to be a rather homogeneous population, similarly to Haag's "Woodland-Mississippi dogs", although they are slightly larger. Using Allen's (1920) classifications, the Keffer dogs belong in the "larger or common Indian dog" group.

Apparently many dogs were kept at this site (Tables 6-7 and 6-8). For Midden 57, the most commonly represented *Canis* specimen was the left, lower, permanent canine. There were six such canines definitely identified as domestic dog. Only one was still in its mandible. There were an additional five left, lower, permanent, loose canines identified only to genus, which could bring the total number of adult dogs to 11. According to Peterson, "the incisor and canine teeth of the domestic dog erupt in the fourth or fifth month" (1966:204), so these 11 individuals must have been older than that and the wear on some cusps suggests that some were much older. In Midden 71, there were two left talus bones from adults and some immature bones as well as one from a very old adult. Only one immature and one adult dog could be demonstrated for Midden 77. In the houses, there were at least one old and one young adult in House 12; an adult and an immature individual in House 13; an adult in House 19, and an adult and one immature animal in House 20. Supposing that the houses and middens were discrete entities, 19 adult dogs (two of which were very old), one young adult and four immature dogs were represented for a total of 24 animals. Combining the house samples, a MNI of three is demonstrable using radii of old adult, adult and immature ages. Although bones in the houses may have originated in the same animals as those represented in the middens, one can conclude that many dogs lived at the Keffer site.

The frequencies of specimens in the different age groups is of interest for reconstructing the dog population on the site. Combining all the *Canis* sp. remains, the following pattern emerges: immature, 65 specimens; young adult, 12; and adult, 176. These figures suggest that most, but not all, puppies lived to become adults.

All body regions were represented and the scattered distribution of the dog specimens throughout the middens in disarticulated disorder, in the same manner as the remains of other game species, suggests food refuse. The presence of cut marks on two dog bones and on five *Canis* sp., plus one *Canis* sp. femur with a straight edge cut across it, is evidence for their being butchered (Table 6-9). Burning was even more common (Table 6-10). Dogs may well have assisted in hunting but they were fair game too.

An incomplete, disarticulated skeleton in a house feature is evidence of special treatment for this puppy, aged between 4.5 and six months (S. Thomas 1986). Possible cut marks and some charring as well as the disarticulated condition of the bones suggest food refuse, although their placement in a pit with no other objects might reflect a special burial. Being from House 1, they are not included in the figures in this dissertation.

Following dogs in frequency were beavers (*Castor canadensis*) with a NISP of 117 (Table 6-7). That parts of 13 beavers were discarded in Midden 57 can be demonstrated by that number of distal ends of right lower incisors. However, this MNI is too high. There are only two lower incisors in a beaver skeleton, which is comprised of about 200 bones when adult. Therefore, 31 lower incisors in a total sample of 117 specimens is an unnatural circumstance. As well, there were only two cheek teeth in the midden sample. To explain this over-representation, it can be assumed that incisors were saved as tools and/or tool preforms and transported from site to site and thus, those found on any one site did not all originate from animals killed during the period when it was occupied. (This is of interest to dietary reconstruction and as an indication that incisors were durable.) In order to find a more reliable MNI for beaver, the other specimens must be used. There were three, right, zygomatic bones from adult beavers and a single, left, immature zygomatic bone, giving a more acceptable MNI of four for the middens. In Houses 12, 13 and 20 (Table 6-8), teeth predominated although cheek teeth were more common than incisors. In each of these houses, the MNI was one. House 19 was unusual, having no beaver remains. The MNI for the combined house refuse was only one adult. When the incisor specimens are subtracted from the total sample, only 74 remain. Obviously, beaver trapping was not so common when the Keffer site was occupied as it became historically. Excluding the teeth, the beaver specimens were from the following age categories: immature, 16 specimens; young adult, three; adult, 44; and old adult, two. Thus, like the deer remains, beaver exploitation appears to have been slightly selective for adults but all ages were harvested, likely reflecting their natural family groups.

There were 77 woodchuck (*Marmota monax*) specimens. In Midden 57, parts of two individuals of different ages were found. An immature metatarsal bone could not have come from the same individual as the adult long bones, because the epiphyses of the former fuse before those of the latter. Low MNIs were found for most of the other units too (Table 6-8). In House 20, an adult and an immature individual were represented by two mandibles. Aggregating the house samples, the MNI is four: one immature and three adults. The proportions of the specimens by age were: immature, 13; young adult, three; and adult, 23 specimens.

Considering their limited period of activity (Figure 6-4) and the poor quality of woodchuck furs over much of this period, it is surprising that woodchuck remains were so common. Their total of 77 remains exceeds the 74 non-dental beaver total. In addition, although woodchucks have fairly large central incisors that can be employed as tools like those of the beaver, only one incisor was recovered. Furthermore, it was unmodified and still in its mandible. Perhaps the Keffer people relied on woodchucks as a locally available supply of limited amounts of meat. Since woodchuck and beaver infra-cranial specimens were almost equal in numbers and since beaver could be caught all year, whereas woodchucks were only available for a limited time, it appears that woodchucks were actively hunted and presumably eaten frequently over the summer months. Considering the historical evidence that it was women who remained in the village area over the summer months (chapter 2), it can be concluded that they likely caught and ate most of the woodchucks represented by these faunal remains.

Muskrats (*Ondatra zibethicus*) remains were much more common in the middens than in the houses; 50 were from middens (Table 6-8). From two mandibles and two fourth metatarsals, it is known that parts of at least two muskrats, one adult and one young adult, were deposited in Midden 57. For each of House 12, 13 and 20, the MNI was one. For the aggregated house remains, the MNI was two, based on an immature and an adult humerus. The age distribution was: immature, 18 specimens; young adult, six; and adult, 20.

Like the beaver and porcupine, muskrats have fairly large central incisors. However, there is no evidence that the Keffer Indians used them. There were two unmodified incisors still in their mandibles and a single unworked upper incisor. This is similar to the woodchuck sample but markedly different from the beaver evidence, which adds support to the conclusion that the number of beaver incisors was culturally inflated.

There were 41 raccoon (*Procyon lotor*) zooarchaeological remains (Table 6-7). Even though there were only 13 from Midden 57, teeth from both sides of the mouth indicated that these came from at least two individuals. Raccoon parts were relatively rare in the middens excavated in 1988 too (Table 6-8). House 20 had six raccoon specimens from both an adult and an immature individual. In the aggregated house samples, there were two right calcanei, one from an adult and the other from an immature raccoon. For the total sample, there were 12 immature, three young adult, 12 adult and three old adult specimens.

Like the raccoon, there were 41 red squirrel (*Tamiasciurus hudsonicus*) specimens. Nearly all of these were from middens (Table 6-8). Of the houses, only number 20 had any red squirrel bones and these represented a single individual of uncertain age. For the site as a whole, the aged specimens were 24 adult and seven immature.

Another small member of the squirrel family, the eastern chipmunk (*Tamias striatus*), contributed 35 specimens. Thirty of these were from Midden 57 where, surprisingly, there were three mandibles with their incisors in place. House 13 yielded one specimen, whereas two were found in Middens 71 and 77. The two from Midden 71 were a mandible and a loose lower incisor. The predominance of mandibles in the chipmunk remains needs explanation. Although the sample is much smaller, it is reminiscent of the beaver remains, where the disproportionate number of incisors was thought to reflect a cultural selection. However, while it is possible that the Indians saved these parts, it seems more plausible that these chipmunk mandibles might have been noticed and given greater care during excavation. Combining the chipmunk finds: 29 were adult, two were young adult and one was immature.

Two grey squirrels (*Sciurus carolinensis*) were represented in the 33 remains identified to this species. The ages of the specimens were four immature, one young adult and 15 adult; the MNI was one adult and one immature. From the houses alone, the MNI was two, because both an adult and an immature humerus diaphysis were identified. For House 20, the MNI was one adult.

Following closely behind the red squirrel and the chipmunk was one of their predators, the red fox (*Vulpes vulpes*). There were 17 specimens identified to this species and a further 16 recognized to its genus. Two species occur in southern Ontario, presently, but the past distribution of the gray fox (*Urocyon cinereoargenteus*), which is primarily a southern species, has not always included Ontario. For about 300 years before 1930-40, there is no indication of gray fox in Ontario, but prior to 1630 there is zooarchaeological evidence for it in this region (Peterson 1966:217). Considering their habitat preferences (Figure 6-5), the likelihood of the archaeological remains being from the red fox is increased. This fox is slightly smaller than the largest gray foxes but their sizes overlap, making it difficult to distinguish their skeletal elements.

Animals of different ages were represented in the fox material. Parts of the skeletons of two red foxes, one an old adult and the other immature, were deposited in Midden 57. The MNI remains at two even when the remains identified to genus only are added. The two fox bones from Midden 71 were adult. These in Houses 12 and 13 were adult foot bones; the bone from House 20 was an adult femur. Thus, a single adult could have provided all the fox specimens from the houses. Yet, foxes of differing ages were exploited by the Indians, as evidenced by the six immature, one young adult, 17 adult and one old adult specimens.

The black bear (*Ursus americanus*), the only bear native to southern Ontario, was the only one found at Keffer. There were 32 bear remains. The 26 midden specimens included one metatarsal from an old adult and a proximal phalanx from a young adult. House 12 had four black bear specimens and House 20 had two. The MNI for bear in each of these two houses was one adult. These specimens were either phalanges or teeth and thus they may have been attached to skins used in the houses.

The historic Hurons had special observances for bears and their remains (chapter 2). Bear bones were supposed to be disposed of with care to prevent dogs from chewing them. If these beliefs were held by the Keffer people, their bear refuse likely would not have been thrown on the garbage heaps. Also in the historic period, young bears were sometimes kept in enclosures in the village for up to three years before they were killed and eaten (Tooker 1967:66). Possibly the Keffer material reflects this. There were no immature bones; rather there were two young adult specimens, 21 adult and one old adult. An emphasis on adult animals is suggested but the sample size is small.

The last mammal with more than 20 zooarchaeological remains was the snowshoe hare (*Lepus americanus*) with 24 examples, plus two identified only to the family Leporidae. Eleven were from middens, nine from House 13 and four from House 20. For these two houses, the MNI was two, based on long bones of adult and immature ages. Of the nine specimens which could be aged, seven were adult and two were immature.

The mink (*Mustela vison*) was the last mammal with more than ten faunal remains. Seven specimens were excavated from Midden 57 and four from Midden 77. Considering this distribution, it is likely that at least two individuals were represented, but this cannot be demonstrated by the skeletal specimens.

There remain 11 wild species with fewer than ten specimens (Table 6-7). Most of these were small creatures such as mice (*Peromyscus* and *Synoptomys*), voles (*Microtus*), shrews (*Blarina brevicauda*) or moles (*Condylura cristata*). Although ethnographic accounts relate that such vermin were common in the longhouses and that they were eaten (Tooker 1967:64), from the small size of each individual and the low frequency of their remains, it can be concluded that they were not significant contributors to the Keffer people's diet. The medium-sized animals in this fewer than ten specimens group (Table 6-8) would have been more significant meat providers. These are marten (*Martes americana*), with an aggregated houses' MNI of one adult, skunk (*Mephitis mephitis*), with a houses' MNI of two based on left mandibles, and porcupine (*Erithizon dorsatum*) with only two remains from the middens (MNI=1). Except for the porcupine, the furs of these animals might have been as attractive as their meat contributions. The porcupine's quills were likely valued for decorative purposes (Tooker 1967:20), but its large incisor teeth, which are similar to those of the beaver, apparently were not made into artifacts. In fact, the identification of only two porcupine bones was surprising.

Two larger mammals were included in this infrequently found group. From Midden 57, there was a single adult ulna identified to the genus *Lynx* only because bobcat (*Lynx rufus*) and lynx (*Lynx canadensis*) infracranial skeletons are difficult to distinguish. Both species inhabit southern Ontario, but both are very shy of humans and this may account for there being only a single archaeological *Lynx* specimen. The other mammal was the moose (*Alces alces*), the largest of all Ontario mammals. Two moose foot bones and four teeth were identified, for a single MNI (Table 6-8). These findings were unexpected because, although moose ranged farther south in the past, generally "it is absent from Ontario south of the Precambrian shield" (Peterson 1966:328). Since other deer family phalanges were often worked (J. Jamieson 1993), it may be that the toe bones were traded to the Keffer people. However, these bore canine punctures suggesting they were not highly valued but rather were refuse that dogs chewed.

Summary Comments on the Mammalian Remains

Except for the moose, all of the mammals identified in the Keffer sample are native to southern Ontario. It is apparent that the whitetail deer was the most significant prey. Beavers, woodchucks, muskrats, red squirrels and chipmunks formed the next group, which was followed by foxes, bears and black squirrels. One bobcat or lynx and several other small creatures make up the rest. In total, the mammalian specimens were slightly under 30 percent of all the vertebrate remains and that was the most surprising thing about them, considering the dominance of mammalian remains in most other faunal samples from Ontario.

Some of the infrequently represented mammals inhabited niches not common in the immediate vicinity of the site (Figure 6-5). The porcupine and the marten prefer coniferous forests. The snowshoe hare also occurs most often in such forests, although it can be found in mixed forests with some conifers. The lynx is found with the hare, which is the lynx's major food source. Similarly, bobcats eat hares but are more adaptable to agricultural lands. Like the hare, both these cats like swampy areas. Their scarcity in the zooarchaeological sample may reflect a lack of swamps in the local environment. The poorly represented mice and the skunk, which may have been avoided because of its scent, are found in a wide range of habitats. The stream flowing by the site provides an ideal location for mink, so the scarcity of this species was surprising, especially considering its fur. The only mammal native to the area from the late fifteenth century on which was not represented in the archaeological remains was the fisher. Apparently, like the mink, this larger mustelid was not exploited much.

In general, it can be concluded that Keffer hunters concentrated on mammals of the deciduous forest and its edge zone, including areas of secondary growth. These are the preferred habitats of the whitetail deer. As well, water mammals such as the beaver, muskrat and raccoon were exploited quite heavily. Few grassland animals were represented, except for the small and omnipresent mice. Several coniferous forest mammals occurred in the archaeological sample, but these had lower NISPs than the deciduous forest creatures. Of the former, only the fox and the red squirrel were relatively common in the Keffer material. Thus, it appears that the greatest exploitation was from the deciduous forest edges and streams. Trips probably were made to ponds or lakes for beaver and muskrat. Hunters might have taken some longer sorties into the pine and spruce forests and/or the Keffer people may have traded with Indians living north of them. This was certainly an historic period activity and is archaeologically documented for the prehistoric period too.

Avian Remains

Although there were at least 31 bird species represented in the avian bones from Keffer, this class was much less significant than either the mammalian or fish class. The 432 bird bones were only 3.6 percent of the faunal total and many species were represented by a single specimen (Table 6-11). In addition, two, the ring-necked pheasant (*Phasianus colchicus*) and the domestic chicken (*Gallus gallus*), were introduced to Canada after European settlement. Of the 15 represented families (Table 6-4), geese and ducks (family Anatidae) had the most variety and the highest NISPs, followed by turkeys (Meleagrididae), grouse (Tetraonidae) and pigeons (Columbidae).

The 37 wild turkey (*Meleagris gallopavo*) specimens were the commonest of those identified to species. All but four were from Midden 57 (Table 6-12). The four included two from House 20 (MNI=1 adult) and one each from House 19 and Midden 77.

The passenger pigeon (*Ectopistes migratorius*) was next by NISP. It became extinct in the early 1900s, but was very common in southern Ontario in the 1800s (Kalm 1911). It appears to have been one of the three most harvested birds (Table 6-11). Most of the pigeon bones were from Midden 57 (Table 6-12), where the MNI was six, based on five, adult, left humeri portions and an immature, left humerus shaft. The single pigeon bone from one other midden and the two from House 20 did not increase the pigeon MNI for the site.

Almost as frequent as pigeon bones were remains of ruffed grouse (*Bonasa umbellus*). Three pairs of the same element indicate a MNI of three adults for Midden 57. Grouse bones were also present in Middens 71 and 77 and in Houses 13 and 20 (Table 6-12), where there was no duplication of elements.

The other grouse recognized in the faunal sample was the spruce grouse (*Dendragopus canadensis*). Its four specimens all came from Midden 57. A MNI of two for this small sample was derived from two distal ends of adult left humeri. In addition, there was a femur and a tarsometatarsus portion which suggests that whole birds were brought to the site. That ruffed grouse (NISP= 27) remains were more frequently identified than those of spruce grouse can be explained by their ranges and habitat preferences. The Keffer inhabitants would have had to travel considerable distances to coniferous forests to hunt spruce grouse or trade for them with more northerly people.

Fourteen species of the Anatidae family were recognized in 61 bones. One of these was the Canada goose (*Branta canadensis*), represented by eight bones and a MNI of one. These were all from middens (Table 6-12). Five were adult; three were of undetermined ages. In addition to this species' contribution to the diet, Canada geese bones were considered appropriate sources of raw material for tools. Three of the goose bones from Midden 57 were artifactual.

Of the many duck remains, only the oldsquaw had ten specimens. All but one from House 12 were found in middens (Table 6-12). The oldsquaw MNI was two, based on the distal half of the left humerus.

The species of surface-feeding ducks represented were green-winged teal (*Anas crecca*), northern pintail (*A. acuta*), blue-winged teal (*A. discors*) and northern shoveller (*A. clypeata*). Except for the two bones identified as blue-winged teal, there was a single specimen for each of these and all had MNIs of one. Two additional bones were from this genus. None was found in any house (Table 6-12). All these ducks prefer habitats with freshwater ponds, marshes or shallow edges of lakes. It is interesting that the blue-wing teal can also be found on tiny streams, since only this species had more than one zooarchaeological specimen.

Four, fresh-water, diving ducks were recognized in the avian remains by three or fewer bones. These four in phylogenetic order were redhead (*Aythya americana*), ring-necked duck (*A. collaris*), greater scaup (*A. marila*) and lesser scaup (*A. affinis*). All had MNIs of one. None of these was from House 20 and only the greater scaup was represented in any house (Table 6-12).

All but one of the remaining duck species found in the Keffer sample belong in the Mergini tribe of diving ducks, which includes the sea ducks and the mergansers. Its representatives in the archaeological sample, in addition to the ten oldsquaw bones, included white-winged scoter (*Melanitta fusca*), bufflehead (*Bucephala albeola*) and red-breasted merganser (*Mergus serrator*), all from middens (Table 6-12). Finally, a single specimen of ruddy duck (*Oxyura jamaicensis*) was identified from Midden 57. Thus, it can be concluded that, while ducks as a group were hunted, there was little selectivity in the type of duck taken, excepting perhaps for the oldsquaw. Few had more than one or two bones assigned to them and all had MNIs of one.

The family Corvidae was relatively well-represented in Midden 57 but it was limited to this feature. While only a single specimen was identified as blue jay (*Cyanocitta cristata*) and another one as American crow (*Corvus brachyrhynchos*), there were three common raven (*Corvus corax*) bones and two of these were identical parts of the left ulna. Single bones of the bald eagle (*Haliaeetus leucocephalus*) and the screech owl (*Otus asio*) were also identified. An eagle hind, distal phalange was found in House 12 and an owl leg bone in House 20. Several other poorly represented birds were found only in Midden 57 (Table 6-12).

Summary Comments on the Avian Remains

Bird specimens were not numerous in the Keffer zooarchaeological sample but their diversity was great, with at least 31 species. Those not represented were primarily small passerine song birds which are not hunted by most people. From the bird NISPs and MNIs, it can be concluded that wild turkey, passenger pigeon and ruffed grouse were specially hunted. The pigeons must have been taken in the warm weather. The large variety of ducks too was mostly representative of spring or fall hunts but some of the sea ducks and mergansers may have been winter kills from Lake Ontario (Figure 6-6). In this sample of 432 bones, the absence of medullary bone in all but one turkey femur is indicative of a lack of spring exploitation, because such bone develops a few weeks before laying and is absent shortly after the laying period (Rick 1975). As well, the relatively few immature bones support the conclusion that most bird hunting was done in the fall or winter. Only 16 bones were immature, one was from an old adult and the remaining 130 assigned to an age category were adult (Table 6-13). The greatest spread in ages was found in the turkey bones. This heavily utilized species was in the Toronto area throughout the year and may have been hunted in more than one season. Considering the relative body sizes of the birds, the turkey gains in significance as a contributor to the diet. Although passenger pigeons were much smaller, their migratory flocks darkened the skies in spring just when the Indians' stored food might have been running out. Thus the pigeons' significance may be greater than their numbers indicate. Obviously the Canada geese and the 14 additional duck species, as a group, were important dietary contributors. Many of these birds breed in southern Ontario, so their eggs may have been collected as well. Finally, some birds, for example the eagle and loon, may have been valued for their feathers as much as for their meat and the skeletal elements of others may have increased their value to the Indians. The long bones of large birds were good raw materials for beads and tubes.

Amphibian and Reptilian Remains

Just over two percent of the vertebrate remains were amphibian, either frogs or toads (Anura). That this percentage is greater than that for reptiles (Table 6-1) suggests that amphibians were collected despite their small sizes. Only one bone was assigned to the large bullfrog (*Rana catesbiana*). The remaining 279 specimens included 266 that were from smaller frogs and toads. Among these, hind limbs predominated and bones of the rump area (innominates) were second (Table 6-14). Together 68.2 percent of the specimens were from the posterior half, suggesting that the more muscular hind legs were saved and that these remains were not merely intrusive additions to the midden. The total of 86 tibiofibulae specimens gives a MAU and thus a MNI of 43. All but one of the Anura bones were found in middens.

Reptile specimens were recovered from all three middens and from all the houses except 19 (Tables 6-15, 6-16). Painted turtle (*Chrysemys picta*) specimens were much more abundant than snapping turtle (*Chelydra serpentina*) remains. The wood turtle (*Clemmys insculpta*) was represented by two pieces.

That the painted turtle was exploited more than any other turtle is indicated by its MNI too. Using the left pleural 2, at least four individuals were represented in Midden 57. Two of these were small; a third was large and a fourth was intermediate in size. Another turtle can be added on the basis of two, larger adult, right, pleural 2 specimens. At least two individuals were represented in Midden 71 and similarly, Midden 77 had one large and one small individual. Of the houses, numbers 12 and 20 both had two individuals of different sizes. House 13 had only a single peripheral shell segment.

Many turtle pieces fitted together and from these reconstructions, it could be seen that the smallest painted turtles had carapaces measuring about 6 cm long, while most were about 12 to 15 cm long. There was one very large individual represented by a few pleurals.

There were at least two types of snakes represented by vertebrae found in Midden 57. One of these was similar to the common garter snake (*Thamnophis sirtalis*) and the other was like the large northern water snake (*Natrix sipedon*). Four large vertebrae articulated well and were found in close association, so it is highly probable that they came from a single water snake.

In sum, it is evident that reptiles and amphibians provided diversity more than great substance to the diet. This was not because such animals were exotic; all the identified species can be found in the immediate vicinity of the Keffer site. They are all hibernators, however, and therefore have a limited availability.

Interpretations

Butchered Remains and Represented Body Parts

In the Keffer zooarchaeological sample, a few parts of some animals were more common than their proportions in complete skeletons. Beaver skull parts, specifically their incisors, were disproportionately common (Table 6-17) as were frog or toad hind limbs (Table 6-14), whitefish infra-cranial bones, catfish skull bones (Table 6-18), bird wings (Table 6-19) and turtle shells (Table 6-20).

For fish, an over-representation of skull bones should be expected, as these are the most readily identifiable elements. However, the opposite occurred with the whitefish specimens, where there were 54 skull to 531 infracranial bones (Table 6-18), a ratio of approximately one to 10. In a purchased specimen carefully skeletonized for this purpose, I counted 122 skull bones and 226 infracranial elements, excluding fin rays which are very fragile and seldom preserved in archaeological material. Thus, the natural ratio is approximately 1:2. The unnaturally low proportion of zooarchaeological whitefish skull bones likely reflects whitefish being decapitated where they were caught, with only the meaty bodies being transported to the village. In the 1600s, when the Hurons fished this species in Georgian Bay, they cleaned and sun dried or smoked them there (Wrong 1939:185-190). It appears that this treatment can be extended back to *ca.* A.D. 1500. However, because it has been shown that whitefish skull bones do not preserve as well as vertebrae (Lubinski 1996), some of the difference might reflected natural differences in decay rates. Salmonid skull bones decay rapidly because they are highly cartilaginous compared to other fish (ibid.:179).

Trout, the second most commonly identified fish, are similar to whitefish. Being from the same family, their natural ratios of skull to non-skull elements are alike. In the archaeological sample, the trout infracranial remains outnumbered the skull bones by approximately four to one. The higher proportion of trout than whitefish skull specimens suggests different treatment of these two types of similar fish even though lake trout too must have been caught at some distance from the village. Most might have been prepared off site; bones of this species were not very common in the sample. Alternatively, brook trout, which could have been fished from the stream adjacent to the site, exhibited a ratio for the zooarchaeological remains which was close to 1:2, like that in the complete skeleton. Likely, many whole brook trout were carried onto the site, as opposed to a few whole lake trout.

The catfish archaeological sample displays the reverse situation. The remains identified to family only were 119 skull bones to 53 infra-cranial bones. When the remains identified as channel catfish and bullhead specimens are added, the imbalance increases, with 307 skull remains to 67 infra-cranial bones giving a ratio of about 4.5 skull bones to every infracranial bone which is quite different to the almost one to one ratio in a complete skeleton. The three brown bullhead reference specimens in my collection have 78, 68 and 65 skull bones to 76, 68 and 71 infracranial elements respectively. Catfish can be found in a wide variety of habitats, including the Don River. Therefore, some were likely caught close to the village. If these fish were transported whole to the site, then there should be about the same number of bones from the skull as from the rest of the body. Some of the increase in skull specimens can be attributed to their easy identification, but I doubt that this accounts for all of the inflated skull total.

An unnatural proportion in fish bones was noted for the Dougall site (BdGu-2), located at The Narrows between Lakes Simcoe and Couchiching in Simcoe County (J. Wright 1972a). This site is dated to the Woodland period, with greatest use in the Middle Woodland judging from artifact types and numbers. Here the abundance of skull bones in the fish sample led J. Wright to conclude "that fish were being gutted, decapitated and dried or smoked on the site and then eaten elsewhere: presumably at the interior villages" (ibid.:15). As a major, year round settlement, Keffer is the complimentary opposite to the Dougall site in such a system. The Keffer whitefish remains fit this explanation well. Similarly, catfish may have been prepared at the Keffer village for consumption elsewhere.

Other locally available species were represented in the expected ratios or the discrepancy could be explained as part of some natural occurrence or condition. For example, my reference American eel has 46 skull bones to 122 infracranial bones, but in the archaeological sample there were only four skull bones in the total of 55 remains. In this case, the small skull bones are difficult to recover and identify, whereas the vertebrae are very distinctive. On the other hand, there were many more skull than non-skull specimens identified as pumpkinseed (Table 6-18) and the natural ratio from three pumpkinseed reference skeletons was nearly one to one. However, because the vertebrae of the members of the sunfish family are not readily recognizable, identification procedures likely produced the imbalance in this family. Repeating their natural ratios, perch remains were found in about a one to one ratio as were the walleye/saugers. The remaining species were more poorly represented and not surprisingly, considering the difficulty in identifying infracranial elements to species or even families in many instances, most were skull pieces. These locally available, riverine fishes appear to have been returned as complete carcasses to the site.

It might be expected that the larger mammal remains would exhibit evidence of culling and butchering if they were procured at a distance from the village or if they were too large to fit into a pot whole. The mammalian specimens cross-tabulated by species and body part (Table 6-17) revealed a slight imbalance in favour of hind limb bones for all mammals except *Canis* and *Odocoileus*. The *Canis familiaris* remains were from all parts of the body and the appendicular specimens were almost evenly distributed between fore and hind limbs. Such a distribution is expected for an animal raised on the site. Even the large *Odocoileus* had all parts of the skeleton represented in the archaeological material. The high number of limb bones in the sample reflects the numerous phalanges (about 40 per animal). The numerous skull specimens include teeth, which both preserve well and usually can be identified. The number of trunk specimens appears somewhat depressed; limbs may have been transported home slightly more often than whole carcasses but certainly all parts of deer bodies reached the site. The predominance of fore limb specimens for the deer was not expected, considering the greater nutritional value of hind quarters (Binford 1978; Metcalfe and Jones 1988). There were a large number of deer limb bone remains not assigned to either hind or fore limbs (Table 6-17), but most of these were phalanges and so would not likely change the body part distributions. The beaver remains were overwhelmingly incisors, but the bones were from all parts of the body. This proportional representation was true of the other medium-sized and small mammals too. Thus, most mammalian body parts appear to have been returned to the site in proportions consistent with those occurring naturally. This strengthens the usefulness of MNIs for estimating meat weight contributions to the diet.

Direct evidence of butchering occurred on only 2.6 percent of the mammalian remains and the majority of the bones so marked were not identified beyond class. The mammal exhibiting the greatest number of butchering marks was the deer (Table 6-9). All types of marks were found on deer bones but these were still such a limited number that no patterns emerged. In general, for all the mammals, cut marks were slightly more common than spiral fracture features and there were very few straight edges across varying bone densities. There was no evidence for the cutting of bones for grease extraction. This cutting of bones into small sections and then boiling them to skim off the grease may be more an Algonquian practice than an Iroquoian one (but see chapter 7), or it may have occurred mainly at Iroquoian hunting camps as Champlain recorded in 1615 (Biggar 1929:85).

The avian bones, excepting grouse, were predominantly from wings (Table 6-19). This likely reflects both the relative ease with which even small portions of avian ulnae can be identified and a real selection of wings for their feathers and/or the long hollow bones. Birds were likely also hunted for their meat. The most frequently found species, the wild turkey, was apparently returned to the village whole. Similarly, all parts of the passenger pigeon were recovered but pigeon wing bones were almost three times as common as any other pigeon bone. Perhaps some pigeons were killed off-site and only the breast muscles and wings were saved, whereas others were killed in the immediate vicinity of the village and so were returned to it intact. If ducks were hunted in the fall and/or winter from Lake Ontario, perhaps only some meat and their wings were transported back to the Keffer village. With the small numbers of specimens available, such suppositions cannot be substantiated. It is interesting that the turkey was not butchered where it was killed, but was returned to the site whole. Some preparation must have been made before the birds were cooked. However, there was only one archaeological avian bone (wild turkey) with cut marks. This lack of butchering evidence suggests that birds were not dismembered prior to cooking and that the meat was removed from the bones without marking them.

It is difficult to reconstruct the Keffer inhabitants' butchering practices. Likely most meat was boiled, reducing the need to cut it away from the bones, but one would expect that deer would have been at least partially dismembered prior to boiling them. There are historic descriptions relating to this. In one feast, 30 or

40 kettles were used to cook 30 deer and in another, 30 kettles contained 20 deer and four bears (Brébeuf 1636 JR 10:179). These figures suggest that the kettles were very large, which in turn would mean that the carcasses to be boiled in them would not have to be butchered into small sections. Alternatively, whole deer may have been roasted. Finally, it is possible that the scarcity of cut marks attests to the great skill or care of the butchers.

As is common in archaeological materials, the turtle remains were mainly shell pieces from both the carapace and the plastron, but two other bones were also found (Table 6-20). These suggest that whole turtles were returned to the village. In the seventeenth century, *whole* turtles were cooked alive (Tooker 1967:66).

Amphibian hind quarters appear to have been purposefully collected and their bones later discarded with other food refuse. Frogs' skins may have been used for baiting fish hooks (ibid.:24).

Only 27 remains, two avian and the rest mammalian, appeared to have been opened by spiral fracturing (Table 6-21). The fracturing of long bones is usually assumed to reflect the extraction of the rich marrow found in their central cavities. Apparently the Keffer people did not ordinarily collect this food source, from which it can be inferred they had sufficient meat without it.

Fish Meat Weights

Fish meat came from a variety of species. But, as expected from the NISP figures, whitefish dominated in this category despite its MNI being under-represented more than the MNIs for other fish because whitefish skull specimens were few and their vertebrae could not be sorted to individuals. In addition whitefish are larger, generally, than most of the other represented species. As the figures in Table 6-22 show, whitefish clearly dominated the meat contributions in the houses followed by other members of the salmon/trout family. These are mainly lake fishes, although brook trout spawn in streams. Since Keffer is located on a tributary of the Don River, it was not surprising to find that shallow water and riverine fish were richly represented. However, their NISPs and MNIs were low, except for catfish (Table 6-5). The single channel catfish would have provided about 3.63 kg of meat (chapter 5), considering the large size of the zooarchaeological bones. The smaller but much more common brown bullheads accounted for considerable amounts of meat too (Table 6-22) and there were many catfish bones not identified to species and therefore not added to these meat calculations. Northern pike, because of its large size and moderately high NISPs and MNIs, was almost as great a meat provider as the catfish. Members of the bass family as well as walleye/saugers added to the meat calculations for the houses, whereas largemouth and rock bass specimens, as well as those of yellow perch, were found only in middens. But at least one bass sp. was represented in House 20, as was a single pumpkinseed whose meat contribution equalled that of the bass. Suckers, American eel, pike and bowfin were minor contributors to the meat in the houses, and freshwater drum and longnose gar were used very sparingly. Drum occurred in some houses, but not House 20, whereas gar remains were restricted to midden deposits. For the four houses combined, based on MNIs, the total fish meat contribution was 53.21 kg. For House 20 alone, fish provided at least 26.28 kg.

Mammalian Meat Weights

Remains of a greater variety of mammals than fish were found in the houses and these are assumed to represent primarily, but not exclusively, meat sources. Whitetail deer was the main contributor to the diet. Deer specimens were more common than any other species (Table 6-7) and, as can be seen in Table 6-23, members of the deer family provided the greatest amount of meat. The four adults found in the four houses would provide about 181.6 kg of meat. The single large immature individual likely contributed at least 34.05 kg bringing the deer total to 215.65 kg. This is a conservative estimate since some of these individuals were bucks. For House 20, three adults and one fairly large immature individual would provide at least 170.25 kg of meat. In the same family, but much bigger, is the moose. The single immature moose represented in the four houses and in House 20 would have added greatly to the meat component of the diet (chapter 5).

Following the deer and probably dogs as meat contributors were the single adult black bear and three medium-sized animals: beaver, woodchuck and muskrat. Except for the raccoon, hare and red fox, the remaining mammals contributed only small amounts. Numerous smaller mammals, such as squirrels, chipmunks, martens and even mice, shrews, voles and moles (Table 6-7), likely added variety more than substance to the meals. Occasionally, the inhabitants of the Keffer village may have tasted lynx, porcupine and even skunk. According to Waugh, the Iroquois avoided porcupine as a food (1973:132).

Based on the domestic dog specimens, two adults in the four houses could have provided 20 kg of meat and the one adult in House 20, ten. Almost 30 percent of those mammalian remains identified to genus or species were *Canis*. When specimens identified to the *Canis* genus only are considered, a further 27.5 kg of meat are added for the houses and 17.5 kg for House 20.

The Jesuits, Sagard and Champlain all recorded the eating of dogs, usually ceremonial, in the seventeenth century. Dogs were boiled and fed to war captives (Tooker 1967:35); dog heads were eaten at feasts (ibid.:39); dogs were eaten after dances (ibid.:78); they were consumed as a cure for epidemics (ibid.:105) and they were an ingredient of wedding feasts (ibid.:126). Later Iroquois also consumed dogs "on special occasions and as a ceremonial observance" (Waugh 1973:133). Thus, while dogs might have been a special dietary item, they were eaten often and usually, but not always, their bones were discarded like those of any food animal. With the inclusion of the dogs, the mammalian meat total for the four houses is 547.22 kg. Much of this was from House 20 which had a total of 474.72 kg of edible flesh.

Avian Meat Weights

Combined, the fish and mammalian NISPs were over 90 percent of the faunal remains, making it clear that birds were very small contributors to the diet.

Not only were their NISPs low, but also most were small creatures. However, bones of the large wild turkey were the most frequent (Table 6-11). For House 20, as for the four houses combined, the single turkey represented would have contributed 4.5 kg of meat (chapter 5 and Table 6-24). Almost as common as turkey were the remains of pigeon and grouse, but because of their smaller sizes these birds contributed much less meat.

None of the other species occurred in large numbers, but for the site as a whole, the combined duck and goose NISP is greater than that for turkey (Table 6-11). However, from the houses only two ducks were represented (Table 6-12): greater scaup and oldsquaw and each of these yields less than one kg of meat.

As was true for the mammalian remains, there was a variety of bird species represented by only a few bones (Table 6-11). In sum, birds were not very important dietary sources. For all four houses combined, this class provided only 10.6 kg of meat, whereas from House 20 alone 5.5 kg were represented.

Reptilian and Amphibian Meat Weights

Similarly, on the basis of their low NISPs, it must be concluded that reptiles and amphibians were very minor food items. However, it is likely that the three types of turtle and two snakes represented in the faunal material were consumed (chapter 5). Only painted turtle and frogs or toads were recognized in the house deposits. The two painted turtles from House 20 would have yielded about 0.1 kg. of meat each (B. Smith 1975:183) and the amphibians much less.

In sum, it can be concluded that the Keffer people consumed a variety of animal matter. The total meat figure based on MNIs for the four houses is 612.92 kg and for House 20 alone, 506.70 kg, ignoring the amphibians and the few invertebrates.

Seasonal and Habitat Exploitation Patterns

When considering the seasonal procurement rounds of the inhabitants of the Keffer village, it is important to remember that their main source of food was probably their corn, beans and squash produce. Spring preparation of the land and seeding, summer weeding and fall harvesting likely limited exploitation of wild species. However, a sexual division of labour, such as that recorded for the Hurons (Trigger 1990), could have circumvented conflicts in scheduling which otherwise might have limited the exploitation of animals most easily captured when horticultural activities had to be performed.

Fishing was done mainly in two seasons and in three types of water (Figure 6-3). The major effort was for whitefish from deep, cold water lakes, presumably during the fall spawning period. Since Keffer is closer to Lake Ontario than to Lake Simcoe or any of the other Great Lakes, all of which contain whitefish, it is most probable that fishers spent much of late October and November on Lake Ontario catching and preparing whitefish. At this time, when the whitefish were spawning in shallow lake waters, most agricultural activities would have been completed for the year. Whitefish was the most important fish, perhaps precisely because fishing it did not conflict with the horticultural schedule.

When fishing for whitefish, some lake trout, gar, pike and drum were procured, but their NISPs were low so they may have been only incidental catches. It is unlikely that any members of the Salmonidae family were taken either in summer or winter, because at these seasons they are in the deeper waters of the lakes. However, they swim into shallow water or at lake surfaces in spring, so some may have been fished then, but at this time they would not be congregated together as they are in the fall for spawning.

Some fishing was also done in small lakes or ponds. Catfish, members of the perch family and bowfin would have been fished from such small bodies of water. The brown bullhead swims in schools throughout the year but it spawns in the spring as do perch and bowfin. Bullheads and bowfins continue to spawn into the early summer in their shallow water habitats. Channel catfish leave shallow lakes to spawn in streams from April to June. This scheduling might account for their low frequency in the archaeological deposits, as this is when Iroquoian farming involved both sexes. Since brown bullheads were the most frequently identified catfish and since this family was second in importance to the Salmonidae, it can be concluded that some of the Keffer people fished in shallow waters in the spring or early summer. It may have been women and/or children who did this from the streams close to the site. Local small lakes and ponds were likely exploited and this probably occurred after the fields were planted but while these fish were still spawning. June would be ideal for this.

Streams were also fished. From the identified fish species, it appears that most of this type of fishing occurred in cold, clear streams with sand or gravel bottoms. Fish inhabiting such an environment include suckers and walleye/saugers, as well as brook trout, channel catfish and perch, which ascend such streams to spawn in the spring. Warmer, shallower, streams contain members of the sunfish family, particularly bass, which like a sand to mud bottom, as do those brown bullheads that inhabit streams. All these riverine fish spawn in the spring. An exception is the catanadromous American eel, which swims upstream in the spring and migrates downstream in the fall in order to spawn at sea. It can be concluded that some Keffer fishers exploited rivers in the spring. That bass, pumpkinseed and walleye/sauger specimens were more common in the zooarchaeological sample than sucker bones might be because suckers spawn earlier, when labour would be needed to prepare and plant the fields. Riverine fishing could be practiced early and easily, since it did not require movement away from the village. Because of this, such fishing may not have been considered a major procurement activity by the Indians and/or their early European visitors. Certainly, the results, as reflected in the faunal remains, indicate that it was not as productive as the fall whitefish effort. These conclusions, based on the archaeological fish materials, are similar to the information given in the ethnographies, where it was recorded that:

> Fall was the season for fishing; at this time of the year numbers of people were engaged in it. ... But fishing was also important in the early spring ... and in the summer (Tooker 1967:63).

Summary information on the seasonal availability and desirability of the mammals represented in the faunal material is presented in Figure 6-4, where the species are listed in order of decreasing frequency from top to bottom. They are listed by their preferred habitats in Figure 6-5. From these two figures, it can be seen that mammals were hunted mainly from areas of secondary growth and in the hardwood forests, although there may also have been a little hunting in climax, coniferous forests, and that hunting occurred primarily in the fall and winter. Such a conclusion agrees with Tooker's. Faced with contradictory statements in the historical sources, she concluded that "hunting took place in the late fall and early winter" (1967:65). Whitetail deer could be taken most easily from mid-September to December. Evidence for a fall to early winter hunt exists in four antlers still attached to skulls, one antler beam exhibiting chopping scars at its base and two cut bases, as opposed to only one frontal bone with a pedicle for a shed antler. But fall is when the corn must be harvested (September and October) and whitefish are spawning (November). Deer could have been hunted when they yarded in late winter as well as in the fall. The seasons for harvesting corn and fishing whitefish were less flexible. Since the harvesting of the crops was left to the women primarily, men could have left the village early in September to hunt deer, which at this time of the year would be found in areas of mixed vegetation; towards the end of the fall deer would be moving into oak forests to feed on acorns. The same group of hunters might have ceased hunting and returned to the village in time to leave for Lake Ontario for November. Alternatively, the hunters and fishers might not have been the same individuals. However, when Champlain described a deer hunt in the fall of 1615, he noted that, while 25 men of his party were building a deer fence, others had gone to catch trout and pike (Biggar 1929:83-5). Raccoons might have been hunted in the fall as well, but the other mammalian species were more likely taken in other seasons.

The possibility of a winter hunt for deer has been mentioned. Beaver and muskrats were likely taken then too. Black bear could be hunted most safely in winter, whereas most of the other hibernating species were likely taken in the warm weather. Historically,

> a bear, after being captured might be fattened for 2 or 3 years and then be killed for a feast. The bear was shut up in the middle of the house in a little round enclosure made of stakes driven into the ground. He was given the remains of *sagamité* to eat (Tooker 1967:66).

Such a captive animal could be slaughtered whenever the Indians wished. The relative NISPs for the mammals indicate that there was a significant hunt for deer and also for beaver, woodchuck and muskrats, but that the other wild mammals were not exploited very heavily.

As mentioned above, the deer would have been stalked in areas of secondary growth or deciduous forests. Woodchuck, red foxes and some bears might also be found in such habitats. Beaver, muskrats, raccoons and mink would be encountered in ponds or along streams in these open areas or woods. Bears, bobcats and some lynx, as well as black squirrels, would be found in mixed forests. Climax, deciduous forests, common in southern Ontario in the sixteenth century, are habitats for black squirrels, chipmunks, foxes, black bears, raccoons and some red squirrels. Most red squirrels live in climax coniferous forests with bears, porcupines, martens, snowshoe hares and lynx. These last four were all poorly represented in the faunal sample. Although many of these species can be found in more than one vegetational zone (e.g. bears), it can be concluded that most hunting was done in secondary growth areas and deciduous forests. Such areas surrounded the village and its fields. Thus, unlike the exploitation of whitefish, most mammal hunting would not have required much travel away from the village. However, hunting may not have been as successful overall as fishing (Table 6-1). Individual hunts and the social significance of hunting may have been more important than fishing, but as an economic activity, fishing appears to have been more productive in terms of the numbers of animals harvested.

Many of the birds that were brought to the Keffer village are in southern Ontario seasonally (Figure 6-6). This is not true of the wild turkey. Perhaps its unlimited availability contributed to its being the most commonly represented bird, but its large size was probably also significant. The lack of medullary bone in all but one turkey limb bone indicates that birds were seldom taken in the spring. Maybe the Keffer people were too busy planting and fishing spring spawners to pursue birds in this season. Alternatively, it may be that the Indians were conserving the bird stocks by not hunting them in their breeding season (Bent 1963:359-60). Like the turkey, the grouse could be taken year round but it may have been easiest to gather in the fall, when it was in family groups.

Certainly, some birds, such as the passenger pigeon, were hunted in the warm weather because this is the only time they are in Ontario. However, although most duck species are spring and fall migrants in southern Ontario, it appears that, like the pigeon, the zooarchaeological specimens were not from spring kills. The sample is small, however. Finally, the sandhill crane migrated through southern Ontario (Godfrey 1986:176) and might have been taken in corn fields in the fall and thus, mostly by women and children.

There is evidence for some late fall and winter bird hunting. About half of the represented duck species winter on the Great Lakes in small numbers. It may be that hunting such ducks and fishing were contemporaneous activities. Two species, grebe and goshawk, winter only in the region and the common loon is found there in greatest abundance in the winter.

In sum, the relatively few bird remains from species which have varying seasons of availability in the Keffer area combine to suggest that hunting birds was not a common activity and that there was not a specific season for it. There is only negative evidence that it was not pursued much in spring.

Most of the represented birds inhabited open areas adjacent to the site or deciduous woodlands located immediately beyond the cleared areas. The spruce grouse was the only coniferous forest species identified. Water birds were more numerous than forest ones, mainly due to the ducks. The goose, loon and grebe are also water birds and the raven is usually found near water. Sandhill cranes and American bitterns can be found in marshes and, like ducks, these water birds would be found in proximity to beavers and muskrats. Most of the other represented birds live in open areas or mixed woodlands, with the exception of the turkey and the passenger pigeon, both of which preferred deciduous forests. Short sorties into deciduous forests must have been undertaken to obtain turkeys and pigeons. These birds could have been captured in stands of oaks coincidentally with deer hunts there. The acorns would have attracted both these animals and the Indians.

Bird hunting appears to have been relatively unimportant, but the collection of turtles and amphibians was even more insignificant. These creatures, like clams, must have been warm weather foods and, although they contributed little to the total diet, they provided variety and perhaps had added importance as "summer dishes". That their remains were recovered as frequently as they were indicates that the Keffer people valued variety in their diet. They likely also wanted these animals for non-dietary uses. Based on their season of availability, it can be assumed that they were exploited mostly by women and children.

There are other possible food items which would have not been preserved. Bird eggs may have been gathered in the spring to early summer period. Amphibian eggs could be found in the summer, whereas turtles lay in the summer and fall. Such foodstuffs likely were exploited in a minor way, mainly by women; the major collecting activities were fishing and deer hunting in the fall, some mammal and likely turkey exploitation in the winter and river fishing again in the spring. These mainly male pursuits had to be meshed with the agricultural activities and they may well have been subordinate to them.

Comparison of the Faunal Remains to the Human Consumers

In order to compare the amount of meat to the number of consumers, following the methods outlined in chapter 5, the refuse and hearth numbers from the 1988 excavations of Houses 12, 13, 19 and 20 will be combined to arrive at the highest estimates of the numbers of families and faunal remains before considering the material from House 20 alone. Similarities in the faunal remains from the houses were anticipated because they were from the same village and because they were mostly contemporaneous, although House 20 was built after Houses 12 and 13, and House 19 was built even later (Finlayson 1989:10).

The most obvious differences between the zooarchaeological samples in the houses are in their quantities. Houses 12 and 13 had similar numbers of macrofaunal specimens (Table 6-3) but House 20 had almost twice as many. Houses 12 and 13 had fewer because, unlike the other two, they straddled the ploughed and unploughed areas of the site. Thus, for House 12, the faunal remains from only 16.4 meters of its length were analyzed and similarly, those from only 18.0 meters of House 13 have been studied. Since House 20 had a total length of 41.4 meters, the amounts of faunal material for these three houses per meter of undisturbed area are very similar. House 19 was not ploughed and although it was 23.8 metres long, it produced only 51 macrofaunal specimens, which is certainly much sparser than such remains in the other three buildings. Since House 19 was the shortest longhouse on the site, it is possible that it had a special function.

Related to length is the number of hearths in a house. Assuming two families used each hearth, there is a reason to expect a positive correlation between hearth numbers and faunal quantities. More families implies greater food consumption and more refuse. House 20 had seven hearths for 14 families, whereas hearths in the undisturbed portions of Houses 12 and 13 indicated four families each. There were actually three hearth stains in House 13's southern end, but two of these were so close together that it is assumed that they were used by the same two families. Similarly, there were two closely spaced hearths in House 19, as well as one situated farther away, so it is thought that four families might have used this house. In total then, for the undisturbed deposits, these houses had 13 hearths for 26 nuclear families. The house with the greatest number of families, House 20, was the one with the greatest quantity of faunal refuse.

Longevity of use likely affected the faunal samples within the houses. House duration can be estimated by examining the density of post hole stains marking the walls (Finlayson 1985; Warrick 1988, 1990:265-293). Using the method devised by Warrick and, like him, assuming that cedar poles were used to construct longhouses, the durations of the four houses have been determined. Using the somewhat imprecise graph presented in Warrick's work and his average of 3.5 original posts per meter for Huron longhouses (1988, 1990), House 20 existed for about 27 years since it had a post density of 5.66 posts per linear meter, with 276 in 48.78 meters. House 19, with 87 posts in 48.78 meters, had a density of 5.84 poles/m for a duration of about 30 years. In House 12, there were 141 posts in 23.11 meters or 6.10 posts/meter, indicating a duration of about 32 years. Surprisingly, House 13 with 124 posts in 27.84 meters had a density of 4.45 posts/m, and a period of only about 19 years. The longer duration of Houses 12 and 20 may explain the greater proportions of faunal material for these dwellings. But based on this reasoning, there should have been many more faunal remains in House 19 than House 13 rather than the reverse (Table 6-3). Apparently longevity is not consistent with zooarchaeological quantities.

Warrick recommended establishing a site's duration by ageing a house which was occupied throughout the existence of the village. Considering the positions of the palisades, House 12 might have existed for the whole time the village was located here and thus, it can be concluded that the village existed for at least 32 years. Houses 20 and 19 appear to have been built after the demolition of House 13, and therefore the village might have existed for as long as 46 or 49 years. Because House 19 is thought to have been constructed after House 20 and because 19 lasted longer, it is possible that the site was in use for over 50 years. This figure might be too high, considering that none of the 20 sites examined by Warrick had estimated durations of over 50 years (1988:47) and most ranged from 20 to 40 years (ibid.:49). However, D. Smith estimated the village likely existed for about 50 years on the basis of analysis of the pottery and pipes in combination with the strata in Midden 57 (D. Smith 1991:25).

The number of animals and the kilogrammes of meat consumed by the 26 families, over a period of at least 32 years but likely closer to 50 years, can be summarized. These families consumed, at a minimum, parts of 33 mammals, 26 fish, seven birds, two painted turtles and one frog/toad and possibly a few clams. Since the meat weight estimated from MNIs totals 612.92 kg, for each nuclear family, there were about 23.57 kg of meat. These figures greatly underestimate the actually quantity consumed, but they can be compared with similarly derived ones from the McKeown zooarchaeological sample (chapter 7).

Although none of the four houses over-lapped, there is the possibility that the families in House 20 or 19 had previously lived in one of the earlier houses. In order to avoid the possibility of inflating the number of families, the remains found in House 20 alone will be considered. House 20 has been chosen because it was the largest of the four with identified faunal samples and it was completely excavated. It had seven hearths and its floor area was 290.57m^2 or 20.76m^2 per family which was more crowded than the average of 26.68m^2 for the 26 families in the four houses.

The refuse from House 20 included specimens from all classes. The MNI of 25 mammals from at least 16 genera contributed at least 474.72 kg of meat (Table 6-23). Four birds from four species contributed 5.5 kg (Table 6-24). At least 15 fish from 11 different types yielded 26.28 kg of meat (Table 6-22) and the two painted turtles about 0.2 kg. The single medium-sized toad or frog and a few clams (*Elliptio* sp.) added minuscule amounts. Minus this last group, the total vertebrate meat represented for House 20 is 506.70 kg. Thus, the amount for each of its 14 nuclear families would have been 36.19 kg which is more than the 23.57 kg average for the 26 nuclear families in the four houses.

Summary and Conclusions

The 12,132 faunal remains recovered from the Keffer site included a wide range of species from all five vertebrate classes. These species indicated that animals were procured from both water and land habitats. Fish and birds were taken from large bodies of water, such as Lake Ontario, and smaller bodies, particularly streams. Amphibians and reptiles were also gathered from such localities. On land, birds and mammals were harvested from a variety of habitats but open areas with secondary growth and deciduous forests were the ones exploited most. Such habitats dominated the Keffer catchment area.

One of the most interesting findings was that fish accounted for 61.1 percent of the remains by NISP. Identification revealed that whitefish, catfish and trout were the preferred species. From their natural cycles, it is concluded that the major fishing effort was in the fall for whitefish, likely from Lake Ontario. A secondary fishing effort was undertaken closer to the village during the spring spawning periods of the catfish, perch and several sunfish. Rivers or ponds of different temperatures were fished for these species.

Examination of the particular fish body parts revealed that whitefish were decapitated off site and many of the heads were not brought back to the village, resulting in an under-representation of this species in the zooarchaeological sample. The riverine species, on the other hand, were carried onto the site whole. There was a high quantity of catfish skull bones, perhaps reflecting special preparation. The requirements of horticulture dominated the economy but fish cycles were probably very influential in the subsistence activities and seasonal rounds of the Keffer inhabitants.

The mammalian class was less significant than anticipated, forming only 29.3 percent of the specimens by NISP. However, within this class, the species most commonly identified were predictable: deer, *Canis* sp. and beaver. Deer remains were the most frequently identified wild species and its importance as a meat provider is magnified by the large size of this mammal. Likely deer were hunted in the fall when they would be most desirable, but a second season for hunting them may have been in mid-to-late winter. In addition to the value of deer to humans for skins and meat, antlers and deer bones provided raw materials for tools and deer phalanges appear to have provided nourishment for dogs. The domestic dog kept by these people was slightly smaller than a coyote. The presence of a few cut marks and numerous burnt *Canis* sp. specimens indicated these mammals were eaten, but the occurrence of dog bones in a pit in House 1 attested to occasional special treatment of their remains too. The beaver was valued for its long, lower incisors, which appeared to have been saved over many years, but the rest of the body was used also. From the geography of the Peel plain, it can be concluded that beaver would have occurred in the vicinity of the site, but the absence of marshes and swampy depressions would have restricted their numbers. Apparently its fur had not attained its high value of the historic period in the early 1500s.

The Keffer people also made use of several medium-to-small sized fur-bearers. Although these mammals contributed small amounts of meat or skin individually, they were not merely incidental variations in the sample. Evidence of purposeful collection of woodchucks, squirrels and chipmunks corroborates findings at other sites, such as Nodwell (Stewart 1974) and Wiacek (Lennox *et al.* 1986). Most of the hunted mammals were from the open areas or from deciduous forests common in the site's vicinity. Some less frequently encountered species, such as the porcupine, marten, snowshoe hare and lynx, were from coniferous forests primarily. These and the moose specimens represent acquisitions from areas beyond the Keffer 10 kilometre catchment area.

Avian bones were only 3.6 percent of the total, but a variety of bird species were included in this sample. However, as was true for the fish, many were represented by only a few bones. Wild turkey bones dominated the sample, followed by those of passenger pigeon and grouse. A wide variety of ducks were taken too. These and the pigeons provided evidence of seasonal hunting activities in the warm weather months, particularly in summer and fall. The turkey was available in deciduous forests throughout the year, but it may have been easiest to hunt in the winter. Like the mammals, most birds were taken from open areas or deciduous forests and both land and water species were hunted. One bird, the spruce grouse, prefers coniferous forests and it may have been a trade item. It is possible that turkeys too were traded from people living farther south, particularly in cold seasons.

The return of spring allowed the Keffer inhabitants to add variety to their diet with turtle and amphibian meat and perhaps, infrequently, snake meat. Amphibian bones were only a small percent of the total sample and reptiles were even fewer. Painted turtles accounted for over half the reptilian remains, with those of snappers following. The amphibian bones were almost exclusively those of frogs or toads of medium size. They were of interest because most were from the hind limbs; although the sample size was small, this meaty section of the body appears to have been returned to the site more often than the complete carcass.

Consideration of the natural histories of the species represented allows several conclusions. First, most were taken from deciduous woodlands or more open areas, but greater distances were covered in order to exploit whitefish. Second, the various procurement activities were undertaken in specific seasons. Fishing occurred in the fall and to a lesser degree in the spring. Birds were not hunted in the spring and some species were taken only over the warm weather months. Reptiles and amphibians were gathered from spring to fall. Deer hunting was likely a fall and late winter activity and beaver, bear and turkey too were most easily captured in winter. Most hibernating species must have been taken in the warm weather. Caged bears and dogs could have been killed whenever the desire or need arose.

From the particular skeletal specimens found, it can be concluded that most prey animals were returned to the site as complete carcasses. Butchering of the carcasses appears to have been minimal. The skinning of the mammals and the dismembering of the larger species must have been done with skill. Relatively few specimens were burnt. From this evidence (Tables 6-10, 6-25, 6-26, 6-27), it can be supposed either that some members of each faunal family were roasted over an open fire or that waste bones of all families were burnt accidentally or more probably purposefully. Cooking food was a female activity, according to the ethnohistorical records. Natural history information on the animals available in the warm weather in habitats that would have been found close to villages suggests that some fishing and hunting, as well as gathering, were probably in the female domain too. Finally, a minimum average of between 23.57 and 36.19 kg of edible flesh per nuclear family was deduced from the faunal sample found with the four houses of the Keffer site.

This discussion of the faunal material from the Keffer site has included data on remains from both middens and houses in order to use the most amount of information available for interpretations on the different habitats and seasons of exploitation. However, to reconstruct the amount of meat that was consumed the remains from the houses only have been used, for two reasons. It is assumed that refuse in the houses represents food consumed by families in those houses primarily. Thus, the number of hearths, and thus families, can be compared to the amount of refuse. Middens, on the other hand, were likely added to by many families from different longhouses, and it is impossible to determine which bones came from which house. If the faunal remains from all the houses and all the middens had been identified, the totals could be compared to the number of hearths on the site to arrive, perhaps, at a better estimate of the amount of meat consumed by the families. (There would still be problems of the hearths' contemporaneity.) Such data were not available for Keffer because not all of the excavated assemblage was identified. The total sample is not available at the McKeown site either, because only one quarter of the village has been excavated, and this did not include any middens. This was the second reason for excluding the midden remains from the Keffer diet estimates. The faunal remains from McKeown are described next.

CHAPTER 7

THE ZOOARCHAEOLOGICAL SAMPLE FROM THE MCKEOWN SITE

Introduction

The McKeown site (BeFv-1), located on Lot 11, Concession 2, Augusta Township, Grenville County, is south of Ottawa and just north of the St. Lawrence River (Figure 1-1). Although this prehistoric St. Lawrence Iroquoian village site has been known to archaeologists since the 1930s (Wintemberg 1972:121 cited in Pendergast 1988), it did not receive much attention until the summer of 1987 when it was excavated by Dr. James Pendergast.

Excavation of exploratory trenches located the village's palisades and associated ditches, whereas removal of the plough zone with bulldozers and shovels revealed post moulds of "22 longhouses, or portions of longhouses, and 2, possibly 3, circular lodges within a heavily palisaded perimeter" (Pendergast 1993b:6). Macrofaunal samples originating in the features of the houses and the floated material from all the features in House 2 have been analyzed for this study.

Pendergast has made some preliminary interpretations regarding the site (Pendergast 1988, 1990). Analysis of the settlement data led him to conclude that "the core village population was augmented in two phases" with the second influx of population being the larger one (Pendergast 1988:4). From an examination of the artifact assemblage, particularly the ceramics, Pendergast concluded that this 1.6 hectare site was a "Border" (Pendergast 1993b:1) St. Lawrence Iroquoian village dating to around A.D. 1500. The finding of an European iron awl might indicate a slightly more recent date, but because there were no other trade goods the site should still be considered as dating to "sometime in the first half of the 16th century" (Wright and Wright 1990:4). Radiocarbon dates support this interpretation. However the village could have been occupied slightly earlier, perhaps around A.D. 1475, as dates from the core area (Houses 5, 13 and 16) suggest (Pendergast 1993b).

Using documentary information and analogy, it has been assumed that the McKeown village was occupied year-round, although the population likely fluctuated with the seasons:

> By far the majority of the pits excavated were located in the longhouses. Indeed, the areas between the houses are relatively undisturbed. This pattern is attributed, in part at least, to a village life style in which the greater part of the village activity occurred during the winter months when the weather confined villagers to their longhouses. With the arrival of spring the people left the village for their spring fishing stations on the St. Lawrence River and the farm lands to prepare them for planting. Over the summer months they occupied a variety of locations, some remote from the village, each of which contributed to the seasonal food supply. As a result the village remained sparsely inhabited until after the fall harvest and hunt were complete (Pendergast 1988:5).

In addition to village sites like McKeown, the St. Lawrence Iroquoians also had marsh/swamp habitations and fishing stations (Pendergast 1984:58) for the exploitation of specific animals. The Steward site (J. Jamieson 1982), for example, was a prehistoric St. Lawrence Iroquoian fishing station thought to have been used primarily for the exploitation of the American eel (*Anguilla rostrata*) in the fall (Junker-Andersen 1988). Similarly, the Slack Rockshelter (Nicol 1977) and the Driver site (Neill 1983) might have been spring/summer encampments, although this is difficult to confirm because the faunal sample from the Slack Rockshelter was minimal (n=249) and that from the Driver site (n=1294) was collected in a salvage excavation. Likely, however, most of the animals procured at such special collecting camps were transported back to the main village, at least in part if not as entire carcasses, to be consumed there. Consequently, their remains would be added to the village refuse. More significantly, it is important to remember that much of the food consumed by these people was probably obtained from their crops (Heidenreich 1971:159). As was true for the Keffer population, the necessary protein for the McKeown people could have been supplied by the beans-corn combination. However, it is apparent from the faunal refuse that meat and fish were important sources too and that a wide variety of animal species were utilized.

The Environmental Setting

In common with the whole southeastern Ontario region, the McKeown area has:

> a bedrock of flat-lying Ordovician limestones and shales, and local Cambrian beds, covered by glacial deposits over which in turn lie extensive marine clays and sands dating to the period of inundation by the Champlain Sea in late Pleistocene times. Grey brown podzolic and brown forest soils generally have been developed, with locally some podzols, mucks and peats (Rowe 1959:45).

Shale and dolomite deposits are common in the McKeown vicinity, but chert is not (Chapman and Putnam 1984:82: Figure 16). Most of the area has low relief. "Lakes, poorly drained depressions, morainic hills, drumlins, eskers, outwash plains and other glacial features are common" (ibid.:14-15). Running in a northeasterly direction throughout Grenville County "from its source a few miles north of Brockville to its confluence with the Ottawa [River]" (Chapman and Putnam 1984:106-7) is the South Nation River. It drains an almost flat plain with many swampy depressions and some peat bogs. This river is noted for its recurring annual floods, which are particularly voluminous in the spring but can occur throughout the summer as well. It is fed by many small tributaries most of which, like the main river, are very sluggish. The McKeown site is situated about one kilometre north of an unnamed branch of this river and south of the main branch. In contrast, the St. Lawrence River, "in its natural state ... was marked by numerous rapids" (ibid.:201). The site is about five kilometres north of the St. Lawrence River. Different aquatic species would live in these diverse habitats. Between the South Nation and St. Lawrence Rivers are swamps and bogs, which provide suitable habitats for other combinations of plants and animals.

As well, the site is centrally placed for three distinct soil zones. It is at the western edge of a sand plain and about two kilometres farther west there is a till plain and two kilometres to the north a clay plain (ibid.:1984, end map). The people who lived here were favourably situated on a sandy soil, good for growing corn (Canada, Department of Regional Economic Development 1966), but also close to other resources. However, soils vary from deep to shallow and from excessive to poor drainage resulting in the general area around site having severe limitations to the growth of forests (Canada, Department of Regional Economic Expansion 1971a).

The McKeown site is in the Canadian Biotic Province (Dice 1943) which shares its southern boundary with the northern limits of the Carolinian Biotic Province described in the previous chapter. This boundary "is not sharp because the climax hardwood forest is very similar in both" (ibid.:14). Both are dominated by hardwood forest but in the Canadian Province several types of coniferous forest form important subclimaxes. "Pines of several species constitute an important subclimax, one which on sandy soils may persist indefinitely. Bogs and swamps form another conspicuous subclimax, in which black spruce, tamarack, and northern white cedar are important trees" (ibid.:15).

In the 1500s, both coniferous and deciduous forests stood about 10 kilometres or less away from the village, although the initial extensive clearing for farm land and the continual collecting of wood for construction and for feeding the numerous hearths would have meant travelling greater distances as the period of habitation lengthened. Diversity is found in the forest cover in the upper St. Lawrence Section as defined by Rowe:

> The dominant cover type is composed of sugar maple (*Acer saccharum*) and beech (*Fagus grandifolia*), with red maple (*Acer rubrum*), yellow birch (*Betula lutea*), white elm (*Ulmus americana*), basswood (*Tilia americana*), white ash (*Fraxinus americana*), largetooth aspen (*Populus grandidentata*), and red and bur oaks (*Quercus rubra*, *Q. macrocarpa*), with local occurrences

> of white oak (*Quercus alba*), red ash (*Fraxinus pennsylvanica*), wire birch (*Betula populifolia*), rock elm (*Ulmus thomasii*), blue-beech (*Carpinus caroliniana* var. *virginianus*) and bitternut hickory (*Carya cordiformis*). Butternut (*Juglans cinerea*), cottonwood (*Populus deltoides*) and slippery elm (*Ulmus rubra*) have a sporadic distribution in river valleys, and some small pure stands of black maple (*Acer nigrum*) and silver maple (*A. saccharinum*) are reported on fertile, fine-textured lowland soils. Poorly drained depressions frequently carry a hardwood swamp type in which black ash (*Fraxinus nigra*) is prominent.
>
> Although the general character of the forest cover is broadleaved, there is usually a representation of the needle-leaved conifers within it, particularly the hemlock (*Tsuga canadensis*), white pine (*Pinus strobus*), white spruce (*Picea glauca*) and balsam fir (*Abies balsamea*). Coarse-textured soils commonly support stands of white pine and red pine (*Pinus resinosa*), and wet sites may bear black spruce (*Picea mariana*) or eastern white cedar (*Thuja occidentalis*). The latter species is also found on dry, rocky or stony sites. After fires, largetooth aspen and white birch (*Betula papyrifera*), with balsam fir and white spruce, play a prominent role in the pioneer forest stands (Rowe 1959:45).

Hosie (1975:22) gives more prominence to the conifers (eastern white pine, red pine, eastern hemlock) and yellow birch as characteristic of this forest region and adds that red spruce is abundant in some areas. Hosie notes that the predominant associated deciduous species (sugar maple, red maple, red oak, basswood and white elm) are ones also found in the Carolinian forest region.

The McKeown locality experiences a relatively mild climate for Canada. It has a frost-free period of from 150 to 140 days (Brown *et al.* 1980:31, Fig.24) and a mean annual precipitation of about 90 cm (ibid.:40, Fig.32). At present the mean daily temperature for January is about -7°C and for July about 21°C (ibid:21-2, Figs.10 and 12). These figures might not duplicate the exact conditions when

McKeown was occupied but they are likely similar. The physiographic features have remained much the same, although the flow of the St. Lawrence River and many of the small rivers has been changed by damming. In general, in this part of the St. Lawrence, the water level has been raised causing flooding of the natural shoreline. Changes in vegetation in the region have been more dramatic. It has been deforested for agriculture, a practice that began with the Native peoples themselves. At A.D. 1500 the environment was almost certainly one of great diversity in both plant and animal life. Not surprisingly then, a large quantity and variety of faunal material was excavated from the McKeown site.

The Faunal Sample and Methods of Analysis

Because the soil of the site itself was both sandy and well-drained, the faunal specimens were well-preserved. Even small fish bones and scales were recovered in excellent condition. Only 27 specimens exhibited evidence of erosion. Three mammal specimens and a shell had exfoliated surfaces, eight mammal bones were white in colour, which was thought to be a result of exposure to the sun, and 14 mammal bones and one class-indeterminate specimen were slightly weathered. These 27 remains are less than 0.3 percent of the sample. Their relative scarcity emphasizes the good conditions for skeletal preservation on the site. (These conditions seem to have been marginally better than at Keffer since there the eroded remains were 0.6 percent of the sample and some of the site matrix was clay, although the four houses used in this study came from the sandy soil part of Keffer.)

Evidence of pathology was restricted to two bones. One beaver bone exhibited osteoporosis and a fish bone had some extra bone growth. This tiny number of pathological specimens might reflect an avoidance of sick creatures, but more likely occurred because diseases which infect animals often result in their deaths before there is any morphological modification of the skeletons. However, these results suggest that the animals on which the McKeown inhabitants depended were in good health.

Evidence of osteophagia was rare. The examples were all on mammal bones, 10 being punctured by canine teeth and five grooved by rodent incisors. The paucity of canine marks correlates with a low incidence of *Canis* sp. specimens (see below).

Analysis of the faunal remains was undertaken as two research projects. Initially, I analyzed the remains from three houses, one from each of the three phases of the site's construction (Figure 7-1). House 13, radiocarbon dated to 540 ± 40 BP (Pendergast 1993b:3), was selected from the original core area. It was one of two houses demolished to make room for the four houses built in the first phase of expansion. House 10 was selected from these four and it was radiocarbon dated to 390 ± 90 BP (ibid.). House 2 was chosen from the last phase of village growth and it had an unaccepted early date of 560 ± 40 BP (Pendergast 1993b:10, 29). These specific houses were selected for analysis because they produced larger faunal samples than others in their respective phases. As well, Houses 13 and 2 were completely excavated, and only a corner in the porch area of House 10 was unexcavated. Information about the houses' periodization was relative and very general: House 13, preceded House 10 and they did not co-exist; based on its location, House 2 was built after both of the others but it could have been partially contemporaneous with House 10. These three houses were not necessarily, or even probably, used for the same number of years. Estimates of their longevity are made later in the chapter.

Village growth produced problems for interpretations. The construction of new buildings resulted in the overlapping of the post stains of many house walls, making difficult the assignment of some of the interior features to specific houses (Figure 7-1). The faunal sample was taken only from features and post moulds which could be confidently assigned to specific houses. Thus, the 84 specimens found in the overlapping part of House 2 were not included in my study. The result of these selection procedures was a total of 9,954 non-artifactual faunal specimens from Houses 13, 10 and 2 for analysis (Table 7-1).

An additional 27,499 pieces of macrofaunal material were identified by the staff of the Ostéothèque de Montréal Inc. under the direction of Virginia Elliot (1989). These came from 15 other houses, the palisades, the trenches associated with the palisades and areas between the houses (Figure 7-1). Details of my results will be presented before summaries of those of the Ostéothèque de Montréal Inc., which consistently confirmed mine.

The Faunal Remains

The McKeown faunal material included remains of seven classes of animals, both vertebrate and invertebrate. In the macrofaunal material I studied, only 17 of the specimens (0.4%) were not assigned to class but, when the floated material from House 2 is added, the class-indeterminate figure soars to almost a fifth of the new total (Table 7-1). Mammalian remains were slightly more common than those of fish in the macrofaunal sample (Stewart 1992:Table 1). With the addition of the microfaunal remains, fish dominated (Table 7-1). The bivalve shell and gastropod specimens combined account for just over ten percent of the total sample. The few bird and amphibian bones each comprise less half a percent of the total sample and the turtle specimens were even fewer.

Similar rankings by classes were found for the macrofaunal material studied at Ostéothèque de Montréal Inc. (1989:Table 1). Mammals were 57 percent of the vertebrate remains, followed by fish at 36 percent. Birds were much less frequent, accounting for only one percent and again, reptiles and amphibians were present in minimal proportions (0.5% and 0.25% respectively). No floatation samples or invertebrates were analyzed at Ostéothèque de Montréal Inc.

Fish Remains

The fish remains from the three houses formed a rich and diverse group from at least twelve families (Table 7-2). Floatation produced a large proportion of fish fragments that were not identified beyond their class. Although Table 7-3 includes fish from only 16 distinct species, two more at least must be represented by the gar and sucker remains. The single gar bone could not be identified beyond the family level due to a lack of reference material. For the same reason, the numerous sucker specimens could not be sorted to genus and species. However, as was true of the Keffer sample, most of the McKeown specimens were probably from either indigenous longnose or white suckers or from redhorses (Scott and Crossman 1973:564-86). Among 9,935 fish remains studied at the Ostéothèque de Montréal Inc. ten were identified as *Moxostoma* (redhorses). In my sample, 196 sucker specimens constituted 27.4 percent of the 715 fish remains identified beyond class, which placed them second by NISP to perch.

The perch family accounted for almost half of the fish remains (Table 7-2). Most of these were identified as walleye or sauger but some were yellow perch (Table 7-3). Eight *Stizostedion* sp. individuals were represented by vertebrae with two to nine growth rings (Table 7-4). The MNI for yellow perch was also eight, based on right operculi. The MNI increases to nine if the operculum identified to the genus *Perca* only is assumed to be from a yellow perch.

The pike family ranked third by NISP. Almost half of these were recognized as northern pike. The northern pike MNI was seven, based on vertebrae with two to eight rings (Table 7-4).

The catfish family was fourth. Most were from two species: brown bullhead, with a MNI of four based on various duplicated skull bones, and channel catfish, with a MNI of two, considering either skull bones or right pectoral spines.

Fish commonly called bass come from two families and these were the next most common group. From the Centrarchidae family, almost half the specimens were identified to the genus *Micropterus*, which includes the largemouth and smallmouth bass. This genus had a MNI of four based on left cleithra. Pumpkinseed left cleithra specimens gave that species a MNI of three, whereas the four rock bass bones could all have come from a single individual. The white and black crappies (*Pomoxis* spp.), for which there were only two bones and MNIs of one, are also from this family. The temperate bass family (Percichthyidae) was represented by fish of the *Morone* genus, with a MNI of one.

Anguillidae ranked sixth. All of these bones were from American eels. The MNI was four based on dentaries and/or parasphenoids.

For family Salmonidae, there were only 27 remains. Five of these were trout or char (*Salvelinus*), six were only possibly whitefish and another was possibly a cisco (*Coregonus*). All their MNIs were one.

Even more poorly represented were bowfin, chubs (possibly *Semotilus atromaculatus*) and freshwater drum. The drum had two duplicating left preopercular fragments but the others had MNIs of one. The small chub might have been introduced into the faunal refuse in the stomach of a larger fish.

In sum, considering the NISPs and the MNIs of the fish species (Table 7-3 and 7-4), it is apparent that yellow perch, sucker and walleye/sauger remains dominated. Catfish, basses and American eels were also common but the members of the salmon family were infrequent and most of the remaining species were rarely identified.

Mammalian Remains

Among the 11 families and 19 species of mammals represented in Houses 13, 10 and 2, excluding the nine bones of *Homo sapiens* scattered in the House 2 deposits, whitetail deer and beaver dominated, followed by muskrat and black bear as can be seen from Tables 7-2 and 7-5.

The deer family (Cervidae) had 241 specimens, of which 172 were more specifically identified as whitetail deer. These comprised almost a third of the mammalian remains identified to genus and included parts of at least four individuals, based on three adult and one immature left calcanei (Table 7-6). The latter came from an individual less than one and a half years old (Purdue 1983:1210). Those deer specimens assigned to age categories included 67 adult, six young adult and 24 immature specimens.

The 140 remains identified as beaver constituted just over a quarter of the mammalian specimens identified to genus at least and produced a MNI of five with parts of four right immature humeri and one adult humerus. The beaver sample included 16 unmodified incisor teeth, some of which might have been "curated" considering their value as tools (chapter 6). Unlike the deer, the beaver remains sorted to their age groups show a high proportion of immature animals. There were 55 immature skeletal specimens, four young adult and 36 adult.

There was almost the same number of black bear and muskrat remains. When the single specimen identified as Ursidae only is added to the 35 *Ursus americanus* specimens, these two species have equivalent NISPs. The Ursidae bone was probably black bear, since that is the only species native to southern Ontario (Peterson 1966). Using limb bones, including several immature ones and two adult left humeri, the bear MNI is three. But likely there were at least two immature individuals; one was very young, since in addition to several unfused long bones, there was a metacarpal diaphysis to which no epiphyses had fused at the time of death. Of the aged specimens, 11 were adult, one was young adult and 15 were immature. However eight of the latter were vertebrae. Thus, an apparent selection for immature animals is not substantiated. Likely the larger animals were more prized by hunters.

Based on tibiofibula bones, two immature and one adult muskrats were represented. Adult specimens predominated, with 19 compared to nine immature and no young adult bones.

Five medium-sized species had smaller NISPs than muskrat. In order of decreasing NISPs, they were: snowshoe hare, woodchuck, porcupine, raccoon and marten. In addition, the smaller red squirrel belongs in this moderately represented group. Since none of the snowshoe hare specimens duplicated any other and since all of them were adult, only one individual was represented. Six additional bones, identified to the Leporidae family only, might be from the snowshoe hare but, even including these, the MNI remains one. The woodchuck remains included an immature whole left fibula diaphysis and a young adult left fibula proximal end, indicating an MNI of two. Fifteen of the aged specimens were adult, one was young adult and two were immature. Eighteen specimens were porcupine and these originated in at least two individuals. One was adult and the other immature, based on both limb bone specimens and right maxillae. There were twice as many adult as immature specimens, with six of the former and three of the latter. One immature raccoon only was represented because the five adult specimens could have come from the same skeleton as the eight immature bones. Floatation increased the red squirrel NISP and the MNI to two, based on left frontal bones or left adult ulnae. The seven aged red squirrel specimens were all adult. The marten specimens represented two individuals, one an adult and the other a young adult, based on left humeri. Of the marten specimens assigned to an age group, seven were adult and four were young adult.

Three mammal species were represented by eight specimens. These were eastern chipmunk, meadow vole and deer mouse or white-footed mouse. The MNI of two chipmunks included an adult and an immature individual, based on limb bones with different amounts of epiphyseal fusion. The vole MNI was surprisingly high, with three adults based on two left mandibles with all the teeth in place and an additional loose lower left permanent molar 1. Again, unexpectedly, three *Peromyscus* individuals were recognized in one immature limb bone diaphysis and two adult left humeri proximal ends.

The remaining mammals were represented by fewer faunal remains. Both grey squirrel and wolf had three. Most surprisingly, there were only two *Canis* sp. bones and none from the domestic dog. Red fox and fisher (*Martes pennanti*) also had NISPs of two. Only a single river otter (*Lutra canadensis*) immature tibia bone and one adult metatarsal mink bone were identified. Both the *Canis* sp. remains were adult left ulna proximal ends for a MNI of two. These other poorly-represented species had MNIs of one adult each.

Avian Remains

Birds were weakly represented. Of the six bird species, only passenger pigeon, common goldeneye duck (*Bucephala clangula*), ruffed grouse and Canada goose were represented by more than a single specimen (Table 7-7). The pigeon bones included two left scapula for a MNI of two (Table 7-8). A MNI of two goldeneyes was realized because there were two left digit 2 wing phalanges. The grouse bones represented only one individual as did the goose bones. Single specimens identified to the common loon and the common merganser (*Mergus merganser*) completed the bird total.

Amphibian and Reptilian Remains

Floatation increased the amphibian and the reptilian representation. One bone was from a bullfrog, but most of the amphibian specimens were identified only as frog or toad (Anura). Ten tibiofibulae and ten femora were in this group. These bones were not identified to side but must have come from between five (based on their MAU) to ten individuals (based on their MNE). The only reptile species recognized was the painted turtle with a MNI of one. All but two of the reptilian remains were pieces of turtle shell (Table 7-2); the other two were vertebrae from a medium-sized snake.

Invertebrate Remains

The invertebrates were surprisingly common (Table 7-9). There were 60 gastropod shells and an inflated total of 962 pelecypod specimens, many of which were tiny flakes of shell (n=847), recovered by floatation. Nearly all of the pelecypods were from two very similar mussels of the genus *Elliptio*. Based on right valves, there were at least 16 *E. complanata*, eleven *E. dilatata* and four more *Elliptio* sp. individuals. Two small clams (*Sphaerium*) were also identified. The gastropods (*Anguispira alternata*, *Mesomphix friablis*, *Tridopsis tridentata* and *T. albolabris*) were all forest snails. While the clams were probably purposefully collected, the snails were likely incidental inclusions in the site's soil.

Remains Studied at Ostéothèque de Montréal Inc.

The study by the Ostéothèque de Montréal Inc. complimented my findings (1989:3, Table 3). Using NISPs, they found suckers dominated the fish and whitetail deer, beaver and black bear were the most abundant mammals. In their bird sample, only Canada goose, ruffed grouse and passenger pigeon had more than ten specimens, but at least 14 species were represented (ibid.:Table 4). Reptilian and amphibian zooarchaeological remains were scarce.

Considering the larger number of specimens examined at the Ostéothèque de Montréal Inc., it is not surprising that some additional species can be added to those found in Houses 13, 10 and 2. For the mammals, these additions are mostly insignificant, being one bone of the short-tailed shrew (*Blarina brevicauda*), one of a mole (Talpidae), three from the northern flying squirrel (*Glaucomys sabrinus*) and two striped skunk, as well as intrusive horse (*Equus caballus*) and cow (*Bos taurus*) specimens. More significantly perhaps, there were only four moose specimens. (Their tabling of a single specimen from the family Dipodidae is problematical, as these are jerboas of Africa, Europe and Asia (Peterson 1966:16); there is no discussion of the remain in the text.)

The staff at the Ostéothèque de Montréal Inc. identified bones of longnose and white suckers and silver (*M. anisurum*), river (*M. carinatum*) and greater redhorses (*M. valenciennes*) from the *Moxostoma* genus. New species not recognized in Houses 13, 10 or 2 were lake sturgeon (*Acipenser fulvescens*) (NISP=80), American shad (*Alosa sopidissima*) (NISP=1), fallfish (*Semotilus corporalis*) (NISP=14) and burbot (*Lota lota*) (NISP=102).

Bones from birds not found in Houses 13, 10 or 2 were identified mainly to family. In addition to one spruce grouse specimen, there were two from herons or bitterns (Ardeidae), two from eagles or hawks (Accipitridae), one from a woodpecker (Picidae), nine from ravens or jays (Corvidae), two perching bird (Passeriformes) bones and two from orioles or tanagers (Emberizidae).

The reptiles and amphibians were also more diverse. In addition to the painted turtle, there was one specimen identified as snapping turtle and a dozen as Blanding's turtle (*Emydoidea blandingi*). In addition to the bullfrog, the amphibian bones included one from the northern leopard frog (*Rana pipiens*) and 14 from the American toad (*Bufo americanus*).

In general, the two samples are very similar but these additional identifications increase the richness of the remains. Combined, the numbers of species exploited total 23 mammals, excluding human, cow and horse; eight bird species and 12 families; 24 fish species; three turtles and one snake, and three frogs and toads.

Discussion

An unexpected finding of the McKeown faunal sample was the scarcity of domestic dog remains. From Houses 13, 10 and 2 there were no dog specimens and very few identified to the genus *Canis*, with only three grey wolf specimens and two *Canis* sp. ulnae portions. Researchers at the Ostéothèque de Montréal Inc. concurred that "few dog remains [were] scattered throughout the site in very small quantities" (1989:41). They identified only 10 wolf specimens, 15 dog remains and two additional bones to the genus *Canis* in a total of 7,686 mammalian specimens (ibid.:Table 3).

This very poor representation appears to be an extreme example of the low ranking of *Canis* sp. remains among St. Lawrence Iroquoian sites. However, dogs were very common at the Glenbrook site (Rick 1981:45) and moderately frequent at the Beckstead site (D'Andrea *et al.* 1984:212). Furthermore, dogs are common on most Iroquoian sites across Ontario and dogs are mentioned often in Iroquoian ethnohistories and ethnographies (Tooker 1967; Trigger 1990; Waugh 1973). Their poor representation at McKeown was unexpected, but comparison with other sites in the area (chapter 9) has shown that dog remains are indeed rarer in St.

Lawrence Iroquoian faunal samples than in proto-Huron/Petun samples.

A second surprise was the relatively high frequency of black bear remains. As noted above, black bear ranked third (with muskrat) among the mammals in the sample from Houses 13, 10 and 2. With a MNI of three, and probably four, black bear was the species providing the most meat. Bear remains ranked third in the Ostéothèque de Montréal Inc. sample also, where 455 specimens accounted for "8% of the identified mammals" (1989:41). Furthermore, there was the burial of a nearly complete skeleton of a young bear which had been killed in the fall or early winter (ibid.:19, 41). My examination of the bear bones from three houses revealed no selection by age and thus suggested non-selective hunting.

There are several possible explanations for the high incidence of bear bones on this site. Except for the moose, bears weigh the most of all the wild species and so they would have been significant prey for meat. Their coats would have been very valuable too. Finally, skeletal parts, particularly the canine teeth, are often artifactual at McKeown (J. Jamieson 1993), as well as at other sites, such as Roebuck (Wintemberg 1972:51-2).

This apparent selectivity for black bears might be a St. Lawrence Iroquoian trait. Bear remains are not common on most proto-Huron/Petun or Huron sites, although they do occur in limited numbers (Stewart 1974, 1991b). They were less than 0.1 percent of the mammal remains at Keffer. On St. Lawrence Iroquoian sites, however, bear remains are common. Black bear apparently provided most of the meat at Beckstead (D'Andrea *et al.* 1984:212) and was well-represented at

Glenbrook (Rick 1981:45, Table 1) and at other sites in close proximity to McKeown (chapter 9).

The possible occurrence of a bear burial at the Beckstead site (D'Andrea *et al.* 1984:212) and the young bear buried at McKeown are evidence of a special regard for bears by these St. Lawrence Iroquoians. More bear burials might have been left in the ground at McKeown, if they were mistaken for humans, since one of the conditions for digging this site was to close immediately features with any human or possibly human bones exposed during excavation. None of the bear bones from the three houses was burnt, cut or chewed but the scattered remains were from all parts of the skeleton. Possibly, like later Iroquoians, the people at this site fattened captive bears (Tooker 1967:66).

Interpretations

Body Part Representation and the Meat Diet

Both deer and bear were represented by all their body regions (Table 7-10), which suggests that whole carcasses or most of them were transported to this village. There is a slight difference between deer fore and hind limb specimens, in favour of hind limb bones. But this occurred for all the mammal species, except the snowshoe hare and the red squirrel, where fore limb specimens predominate, and the marten, where the figures for the limbs were equal. Only for the beaver do the numbers seem strong enough to suggest a selection of hind portions. A selection for beaver hind legs is likely because they are much larger and thus have a higher MGUI than the fore limbs. In addition, the fatty tail might have been valued and collected with the hind quarters. However, all sections of beavers were found in the zooarchaeological sample and as for all the species, their NISPs are too low to show definite patterns of body part selection.

Fish Preparation and Meat Contributions

As expected, fish skull bones predominate in the McKeown sample (Table 7-11). The high proportion of zooarchaeological *Ictalurus* skull bones reflects both the high proportion of skull to infracranial bones in a catfish and the ease with which such elements can be identified. For most of the species with more than 50 specimens assigned to body parts, the proportions are fairly even between the heads and the infracranial areas. Even the American eel, which might have been expected to show evidence of having been prepared elsewhere, has bones which are almost equally from the skull and the infracranial regions. Certainly, some suckers were brought on to the site whole, because both skull bones and vertebrae from all sections of the column were found in a feature in House 10 (Stewart 1988:65-6).

Adding the estimated meat weights for each species of fish (Table 7-4), the total edible fish flesh for all three houses is 52.75 kg. When the MNIs based on vertebrae rings are added, the total increases but this larger figure is not comparable to the Keffer figures because vertebrae rings were not examined for all the fish from Keffer. Thus, the lower figure will be used in the discussion of McKeown subsistence.

Mammalian Meat Contributions

Of the mammals, deer, bear and beaver were the most significant contributors to the diet (Table 7-6). For deer, 136.2 kg of meat are indicated by the three adults. Considering the weight gain patterns of deer (chapter 5) and averaging B. Smith's (1975:34) weights for one and two year olds, the immature animal from McKeown would have weighed about 32.2 kg and so contributed about 14.6 kg of edible meat, bringing the total to 150.8 kg of deer meat. A larger contribution was made by the fewer bears. The two adults represented contributed about 190.6 kg. The immature individual and the cub would have added about 81.5 kg (71.5+10) for a total of 272.1 kg. The adult beaver represented in the McKeown sample would have contributed about 17.5 kg of meat (White 1953a:398), whereas each of the four immature beavers would have weighed slightly less. Combined they could have contributed about 52.4 kg (4 x 75% of 17.5). However, if only the hind quarters of some of these beaver were returned to the site, this figure is exaggerated.

Many of those mammals represented by fewer than four individuals were medium-sized creatures. The three muskrats could have provided about one kilogram of usable meat per individual (Cleland 1971:20), but two were immature and thus would have added less. As discussed in chapter 5, the two porcupines represented on the site would be good catches but they might have been avoided as a food source (Waugh 1973:132). Using Peterson's (1966:116) information (chapter 5), the young adult woodchuck represented in the faunal sample would have provided about 2.5 kg of edible flesh (White 1953a:398) and the immature individual about 1.9 kg. The single adult hare would have contributed about 1.0 kg of meat. The single immature raccoon probably represents about 5.9 kg of meat (75 percent of 7.9). The much smaller adult and young adult marten combined would have contributed about 2.0 kg and the two red squirrels would have contributed 0.2 kg. Like the red squirrel, the one adult and one immature eastern chipmunk contributed very little. Most of the remaining poorly represented species, such as vole, mice, grey squirrel and mink, would contribute similar small amounts. Exceptions are the larger fisher, red fox, river otter and wolf. These four larger mammals, each with MNIs of one, would have added noticeable amounts (Table 7-6). Adding the estimated meat contributions of all the mammals, a total of 539.53 kg is reached for the remains from Houses 13, 10 and 2.

Avian Meat Contributions

Birds did not contribute much to the diet. The single Canada goose accounted for most of the avian meat despite its few archaeological bones (Table 7-8). In total, the bird remains from Houses 13, 10 and 2 represent 8.8 kg of meat from six species.

Reptilian and Amphibian Meat Contributions

The few turtle shell pieces, the two snake vertebrae and the five amphibian bones probably represent food refuse. Waugh (1973:135-136) reported that these animals, as well as turtle eggs, were eaten by the Six Nations Iroquois in historic times. The single painted turtle would have provided about 0.1 kg of meat and each frog even less (B. Smith 1975:183). Combined, the bullfrog and the five frog/toad individuals might have contributed the same amount as the single turtle. The occurrence of numerous invertebrate shells, some of which had been heated, suggests that clams also contributed to diet, as they did in the historical period (Waugh 1973:140).

In sum, the McKeown villagers consumed a wide variety of animals. Based on MNI figures, people in Houses 13, 10 and 2 consumed at least 601.08 kg of meat, ignoring the small amounts added by amphibians and invertebrates. Thus, the 30 families had about 20.04 kg each.

Seasonality and Habitat Exploitation

Knowing the species represented, their habitats and their natural histories, it is possible to reconstruct some of the seasonal activities of the McKeown villagers and the environments they exploited. Considering the availability of most of the mammals throughout most of the year within the McKeown catchment area (Figures 7-2 and 7-3), their procurement would have depended primarily on the desires of the Indians and the schedules imposed by their crops. As was true for the Keffer horticulturalists, preparation of the land and seeding in the spring, weeding in summer and harvesting in the fall, as well as the gathering of wild fruits and nuts throughout the summer and fall, would have impinged upon the hunting and fishing efforts. In the historical period, Iroquoian men were able to hunt throughout the year because the women did most of the agricultural work

(Tooker 1967:58), although men helped to clear the fields. "Hunting took place in the late fall and early winter" (ibid.:65) when most mammals reach their maximum seasonal weights, when their furs are in prime condition, when some congregate in large numbers and when the crops had been harvested. Male deer would be carrying their antlers in the fall too. Mammal hunting was probably largely a fall activity which continued into the winter, particularly for hibernating bears and beavers, whose lodges could be reached most easily once ice was solid over the ponds. Most of the mammalian species, including the three most important, inhabit swamps and marshes (Figure 7-2). The beaver, muskrat and otter would be found in such locales exclusively, while other species, such as the deer, bear and raccoon, could often be encountered there. Those mammals less well represented in the McKeown sample are found in hardwood and mixed forests.

The majority of the identified fish prefer cool, swift rivers; so most fishing was probably done in the St. Lawrence River and its tributaries (Figure 7-4). The suckers, perch, trout and drum inhabit cold, clear lakes and streams but most move into cool, swift running streams to spawn. Channel catfish, walleyes, saugers, pumpkinseeds, pikes and eels also inhabit these cooler, swifter rivers. Since these are most of the species as well as the ones with the highest NISPs, it can be concluded that the greatest fishing effort was made in the St. Lawrence River system. However, some of the represented fish species prefer warmer, sluggish rivers or lakes and ponds, so it appears that the South Nation River system was exploited too, although less frequently. From this river system, brown bullhead, bowfin, pike, sunfishes and basses could be taken. Some species (walleye, pike, brown bullhead, perch and pumpkinseed) could be found in both river systems. While fishing along the South Nation River system, marsh mammals as well as turtles and amphibians could be collected. These could also be taken from marshes bordering the St. Lawrence River and on these shores, shellfish could have been gathered.

Fourteen of the fish species represented at McKeown are spring spawners, which suggests that this was the major season for fishing (Figure 7-5). Exceptions include the small numbers of trout, *Coregonus* (ten each) and freshwater drum (three specimens). Perhaps the northern pike was taken then too. Although pike spawn in the spring, they are easy to hook in the fall (MacKay 1963:195). The American eel, which would be easiest to catch during its fall run to the sea or from the mud bottom in winter, might have been caught elsewhere (e.g., the Steward site) and transported to the village for winter consumption. Assuming that the most frequently represented species were fished when they were easiest to capture, catfish and perch would have been taken slightly earlier than suckers, whose exploitation in turn would have preceded that of walleye, sauger, possibly northern pike and the basses. The other species with fewer specimens were most readily caught in the summer or fall.

Examination of the growth rings of those vertebrae centri which still had their most recent rings intact offered information on the seasons of procurement of some fish. The McKeown vertebrae were sorted into four categories: end of winter/spring, summer, mid-summer/end of summer and fall. The possible whitefish vertebrae with readable rings died in the fall, just as one would have supposed from their natural histories. Pike vertebrae showed a majority of these fish died in the mid-summer/end of summer (n=16) and fall (n=9), with only a few being caught in the spring (n=4) and summer (n=1). Six of the sucker vertebrae were from spring kills, nine were early summer, one was mid-summer and seven were fall kills. Surprisingly, walleye/sauger vertebrae displayed midsummer/end of summer (n=3) or fall (n=6) kills. None was assigned to the spring. The bass family, including several species, was represented by five fall vertebrae only, whereas the trout family had a single spring vertebra. A single catfish vertebra with readable rings was from a fish which died in mid-summer, while four eel vertebrae were divided evenly between fall and spring deaths. However, since these eel vertebrae were all a good size, they could not have originated from elvers which run up streams in the spring. Since 30 of all these fish vertebrae were assigned to the fall period, there is support here for a fall fishery, although sucker, the predominant species, was pursued mostly in the early part of the warm weather period. Since feeding and temperature conditions in different years can affect the growth rings and because the interpretation of these is still being refined, the figures given here should be interpreted with caution. In addition, the sample for each species is small.

Like the fish species, the birds represented in the faunal sample can be separated into seasons of availability (Figure 7-6) and divided into two main habitats. Half the species, common loon, ruffed grouse and common merganser, are year-round inhabitants of the St. Lawrence Valley, although the merganser population greatly increases over the warm weather. The other half, passenger pigeon, Canada goose and common goldeneye, are spring-to-fall residents. The extinct passenger pigeon was likely hunted only from late spring to late October (Bent 1963:359-60, 401-2). Some common goldeneyes remain on the Great Lakes throughout the year but most breed farther north and winter on the coast (Bellrose 1976:430-434). Similarly, Canada goose was traditionally most common during its spring and fall migrations, with only a few remaining in Ontario over the winter (Godfrey 1986:80-81). Common loons too mainly migrate and breed in southern Ontario, but a few winter over (ibid.:22). Thus, it is reasonable to conclude that the hunting of birds was mainly a warm weather activity.

Waterfowl hunting likely occurred near rivers and perhaps in marshes, whereas pigeons would be found most densely in deciduous forests, particularly those with oaks and beechwoods. Grouse would be located in deciduous forests, mixed forests, or open areas of secondary growth.

While special efforts might have been made to hunt birds, the low percentage of avian remains suggests that this was not a major activity. This is somewhat surprising considering the exploitation patterns reconstructed here. The Indians could have fished in the spring while the birds raised their young, then hunted them in the summer before returning to fall fishing and taking up hunting.

But perhaps fishing and mammal hunting were the more productive activities and these were pursued precisely when the birds were migrating in large flocks over the area. The numbers recovered from McKeown suggest that its inhabitants focused on fish and mammals, followed only a minor pursuit of birds, and infrequently collected amphibians, reptiles and shellfish.

Comparison of the Faunal Remains to the Human Consumers

As at Keffer, similarities in the faunal remains from the McKeown houses were anticipated. Some of what is known about the houses relative to their fauna is summarized in Table 7-13.

Houses 10 and 2 had similar numbers of macrofaunal specimens (Stewart 1992:23), but House 13 yielded less than half their totals. One explanation for this diversity might be the relative sizes of the houses. The larger floor areas are associated with more numerous faunal deposits. Yet House 10 is almost half way between the other two houses in floor area, but much closer to House 2 in faunal quantities (Table 7-13).

House 13, with its four hearths, probably sheltered eight families and it produced the fewest faunal specimens. House 10 had four distinct hearths; there were actually five hearth stains, but two were so close together that it is likely they were used by the same two families. House 2 had at least seven hearths with an additional position which might have once held a fire or been reserved for later use (Kapches 1994:97). Thus, this building contained at least 14 nuclear families and it produced the most refuse. A correlation between number of hearths and faunal remains exists, but a closer examination reveals that it is not a simple one. Houses 13 and 2 follow the pattern, with House 13 having about half as many families and less than half as many faunal specimens. However, although the number of families in Houses 10 and 13 was the same, House 10's macrofaunal total was more than twice that of House 13's and quite close to House 2's. Thus, while greater numbers of hearths, and thus of nuclear families, correlate with greater numbers of faunal remains in a house, the relationship is not a perfect one.

At McKeown there appears to be a correlation between the number of features in a house floor and the number of faunal specimens. House 2 had both the greatest number of features and the most bones, while Houses 10 and 13, despite numerous overlapping of house walls, had fewer features and smaller faunal totals (Figure 7-1). In sum, size and number of features, including hearths, are correlated with faunal quantities within the McKeown houses, but other factors also affect the faunal totals.

Using Warrick's (1988, 1990) method for establishing house longevity and assuming that cedar poles were used to construct the McKeown longhouses, the length of times that Houses 13, 10 and 2 existed has been determined. House 13 with 57 post stains in 16.51 metres of side walls had a density of 3.5 poles per metre and a ratio of original posts to total posts of 1 to 1.06, based on a density of 3.2 posts per metre in the original construction. This original post figure is derived from post stains in side wall sections of Houses 4, 5, 13 and 23, which showed a clear, staggered pattern. This is an important finding, since it suggests that St. Lawrence Iroquoian post spacing might have been slightly less than the 3.5 average density of Huron houses; however, the 3.2 figure is within the range of Huron spacing as determined by Warrick. Applying the graph presented in Warrick's work (1988, 1990), House 13 existed for about 16 years. House 10 with 127 posts in 24.44 meters had a density of 5.2 poles/m for a duration of about 27 years. House 2 appears to have had its side walls rebuilt. Using the same 13 meters along the north side wall, the outermost row of posts had a density of 3.92 per meter for a longevity of about 17 years. The inner row had 54 posts in the 13 meters for a density of 4.15/meter and a longevity of about 18.5 years. Since these walls would not have existed contemporaneously, the total time the house stood was about 35.5 years. The longer duration of House 2 than the others might explain its greater proportion of faunal material.

None of the McKeown houses existed for the total time the village existed. However, by adding the 16 years of House 13 to the 27 of House 10 because these two cannot have co-existed, it can be concluded that the site was inhabited for at least 43 years. But Houses 13 and 2 were also likely used in discrete years and thus the duration of the village might have been for about 51.5 years.

The number of animals and the kilogrammes of meat consumed by the maximum of 30 families can be summarized. These families consumed, at a minimum, parts of 42 mammals, 58 fish, eight birds, one painted turtle, one snake, six frogs/toads and 33 clams. The vertebrate meat weight estimated from these

MNIs totals 601.08 kg. Thus for each nuclear family there were about 20.04 kg of meat.

A serious weakness with the estimate of the number of families is that while 30 different nuclear families might have lived by the 15 hearths, it is possible that the same families lived in House 13 and House 10. Certainly, the House 13 residents moved somewhere when their house was dismantled and House 10 was one of the buildings replacing those in the core area. In addition, it is possible that the House 2 families had previously inhabited House 10 and/or House 13. Thus, it is impossible to know how many different families are represented by the hearths in these three houses.

In order to eliminate this problem of over-counting of families, the remains found in House 2 alone will be considered. House 2 has been chosen because it is an average-sized structure on the site as a whole, although the largest of Houses 13, 10 and 2, and because, unlike the other two houses, it overlaps only slightly with another house and that overlapping is in its porch area. The proportion of floor area for the 14 families living in House 2 was $16.9m^2$, which was more crowded than the average of $22.3\ m^2$ for the 30 families in the three houses (Table 7-13). Using one house alone reduces the zooarchaeological sample but fortunately, of the three, this house had the largest quantity of faunal remains. Finally, the macrofaunal specimens are used to arrive at the MNIs because very little floating was done in Keffer's House 20 to which these remains will be compared.

The macrofaunal refuse from House 2 included specimens from all classes (Table 7-1). The 15 mammalian genera, represented by at least 24 individuals contributed at least 288.64 kg of meat (Table 7-12). Four birds from four species contributed 6.4 kg. At least 11 different types of fish yielded 25.29 kg of meat and the single painted turtle about 0.1 kg. The single medium-sized toad or frog and the 16 clams added minuscule amounts. Minus this last group, the total vertebrate meat represented for House 2 is 320.43 kg. Thus, the amount for each of the 14 families would have been 22.88 kg, which is almost three kilogrammes more than the average for the 30 families in the three houses but less than the averages for Keffer.

Summary and Conclusions

The inhabitants of the McKeown site collected animals from two different river systems and from a variety of forests, as well as from open areas that they themselves often created. Mammals, particularly deer and bear, were the greatest contributors to the diet, followed by fish, particularly members of the sucker and perch families. Among the birds, passenger pigeons, various sorts of ducks and grouse were taken but only rarely. A few turtles, snakes and amphibians were collected. Gathering of invertebrates was also a minor activity.

This study of the McKeown faunal remains has allowed a reconstruction of the diet and of seasonal activities related to subsistence. Apparently, the inhabitants availed themselves of a wide variety of wild animal species despite their being agriculturalists. They fished from various waters, primarily in the spring and they hunted from swampy and forested areas, primarily in the fall and winter. Their foraging practices seem to be of a broad spectrum type, but what really sets these McKeown people apart from other Iroquoians is their great use of bears. What makes this particular site unique, even among St. Lawrence Iroquoian villages, is the paucity of dog remains.

Determination of the amount of meat represented by the faunal remains, combined with the number of hearths in the houses producing the remains, showed that 20.04 to 22.83 kg of meat was the average amount per family.

CHAPTER 8

A COMPARISON OF SUBSISTENCE AT THE KEFFER AND MCKEOWN SITES

Introduction

The Keffer and McKeown sites share many similarities. Both were palisaded villages which were probably occupied year round, but most heavily in the winter when most of the villagers lived in them. Both expanded, from which it can be supposed that each had subsistence systems capable of feeding not only their original populations but also more people. They were likely contemporaneous and therefore any global climatic changes would have been experienced by the inhabitants of each in similar ways. The ranges of plants and animals on which they relied would have been moving north or south in concert in response to climatic warming or cooling. In particular, a period of cooler temperatures, the postulated Little Ice Age, dating from *ca.* A.D. 1450 to 1850 according to Campbell and Campbell (1989), but beginning after the time of the Keffer and McKeown sites, *ca.* A.D. 1550, according to others (Grove 1988), would have been experienced by both regions. However, its effects would have been moderated in southern Ontario because of the ameliorating effect of the Great Lakes (Griffin 1961:711 quoted in Heidenreich 1971:59). Both sites were excavated in the 1980s, using similar techniques, and their large zooarchaeological samples have been analyzed using identical methodologies and almost identical reference collections (a few additions were made during the study as noted in chapter 6). Keffer was occupied for at least 32 years, but more likely for over 50, and McKeown for at least 43 years, but more likely for over 51 years. Finally, the well-drained neutral soils at both sites resulted in very good preservation of their zooarchaeological remains. These similarities allow a meaningful comparison of the subsistence evidence at the two sites.

There are also important differences between the sites. The larger Keffer site extended over slightly more than five acres (2.1 hectares) of which at least 90 percent was excavated, whereas the McKeown village covered just under four acres (approximately 1.6 hectares) of which about one quarter (6,000 square metres) was excavated. The Keffer site included 26 middens located both within and outside its palisade, whereas no middens were found at McKeown. Although it is possible that ploughing removed some small internal middens and likely that others still exist outside the McKeown palisades, some methods of refuse disposal seem to have been different at these two villages. Inside several of the McKeown houses, including House 2, there were large pits over a meter in depth under the bunk lines, which were probably used to store corn (Pendergast 1988:5). Underground pits are an effective way to store grain because they keep out moisture and because the atmosphere of carbon dioxide which originates with the rotting of the outermost seeds is good for preservation. Pits are particularly useful for storing seed corn because the germination rates of such corn is high (Bendremer, Kellogg and Largy 1991; Wagner 1996:267). Buried corn would also be protected from vermin and possibly from house fires. Wagner notes that concealment from outsiders would be an advantageous attribute of storage pits (Wagner 1996:267-8). But once the corn was removed, these features were filled with soil and refuse, including many bones. Thus, one function of these pits might have been similar to that of the middens at Keffer. The lack of internal middens, combined with these large features inside the houses at McKeown, probably contributes to the larger quantities of faunal refuse in the McKeown than in the Keffer houses. It is unfortunate that there was not an external midden excavated at McKeown for comparison with the large faunal sample (n=9,243) from the largest midden (Midden 57) at Keffer.

To accommodate these differences, material excavated from houses will be emphasized in this chapter. The aggregated zooarchaeological remains from Keffer Houses 12, 13, 19 and 20 will be compared with those from McKeown Houses 13, 10 and 2. In addition, the faunal sample from a single completely excavated house with little or no overlap with other houses from each site will be compared. House 20 from Keffer and House 2 from McKeown will be used for this. The use of individual houses reduces the size of the zooarchaeological samples for comparison but gains the advantage of the surety that the remains compared were definitely associated with those houses. In the aggregated house samples, overlapping areas contain features with faunal remains and it is often unclear to which structure these belonged. Fortunately, House 20 from Keffer did not overlap with any other structure and there was minimal overlapping of the end storage cubical of House 2 at McKeown across the side wall of an earlier house. No faunal remains from this overlapping area are included with the House 2 sample. Analysts at the Ostéothèque de Montréal (1989:Table 1) identified 55 mammal and 29 fish specimens for a total of 84 from this overlapping region, but since it is not evident with which house these were associated they cannot be added to the House 2 totals. It seems probable that most of these were from House 6, however, considering the respective areas of overlap for each house (Figure 7-1).

At both sites, the longhouses exhibited a typical Iroquoian pattern with central hearths, benches along each side wall, end storage cubicles (Brébeuf 1635 JR 8:107-109, 1636 JR 10:91; Biggar 1929:123; Wrong 1939:93-95; Dodd 1984; Kapches 1990, 1993; Ramsden 1990:378) and floor pits containing faunal remains as well as other debris (but as mentioned above large storage pits occurred at McKeown only). Each of Keffer House 20 and McKeown House 2 likely was inhabited by 14 families (Wrong 1939:94; LeMercier 1638 JR 15:153; Lalemant 1639 JR 16:243; Ragueneau 1650 JR 35:87). Both appeared to be typical of their sites rather than special purpose dwellings. The largest house in an Iroquoian village often had additional special functions, such as being the location for village feasts (Wrong 1939:115), and its inhabitants a special leadership status (Brébeuf 1636 JR 10:101, 233; LeMercier 1637 JR 13:59; Wrong 1939:149; Tuck 1978:328; Warrick 1984:66). Neither of the two houses examined in detail in this study was the largest in its respective village, nor was either one of the smaller structures found on the sites. At Keffer, House 19 was such a small house and for this reason was deemed less appropriate than House 20 as representative of the Keffer buildings. House 20 from Keffer was longer (41.1 m) than House 2 from McKeown (38.8 m) and the area of the former was 290.57 m^2 compared to 260.0 m^2 for the McKeown house. Keffer House 20 existed for about 27 years, whereas House 2 from McKeown had a longevity of about 35 years. Perhaps in part reflecting the differences in duration, the larger Keffer house had only 670 macrofaunal remains compared to 1,599 from the McKeown house.

A Comparison of the Meat Diet at the Keffer and McKeown Sites

Despite the differences in the NISP totals (Table 8-1), the specific zooarchaeological remains found in these houses and across both sites suggest that the quantity of meat per family was greater at the Keffer site. When MNIs are used as the measure of abundance, 26 families in four houses at Keffer averaged 23.57 kg of meat each and 14 families in House 20 had 36.19 kg, whereas at McKeown 30 families in three houses averaged only 20.04 kg and the 14 families in House 2 only 22.88 kg. When the individual house totals are divided by the number of years they were occupied, the difference is even greater. The families of Keffer House 20 had 36.19 kg over 27 years or 1.34 kg per year, whereas the McKeown House 2 families had only 0.64 kg per year over 35.5 years (Figure 8-1). Thus, the Keffer families appear to have had more meat than did those at McKeown.

These meat figures are based on the MNIs of the various species, a procedure recommended by Klein and Cruz-Uribe (1984:32, 37) and the one which seems most suited to Iroquoian material, where most of the bones are fragmented and mammals of different skeletal ages are exploited. But, as mentioned in Chapter 5, MNIs are derived from NISPs and Grayson has argued that their relationship can be expressed by a power function equation (Grayson 1984:68). Obviously increases in MNIs depend on increases in NISPs, but Grayson has shown that the relationship is hyperbolic, with the higher NISPs producing decreasingly fewer MNIs than the lower NISPs (*ibid.*). In the Keffer aggregated houses sample (Table 6-23), mammals with NISPs under nine have MNIs of one. Most of those with NISPs between nine and 20 had MNIs of two. (Beaver was odd probably because the practice of saving beaver teeth affected beaver totals as discussed above. Woodchuck was also odd in that it was represented by four individuals even though it had a NISP of 19. Many of these were mandibular, which might indicate a special selection or retention of this element.) After 19 there is a gap until a NISP of 72 which produced a MNI of three and then a NISP of 143 with a MNI of five, which was the highest MNI figure for the Keffer house samples. Similarly, at McKeown (Tables 7-5 and 7-6), in the combined house deposits, mammals with NISPs of less than eight had MNIs of one (except for the unusual number of deer mouse mandibles). Those between eight and 28 had MNIs of two, except for the raccoon where the NISP might have been inflated because many of the specimens were immature (chapter 5). Those with NISPs of 35 and 36 had MNIs of three, and those with 140 and 170 specimens had MNIs of four. These findings support Grayson's claim, with a few irregularities, and thus comparisons of number of specimens to the number of individuals (NISP/MNI or MNI/NISP) cannot be made without accounting for sample size (NISP). Such comparisons are usually made for investigating amounts of fragmentation and/or culling and transportation practices. They will not be emphasized in this study. However, acknowledging the relationship between MNI and NISP, it might be useful to consider the meat poundage using the NISPs as the measure of abundance despite limitations of NISP for comparisons, particularly interdependence and the different number of bones in the complete skeletons of different animals (chapter 5).

Using NISPs to determine the meat weight amounts results in a reversal of the results obtained when MNI figures are used as the measure of abundance because NISPs were higher at the McKeown site (Table 8-1). However, this contradictory result can be explained by a non-dietary factor. As mentioned above, more of the skeletal refuse from animals consumed at McKeown appears to have remained in the houses, whereas most of the refuse of the Keffer meals was deposited in middens outside the houses. Despite this "handicap" at Keffer, enough remained within the houses there to indicate that the individual animals accounted for larger meat quantities than those represented in the McKeown houses, despite their presumably more complete refuse sample. One solution to this problem of differential deposition practices would be to examine all the remains from both sites. Then whether the garbage was deposited in middens or house pits, all the refuse surviving on the sites would be included in the faunal samples and these could be compared to all the families. Unfortunately, this is not possible at this time. Not all the excavated faunal material from the Keffer site has been identified and no exterior middens have been dug at the only partially-excavated McKeown site. Using what is available, the midden material from the Keffer site could be combined with the house material for comparison with the McKeown sample. When this is done, the Keffer material clearly dominates with a total fish meat weight of 4,407.71 kg and a mammalian total of 30,739.18 kg compared to 939.89 kg of fish and 14,022.58 kg of mammalian meat for McKeown. Based on these two classes, the Keffer total is more than twice that of McKeown, and the bird and reptile remains would increase the difference (Tables 6-1, 7-1). Although this result is complimentary to the MNI-based results, it is not valid because many Keffer families, other than those in Houses 12, 13, 19 and 20, likely added refuse to the largest midden (Midden 57). The differences in deposition practices favour the McKeown houses having larger faunal samples. The MNI figures are biased by this too but, despite that, there is evidence of more meat represented by the individual animals (MNIs) found within the Keffer houses than the McKeown houses.

In addition to the differences in deposition practices, the disparity in the numbers of *Canis* sp. at the two sites favours a larger NISP total at the McKeown site. There scavenging would have been much less destructive of the zooarchaeological sample than at Keffer, where dogs were common. Wing and

Quitmyer's (1992) experimental work on the effects of scavenging on faunal samples included examination of the accuracy of the NISP and MNI

> in reflecting the relative abundance of the species represented in the faunal assemblage. The experimental results indicated that MNI more closely reflected the complex of animals deposited. The reason is that when scavengers take hold of a discarded carcass, the grasped portion is pulled off the site, leaving behind a fragmentary representative of the individual (Wing 1994:311).

Considering the inherent problems in MNI and NISP as measures of abundance and the specific difficulties for comparisons between these two sites, perhaps the ordinal rankings of the various species within their samples are best for comparisons. At each site, the ordinal rankings of species by NISP (Table 8-2) and MNI (Table 8-3) are very similar; some differences occur in the McKeown sample depending more on which sample (macrofaunal only or macrofaunal plus microfaunal) is used.

The differences between the Keffer and McKeown site zooarchaeological samples are not a result of differences in the proportions of the major *classes* of animals (Table 8-4, Figure 8-2). Ignoring invertebrate and unclassified specimens, fish NISPs account for about 62 percent of the identified vertebrate samples at both sites. Fish bones are followed by mammalian remains whose proportions are also very similar, accounting for 30 percent of all the Keffer classified vertebrate specimens and 36.8 percent of those from the McKeown material I studied. The Ostéothèque de Montréal sample was 57 percent mammalian and 36 percent fish, but the lack of floated material in their sample almost certainly explains the reversal of the class NISPs. There are differences in the remaining classes, but as their contributions are minimal and their members relatively light-weight individually their variations in representation are not very important. An exception to this might be some large birds, and these were more common at Keffer. Since the class distributions do not account for the differences between the two sites, the genera and species within the classes must be the significant variables.

Among the fish at Keffer, trout sp., whitefish, and bullhead catfish are usually ranked in the top positions (Table 6-22). The only exception is that pumpkinseed is in third place by MNI for the aggregated house sample. Bullhead catfish falls one (House 20) or two places (all four houses) using NISPs, from first place by MNIs, probably reflecting the fewer bones in a catfish skeleton than in many other species. Northern pike is ranked fourth by both NISP and MNI in the four Keffer houses. Considering House 20 alone, pike ranks in fifth position after sauger/walleyes by NISP, whereas by MNI it is in second place with trout. The remaining species in House 20 have MNIs of only one and the lowest NISPs in the sample. The Keffer fish ordinals remain the same whether the macrofaunal alone or the macrofaunal and microfaunal sample is used. This is because so little of the soil in the houses was floated.

At McKeown, in the macrofaunal sample, suckers and sauger/walleyes rank first or second by NISP (Table 8-1) and MNI (Table 7-4) in all three houses and in House 20 alone (Table 7-3). These are smaller fish than the two top ranked species at Keffer. With the microfaunal material added, these two species remain at the top, except that the American eel, by NISP, ranks between the sauger/walleye and sucker specimens in House 2 (Table 8-2). Eel is in third place in the aggregated houses sample. American eel ranks fifth by MNI and sixth by NISP in the macrofaunal sample from the four houses. Using MNIs, third spot in the aggregated houses, float-included samples, is shared by sauger/walleye, American eel, brown bullhead and bass sp. (Tables 7-4). In House 2, with the float, the third and last group of fish includes bowfin, whitefish sp., rock bass, and bass sp. (Table 7-12). The greatest change in ranking between the two abundance measures occurs for perch when the floated material is included. By MNI, for the aggregated houses (Table 7-4) perch was in first place and tied for second place in House 2 (Table 7-12), but by NISP (Table 8-2), perch ranks fourth both in all the houses and in House 2 alone. The difference reflects difficulties in collecting and identifying perch vertebrae relative both to their cranial bones and to the vertebrae of other fish. In the larger samples (float included) for the aggregated houses, pike and pumpkinseed are in fourth place by MNI and in sixth and eighth places by NISP. In the House 2 float-included sample, pike is tied for first place with American eel using MNI figures but in fifth spot using NISPs. The remaining low-ranked fish by MNI are also lowest on the NISP scale.

The quantities of fish species at the two sites can be described statistically. A simple measure is Brainerd's (1951) coefficient of similarity. This figure is derived by adding the differences between the percentages of like items from the two sites and then subtracting that sum from two hundred. Totally different samples have a coefficient of zero and completely similar samples, a coefficient of 200. When the NISPs for the macrofaunal fish specimens from the Keffer and McKeown sites are compared in this way, the coefficient for the aggregated houses is 68.32 and for the individual houses, only 45.29 (Table 8-5). Thus, the fish remains at these two sites are quite dissimilar.

Using Spearman's rank order correlation coefficient (r_s) corrected for tied values in the rankings, the macrofaunal fish NISPs at these two sites show a positive correlation when they are aggregated for the houses ($r_s = 0.45$, Table 8-6) and a very weak negative correlation when the remains from McKeown House 2 are compared to those from Keffer House 20 ($r_s = -0.06$, Table 8-7). When the microfaunal samples, which were predominantly fish and much more numerous for McKeown, are included, the figures change slightly, becoming 0.5 (Table 8-8) and -0.02 (Table 8-9) respectively. These are statistically significant at the .05 level for the aggregated houses but not for the individual houses. Based on MNI figures, the r_s for the macrofaunal samples for the aggregated houses is 0.25 (Table 8-10) and when the float samples are included the $r_s = 0.27$ (Table 8-11). A slightly negative correlation of $r_s = -0.09$ is obtained when the MNI rankings of fish species from McKeown House 2 and Keffer House 20 are compared, including the float, in order to have fewer values of one for MNI in both lists (Table 8-12). Since some of these results are only slightly positive and others are slightly negative, they indicate that the samples are different and that there is no relationship between the fish at the two sites. However, none of these MNI-based figures is statistically significant at the .05 level. In sum, the rankings at

McKeown are independent of those at Keffer and they are different.

The importance of these differences increases when one considers the amount of meat the various species provide. Comparing the rankings, it is apparent that the largest meat providers of all the fish species represented at both sites (trout and whitefish) are ranked usually in the highest two positions at Keffer but in the two lowest positions at McKeown. The top provider per fish was lake trout and this species was identified at Keffer only. Catfish, particularly brown bullhead, is ranked higher in the Keffer than the McKeown samples; similarly pumpkinseed is higher at Keffer although bass, some of which are equally good meat providers as pumpkinseed, rank higher at McKeown. Conversely, suckers, which rank highly at McKeown, often first, are very small meat providers, as is the yellow perch which ranks highly at McKeown also. Thus, the rankings of the fish species suggest that the Keffer fishers caught the larger species more frequently than did the McKeown fishers. The latter brought smaller fish home, which suggests that they might have expended more effort with less result, but this would depend on the various fishing methods used and distances travelled to reach the fishing spots.

Wild North American mammals have less diversity in total numbers of bones in their skeletons than fish. Thus comparisons based on NISPs and MNIs should produce more similar results for mammals than fish. However, a more significant problem with mammalian remains from Iroquoian sites is that most are broken, inflating their NISPs. This bias for NISP increases the use of MNI by researchers. Both will be reported here. Floatation does not increase mammalian specimen totals as much as it does those of fish and the mammalian additions are generally to the very small mammals which are rather insignificant for diet reconstructions.

As was done for the fish remains, the mammalian rankings by NISP and MNI can be considered statistically, using Brainerd's coefficient of similarity and Spearman's r, corrected for tied values. The material from the float samples is included in these comparisons, in order to have the largest possible samples. The mammal NISPs reveal that the species represented in this class are more similar than were the fish remains. Brainerd's coefficient for the aggregated houses was 114.22 and for the individual houses, 118.83 (Table 8-13). These numbers indicate that the samples were slightly similar, a finding which is replicated when Spearman's r is compiled. For the aggregated house samples, using the NISP figures, $r_s = 0.34$ (Table 8-14) and for the individual houses $r_s = 0.30$ (Table 8-15). The results are even less positive with the MNI rankings. For the aggregated houses, $r_s = 0.02$ (Table 8-16) and for the individual houses $r_s = 0.17$ (Table 8-17). These statistics suggest that, while there are similarities in the two samples, they are not same.

Keffer House 20 mammalian remains fall into three groups. Deer is first both by NISP (Table 6-8) and MNI (Table 6-23). Those mammals in second to fifth place by NISP are in the second group by MNIs (MNI=2). Those in the third MNI group (MNI=1) are at the bottom of the NISP list too. The only exception is the skunk. There were only two skunk specimens, but, surprisingly, they were the same elements. Thus, the skunk's MNI ranking was higher than its NISP ranking. The elements were mandibles and possibly represent something other than food refuse.

Similarly, the McKeown House 2 mammalian remains were dominated by deer specimens by both NISP (Table 7-2) and MNI (Table 7-12). The three mammals with MNIs of two (beaver, muskrat and porcupine) ranked in positions two, three and six by NISP. The red squirrel (MNI=1) advanced to position five by NISP but *Canis* sp. (MNI=2) dropped to the third lowest position in the NISP ranking. These changes suggest a lower mammalian meat total, considering NISP values, because the squirrel is light-weight, whereas each *Canis* sp. contributes an estimated ten kg of edible flesh.

As well, the effort to obtain dog meat was minimal and thus the difference in position of this species between the two sites is perhaps more significant than that of the other mammals. At Keffer, dog consistently ranked higher than its position at McKeown in all comparisons. At McKeown the *Canis* sp. NISP was based on two unmodified ulnae, which might represent something other than food refuse. It is certainly odd that only two *Canis* sp. elements were recovered; that they were the same element is even more surprising. Moose, the largest single meat contributor, was found at Keffer only. Of the two third-ranked species by NISP in both the individual and aggregated houses samples, the woodchuck at Keffer (Table 6-8) provides more meat per individual than the muskrat at

McKeown (Table 7-6). However, black bear ranks fourth in the McKeown aggregated houses sample by NISP and 4.5 by MNI, whereas it is 10 (NISP) and 14 (MNI) at Keffer. The differences are not as great for the individual house samples, but still bear ranks higher at McKeown, as does beaver, in all the comparisons. However, raccoon is a fairly good meat contributor and it places higher at Keffer in all rankings. At both sites, small mammals, with the exceptions of the *Canis* sp. and otter at McKeown, fill the last positions. Thus, the mammal rankings indicate some advantages to each site. Bear and beaver being high at McKeown are important for that site. Alternatively the high placement of dogs and the occurrence of moose are significant for Keffer as are the higher positions of woodchuck and raccoon at Keffer. Thus, the differences in mammalian rankings appear to favour Keffer but not as definitely as the fish remains did.

The other classes were poorly represented. Too many of the species in these classes were represented by MNIs of one to allow useful comparisons based on this quantification method. However, among the birds, by NISPs ruffed grouse were important at both sites but the large wild turkey occurred at Keffer only, where it ranked second followed by passenger pigeon and several other weakly represented birds (Table 8-2, Figure 8-5). At McKeown the largest bird, the Canada goose, ranked second in House 2 but only fourth in the combined house sample. Brainerd's coefficient of similarity for the aggregated houses using the species' NISPs for the macrofaunal sample is only 78.59 and that for the single houses is 88.79 (Table 8-18), indicating dissimilar samples. Using the NISPs for the bird species from the aggregated samples, Spearman's coefficient, corrected for tied rankings, shows a negative correspondence of -0.13 (Table 8-19). Thus, while birds were not important at either site, the particular species were significantly different. Thus, consideration of the rankings of the represented animals from these three classes reveals only small variations between the MNI and NISP ordinals and most of the differences would appear to affect adversely McKeown meat weight totals.

Meat Poundage by Species at the Two Sites

Ranked by meat poundage totals based on MNI figures (Table 8-3), members of the class Mammalia were the greatest contributors of meat at both villages. This finding counters the view that Iroquoians "had a well-developed agricultural economy, supplemented by fish and *lesser amounts of meat*" (Heidenreich 1971:158, italics added). At both sites, whitetail deer was a very important contributor (Figure 8-3). By NISP and MNI, it is ranked first at both sites, although by meat contributions, in my sample from three McKeown houses, bear out-ranks deer. These top rankings confirm historical reports that deer and bear were the most significant meat contributors (Biggar 1929:81; Lalemant 1642 JR 23:63). The dominance of deer has great significance for the comparison of subsistence at these villages because "the Upper St. Lawrence region supported much lower numbers of deer than other parts of Iroquoia, even Huronia for which deer availability problems have been reported" (Cossette 1993:62). Because the density of human beings was lower in the upper St. Lawrence region too, there might have been sufficient deer for the upper St. Lawrence Iroquoians (ibid.), but it would have been more difficult to exploit deer there since their densities were lower. The Canada Land Inventory maps indicate that the Toronto region is capable of supporting more ungulates than the Prescott area (Canada, Department of Regional Economic Expansion 1970a, 1971c).

When Radisson (Adams 1961) went hunting from the Mohawk village where he was held captive in 1652-53 to the area around Lake Champlain and up to the St. Lawrence River, the party saw many bears, particularly around the Thousand Islands (ibid.:57). This evidence indicates that black bears were common immediately southwest of the Grenville County area in the past. They might have been more common there than in York County. This might account, at least in part, for their first or second place rank among the mammals in the McKeown houses.

An importance difference in the mammalian frequencies was the secondary rank of moose at Keffer, contrasting with its absence in my McKeown sample (Table 8-3). Moose was the largest individual meat contributor and it accounts for much of the difference between the two sites. But this difference is reinforced by the third place species. At Keffer, the third ranked meat provider was black bear compared to beaver at McKeown. Thus, the top three species at Keffer were all large meat providers, whereas at McKeown third place was filled by only a medium-sized creature, the beaver, whose value might have been inflated by the selective collection and curating of its incisors.

Canis sp. occupied the fourth position in both sites' aggregated houses samples. However, at Keffer there were numerous dog remains, some of which showed evidence of butchering (N=8) and burning (N=84), whereas at McKeown domestic dog remains were absent and there was only a single wolf giving this species its rank. According to Sagard (Wrong 1939:220), dogs were the third most important mammal for food among the historical Hurons. Possibly the importance of dogs increased with time. The great difference in their representation at the two sites increases in significance when it is remembered that dogs, living in the village, could have been used as a safety net for times when meat supplies were low, reducing or eliminating periods of temporary stress due to hunger (Wrong 1939:226; Le Jeune 1634 JR 7:223). Such times of reduced nutrition are when people are more susceptible to diseases, and there are historical accounts of dogs being eaten in curing feasts by the Hurons (Biggar 1929:129; Wrong 1939:220).

Beaver was sixth at Keffer and porcupine was absent there, whereas porcupine was in sixth position at McKeown, using the aggregated houses rankings. Raccoon and woodchuck followed at both sites and after these the mammals occurring at both sites are ranked very similarly because most are reduced to MNIs of one and hence their ordering reflects their body sizes. However, despite these similarities, Brainerd's coefficient of similarity based on the percentages of the meat provided by the species in the aggregated house samples is only 109.45, but for the individual houses it is 132.66 (Table 8-20). Spearman's rank order values also suggest differences between these two sites' mammal meat sources, although none is statistically significant at the .05 level. When the aggregated house samples are compared $r_s = 0.20$ (Table 8-21) and for the individual houses the value is only 0.08 (Table 8-22). These figures may err on the conservative side because they include the contribution that *Canis* sp. might have made to the McKeown diet, even though it is very possible that the *Canis* sp. remains at this site were from wolf which was listed separately or are not indicative of food.

By class, fish are the second most important contributors to the meat poundage figures. Within this class an important difference between the two sites is the heavy reliance on whitefish at Keffer (Table 6-22), as opposed to its absence or, at best, weak representation in the McKeown sample (NISP for *Coregonus* sp.= 7). In the Keffer material, whitefish ranked first in the aggregated sample and second in House 2, whereas at McKeown, whitefish was in seventh and second place respectively. It is known from the ethnohistorical literature that large quantities of whitefish could be netted and prepared for eating months after their seasonal availability. The particular whitefish elements identified in the Keffer zooarchaeological sample indicate that such procurement and preparation techniques were known at least as early as when this site was occupied. This, in turn, suggests that the Keffer proto-Huron/Petuns had a surplus of food and a knowledge of preparation techniques that provided them with a stored supply of fish meat for the winter months (Figure 8-4).

On the contrary, no species dominated the McKeown fish. By NISPs, the numerous members of the sucker family and the species of the genus *Stizostedion* were greatest, but by the MNI-based meat weight figures, bass of the Centrarchidae family (12.75 kg for the three houses) dominated (Table 8-23). The bass were also significant at Keffer, where the family ranked second among the fish for meat contribution. At McKeown, the salmon family, represented mainly by trout but including *Coregonus* sp., was a significant contributor as was the perch family. Perch ranked much lower at Keffer, after the catfish and pike families, both of which are larger meat suppliers, individually, than perch. At McKeown, the combined catfish meat contributions ranked the Ictaluridae family fourth, followed by the equal meat contributions of the sucker, pike and eel families. That sucker ranked so low in meat poundage, despite its high NISP placement, suggests that much fishing effort produced only limited returns of edible flesh.

The relatively low placement of eel at McKeown is of particular interest. According to ethnohistorical sources and archaeological evidence, such as that from the Steward site, there was along the St. Lawrence River a special fishery for eels in the fall and the catch was prepared for later consumption. Thus, eels seem to have filled a role for the St. Lawrence Iroquoians parallel to that filled by whitefish for the Hurons. But at McKeown, the evidence for this is slight. [It is interesting that the occupation of this site corresponds to a period of reduced activity at the Steward fishing site. There, peaks in activity occurred at about A.D. 1150, 1385 and 1550 (Junker-Andersen 1984, 1988:97).] Assuming that the roles of eels and whitefish were analogous, it seems that whitefish provided a more profitable fishery than eels. In addition to the differences in the proportions of these two species at the two sites, a whitefish on average provides 3.52 more kilogrammes of meat than the average American eel. Thus, not only does the practice of fishing and preparing whitefish appear to have been more successful at Keffer than eel fishing and storage at McKeown, but also the effort would have resulted in a greater reward per fish. Eel ranked sixth at Keffer and was followed by drum, bowfin and suckers. Similarly, drum and bowfin had low ranks at McKeown as did some morone bass and minnow species.

In sum, from the rank orderings of the fish families, it is evident that mostly the same ones were exploited at both sites but to varying degrees. Based on the rank ordering of the fish families according to the amount of meat they contributed and using the aggregated house samples in order to have larger and thus more discrete quantities, Brainerd's coefficient of similarity is 111.38 (Table 8-23) and Spearman's r is 0.9 (Table 8-24), which is statistically significant at the .05 level. More fish families were represented at McKeown, where perches and suckers were more important than they appear to have been at Keffer. Apparently, the richness of the fishing effort was greater at McKeown but diversity appears to have been greater at Keffer. The Keffer people were able to amass a surplus of whitefish which they stored for later consumption, possibly in leaner protein periods. The McKeown people could not do this because whitefish are not native to the waters in their region. At Keffer, a surplus of catfish also might have resulted in special preparation and use. While the St. Lawrence Iroquoians prepared dried eel for later consumption, the evidence from McKeown does not show this to have been a major activity, although the relative infrequency of eel remains on the site does not necessarily negate the possibility of a good eel fishery. Most of the prepared fish skeletons could have been discarded at the special fishing sites, but temporally corresponding evidence for this is also lacking at the Steward site.

Bird meat formed a minor portion of the diet at both sites, so there is little to compare (Figure 8-5). However, once again the Keffer sample exhibits greater rewards for the individual birds caught (Table 8-1). The top two ranked birds in the Keffer sample, the wild turkey and the bald eagle, each weigh more per bird than the highest ranked one, the Canada goose, from the McKeown fauna. Like whitefish, the large turkey was not available in the vicinity of the McKeown site; south-central Ontario was the northern extent of its range. While turkeys did occur as far north as Huronia in the seventeenth century (LeMercier 1637 JR 13:97), according to Sagard, they were more common in the Neutral area of southwestern Ontario (Wrong 1939:220). During cold winters, such as those of the Little Ice Age, turkeys would have been limited to southwestern Ontario and the north shore of Lake Ontario, when they were not restricted to areas south of Lakes Erie and Ontario.

Both Brainerd's and Spearman's coefficients show the great differences in avian meat at these two sites. Brainerd's coefficient for the aggregated houses is only 17 and for the individual houses it is 15.62 (Table 8-25). The Spearman's ranking value for the comparison of the avian meat at the two sites, using the MNIs from the aggregated house samples, indicates that in this the two sites were very different because $r_s = -0.86$ (Table 8-26). For the individual houses, $r_s = 0$ (Table 8-27). The sample included only seven species of which only one, ruffed grouse, was represented in both houses.

The Keffer people appear to have made use of a wider variety of reptiles and amphibians than did the McKeown villagers, but the reverse was true for invertebrates. At neither site were clams significant meat sources, but McKeown produced many such shells which had been heated. Invertebrate remains from Keffer were not studied, in part because their scarcity in the deposits gave the impression that they were insignificant. Since invertebrates have long been considered a "starvation" food (G. Bailey 1975; Cohen 1975), although possibly a seasonally significant one (Parmalee and Klippel 1974; Erlandson 1988), particularly in coastal areas (Waselkov 1987), it is of interest that at the McKeown site they appear to have been gathered in fairly large numbers (Stewart 1992). The low incidence of artifacts made of shells supports the assumption that they were a dietary component (Wright and Wright 1993:5). Conversely, at Keffer, where they were infrequent, they were used as a raw material for tools as often as was antler and tooth (J. Jamieson 1993:52, Fig.1b).

In this discussion of the meat at the two sites, the classes have been considered independently of each other and the greatest differences in the meat diets have been found in bird followed by mammalian and finally fish meat. When the species from these classes are combined and their meat contributions for the aggregated houses are ranked, $r_s = 0.23$ (Table 8-28), which is statistically significant at the 0.1 level, and Brainerd's coefficient is 106.07 (Table 8-29). The correlation is closer when the fish, bird and mammal species from the two individual houses are ranked according to their meat contributions. In this case, Brainerd's coefficient is 133.1 (Table 8-29) and $r_s = 0.17$ (Table 8-30). These figures indicate a weak positive correlation reflecting the fact that the samples have similarities, but they also differ in terms of the importance of many of the species as contributors to the quantities of meat in the diets. The question of differences in the quality of the diets will be addressed next.

Nutritional Values of Meat at the Two Sites

While it has been established that the total meat poundage per family was greater at the Keffer than at the McKeown village, it is interesting to compare the nutritional differences, if any, in the animals consumed by the two populations (Table 8-31). The major nutrient components of food are proteins, carbohydrates, lipids (fats and oils), vitamins and minerals. Mammalian and avian game are the major sources of protein, fat, iron, vitamin A, thiamin, riboflavin and niacin (Canada, Ministry of Health and Welfare 1994:34).

"It is known that fish and shellfish are excellent sources of high-quality proteins, comparable to those found in meat and poultry. Most raw fish is 16-24% protein and this can rise to as much as 35% in cooked fish" (Pigott and Tucker

1990:3). According to Sidwell (1981 quoted in Pigott and Tucker 1990:41), most fish have a protein percentage of 20 ± 2, although Geiger and Borgstrom (1962:33) list slightly lower figures, which agree with those found in my survey of the literature (Table 8-31). The fish species represented at the Keffer and McKeown sites indicate that the Keffer fishers might have been better nourished by this class, since whitefish have higher protein proportions, especially when smoked, than do American eels. The American eel has one of the lowest values in protein of all the species listed in Table 8-31.

Fish are also an excellent source of niacin and trace amounts of essential minerals such as zinc, copper and iodine (Canada, Ministry of Health and Welfare 1994:35). Fish livers are a good source of vitamins A and D, riboflavin and calcium, while fish eggs provide protein, calcium, iron and thiamin (ibid.).

Mammalian meat has a protein content of 21 percent according to Watt and Merrill (1963), although Pigott and Tucker (1990) cite lower percentages for domesticated species. The figures in Table 8-31 are higher than these because most wild game is much higher (as much as 50 percent higher according to Canada, Ministry of Health and Welfare 1985:25; 1994:34) than domesticated species in nutrients other than fat. Thus, mammals, as a class, might be a slightly better source of protein than fish but all classes provide almost equal amounts of this essential dietary component. Since amounts of mammalian meat per hearth were higher at Keffer than McKeown, it appears that the protein intake per family for these proto-Huron/Petuns was slightly greater than that of McKeown's proto-

St. Lawrence Iroquoians.

There is less information about the nutritional qualities of avian meat. However, the protein in chickens averages 19.3 percent, with the light meat being slightly higher (23.4%) than the dark meat (20.6%) and the skin considerably less (16.1%) according to Watt and Merrill (1963:23). Their percentages for wild duck average 21.2 (ibid.:30), and for domestic turkey 20.1 (ibid.:63). "Wild birds are an excellent source of protein, iron, riboflavin and vitamin A" (Canada, Ministry of Health and Welfare 1994:36). Likely the protein proportion for wild turkey was higher than 20 percent, making it a good protein source for the Keffer inhabitants. Similarly, the top ranked Canada goose at McKeown presumably provided considerable protein (Tables 8-2 and 8-3). The amount of protein in an animal remains fairly constant throughout the seasons, so it is probable that both the Keffer and McKeown villagers had sufficient protein in their diets throughout the year, especially since the meat diets were augmented with plants, such as corn and beans, which also provide some protein (Table 8-33).

The primary source of carbohydrates is plants. "The carbohydrate content of finfish is insignificant ..." (Pigott and Tucker 1990:42), as it is in mammals (Speth and Spielmann 1983:2) and birds (Watt and Merrill 1963). Small amounts are found in freshwater molluscs (Claassen 1991:280-281). However, at both the Keffer and the McKeown sites, corn would have provided most of the villagers' carbohydrate intake (see below).

In contrast to carbohydrates, lipids (fats and oils) are obtained from animals with only minimal amounts occurring in plants. "Fats and oils are a concentrated source of energy" (Canada, Ministry of Health and Welfare 1994:41) and the deciding ingredient of the calories provided by each food source. In general, mammalian meat is the richest source, followed by avian meat and then fish, which is usually low in fat; however, the fattier fish are a good source of vitamin A (ibid.:35).

Unlike protein, fat content changes dramatically throughout the year in many animals. Ungulates become fat-depleted at different seasons, depending on their sex, but both males and females are fat-depleted in the spring (Speth and Spielmann 1983:3). In the fall, their nutrient values are high. Similarly, animals that hibernate, such as bears, build up fat reserves in summer and early fall but become depleted in fat as winter ends. Some fish, particularly salmon, and birds also change their body compositions with their sexual and migratory cycles (Pigott and Tucker 1990:5) and there can be a considerable range in values within a species (Jacquot 1961:147). The age of an animal also affects its fat content, as Paul and Southgate (1978:142) noted for eels in particular.

Such changes in prey body composition can be of critical importance to hunters and gatherers (Speth and Spielmann 1983), but would not have been as significant to the horticultural Iroquoians. They did not have to rely as heavily on animals for their food; their required lipids could be obtained in corn, possibly in sunflower seed oil and in nuts. In addition, they could eat dog or perhaps captive bears or turkeys when wild meat supplies were unavailable or when their nutritional values were reduced.

Since red mammalian meat is the best provider of lipids (Watt and Merrill 1963), it can be concluded that the Keffer inhabitants ingested higher quantities of fat and fatty acids than did the McKeown population, since the former had more meat per family and most of these totals reflected mammalian contributions. Examination of the fat content of the top ranked mammalian species at the two sites shows little difference between them. Cooked moose and bear yield equal amounts of fat (Table 8-31), but beaver provides more fat and calories per portion than ungulates do. Raccoon, which followed in the Keffer rankings, is a very fatty animal, whereas the porcupine, important at McKeown but not at Keffer, is only half as valuable in terms of fat, and thus calories, when the flesh of both these mammals is roasted. At both sites, the fatter woodchuck and hares were more common than the leaner muskrat. At both sites, the largest animals were not the richest ones consumed. When the mammals ranked below the ungulates and the bear are compared, there is little difference in calories per family between the two sites, but what differences there are slightly favour the Keffer sample, mainly because raccoon and woodchuck rank higher there and porcupine lower. In addition, most wild animals lose fat over the winter, but dogs, being good scavengers and/or purposefully fed, could have maintained their fat content throughout the year. Thus, as Snyder concluded (1991:374-75), dogs at certain times of the year may have been an important alternative source of nutrients for Native North Americans. If this applied to the proto-Iroquoians, then again the

Keffer people had an advantage over the McKeown people.

There was no evidence for the chopping and boiling of bones to extract oils at Keffer but at McKeown:

> bone mash, composed of smashed masses of predominantly deer heads and fish, appear to represent the discarded remains of a process intended to extract all possible fat and protein from bone by boiling it to produce a broth or, possibly, fat for storage (Wright and Wright 1993:5).

The occurrence of this evidence only at McKeown possibly reflects a greater need to extract all possible nutrients, whereas the Keffer inhabitants might have had sufficient fat and protein not to require expending this extra effort to obtain more from the bones of their prey animals. Alternatively, they might have processed bone in this fashion at hunting camps, as the historic Hurons did. Even this would suggest less intensive extraction than at the McKeown site.

"Fish are often classified according to their oil content ..." (Pigott and Tucker 1990:5). Jacquot (1961:146) lists pike, salmon and trout among the fatty fish and bass and perch as semi-fatty. Freshwater catfish, with a fat average of 3.2 ± 1.8 (Sidwell, Foncannon, Moore and Bonnet 1974:26), are also semi-fatty fish, whereas perch at 0.9 (Table 8-31) are actually low-fat fish. Combining this information and the additional figures presented in Table 8-31 with the fish family rankings at the two sites (Tables 8-1 and 8-2), it can be concluded that the Keffer people had a richer fish intake than the McKeown people. The fatty salmon/trout/whitefish family and the fatty pike ranked higher in the Keffer sample than they did in the McKeown one, where the semi-fat bass and the low-fat perch families ranked higher. Three of the top four species in the Keffer zooarchaeological sample were fatty fish, whereas the top two at McKeown (sucker, sauger) were poor fat providers. Yellow perch were common at McKeown (Tables 7-3, 8-2) and they were the least fatty of the 19 species used by the Iroquoians for which composition data are available. However, American eels have the highest fat (17.3 ± 2.6%) content of all the 154 species listed by Sidwell *et al.* (1974) and are more than twice as valuable as whitefish in this regard (Table 8-31). It could be because of their fat that they were a special fishery of the St. Lawrence Iroquoians. The eel family, Anguillidae, ranked only sixth, with two others (Table 8-23), or fifth and sixth (Table 8-1) at McKeown but, as mentioned above, more flesh might have been eaten there than these bones represent.

Little information is available about the nutrient values of wild birds, turtles and amphibians. However, "game birds and fish may be lumped together since they provide similar amounts of protein, riboflavin and niacin" (Canada, Ministry of National Health and Welfare 1985:14) and they are a good source of iron (ibid.:27). Ducks and pigeons appear to be relatively good sources of nutrients (Table 8-31). The same is probably true for the wild turkey, since Watt and Merrill (1963:62) list turkeys, presumably domestic, as being 20.1 percent protein, 14.7 percent fat and providing 218 calories per 100 grams of edible portion. Even though the wild turkey fat composition figures would be lower than domesticated turkey values, the few birds selected by the Keffer and McKeown peoples seem to have been about equally nutritious. In general, the birds consumed by the proto-historic Iroquoians at these two sites were richer sources of fat, and thus calories, than were the mammals or fish (Table 8-31). Contrasting the sites' bird species, it appears that the McKeown inhabitants, hunting primarily geese and ducks, had a richer avian intake than did the Keffer people, who consumed more wild turkey and grouse. The passenger pigeon which, extrapolating from modern pigeons (Table 8-31), likely had a high fat content, was important to both peoples, especially since it would have migrated into Canada in the spring, just when the mammals were least fatty. In spite of the avian evidence, the diet of the Keffer people appears to have had both a higher meat content and a higher nutritional value than the diet of the McKeown people.

Plant Components of the Diets

Iroquoians cultivated corn (*Zea mays*), beans (*Phaseolus vulgaris*), squash (*Cucurbita pepo*), sunflowers (*Helianthus annuus*) and tobacco (*Nicotiana spp.*). Heidenreich (1971:173) thought that the type of squash was the summer squash, *Cucurbita polymorpha*, based on Boucher's 1664 description, but identification of archaeological seeds show that the species was *C. pepo* (Monckton 1992:2; B. Smith 1989; Fecteau 1985:35), which includes many varieties. All but three of the 136 archaeological sites which Fecteau included in his study of cultivated plants in southern Ontario produced corn remains and 46 sites had beans, 32 had squash and 17 had tobacco (Fecteau 1985:8-10). Corn, beans, squash, sunflowers and tobacco were identified at Keffer (Finlayson, Smith, Spence and Timmins 1984:9;

Finlayson, Smith and Wheeler 1987:21), although of these cultigens, only corn and sunflower seeds were noted in the float samples studied by D. Wright (1991:Table 5:18). Remains of corn, beans, squash and sunflower have all been recognized in the floated material from McKeown (Wright and Wright 1993:Table 2:4), but in Ounjian's sample, squash and tobacco were missing, due, it was thought, to the small sample analyzed (Ounjian 1988:8). These findings corroborate the accounts of Cartier (Biggar 1924:153-4), Champlain (Biggar 1929:125), Sagard (Wrong 1939:80, 105-106) and many of the Jesuits (Thwaites 1986-1901), including Brébeuf, who was particularly interested in gardening (1635 JR 8:99; 1636 JR 10:35,53,93,101); duPeron (1639 JR 15:153,159); J. Lalemant (1644 JR 27:65) and Ragueneau (1646 JR 29:247; 1648 JR 33:77; 1650 JR 35:153). Reportedly, sunflowers were grown for their oil, which was primarily rubbed on the body and hair and might not have been consumed (Biggar 1929:50, 133; duPeron 1652 JR 37:105). Tobacco, which was used ritually by the Hurons, was not a dietary item.

While the particular plants cultivated are well-known, their relative importance to each other and to the diet as a whole is difficult to determine (Monckton 1992:83-84). From both ethnohistorical accounts and archaeological materials, it has been concluded that maize dominated horticultural effort, produce and diet. Champlain estimated that about 50 percent of the Huron diet was maize, which he considered to be "their principal food" (Biggar 1929:125). Certainly the historical descriptions of the two daily meals of the Hurons indicate that corn broth (sagamité) was ubiquitous, with most of the other food stuffs being added to this soup. Heidenreich (1971:163) estimated that 65 percent of the calories making up the historic Huron diet was derived from corn, with beans accounting for 13 percent, squash for only two percent and gathered foods, by which he meant wild fruits and berries (ibid.:164), for five percent. The remainder was from fish (nine percent) and "meat", by which he seems to have meant mammalian meat (six percent). These figures are based on Heidenreich's reconstruction of the Huron subsistence system, for which he concluded that meat was unavailable in the summer. This conclusion may reflect an androcentric position. Women and children likely ate the pests they killed to protect the crops (Szuter 1994:60). These included many birds, specifically cranes, geese and crows (Brébeuf 1636 JR 10:145; Wrong 1939:220; Kalm 1935:106,114-116), as well as numerous mammals, including squirrels (Kalm 1935:115), raccoons and woodchucks. Even deer likely raided the fields. Such "garden hunting" (Linares 1976) has often been ignored in subsistence reconstructions, but studies have shown that it can be an important and even a preferred source of game (Neusius 1996). Horticulture increases the density and richness of small mammals and specializations in the procurement of such game occur. Certainly the faunal remains from the Keffer and McKeown sites show that woodchuck, for example, was a significant warm weather catch. "Garden hunting as a subsistence strategy is complementary but not restricted to agriculture. It can be done along with other activities such as field tending, collecting ... wood, and harvesting fruit" (Szuter 1994:60). In addition, the spring fishing effort would have provided food for the summer. The wild turkey and the passenger pigeon at the Keffer site were exploited in summer too. Thus, Heidenreich likely undervalued the amount of food derived from animals and the possible role of females in obtaining it.

Monckton criticized Heidenreich's percentages for another reason. "Heidenreich appears to have underestimated the importance of gathered plant foods" (Monckton 1992:86). According to Monckton, based on botanical remains from four archaeological sites in Huronia (Auger, Ball, Peden and Bidmead), the calorie figures should be: 58% maize, 2% beans, sunflower less than 1% and fleshy fruits 24% (ibid.:86). There are problems with this reconstruction too. Squash has been omitted because cucurbit seeds are rarely preserved on archaeological sites and Monckton concluded that "the relative importance of cucurbit to the Huron subsistence is impossible to evaluate" (ibid.:82). Alternatively, sunflower should perhaps have been left out, considering the descriptions of its use in historical accounts. Finally, many plants were important mostly as medicines, for example, *Galium* (D. Wright 1991:59), or as raw materials for making artifacts, for example, hemp (Wrong 1939:240; J. Lalemant 1642 JR 23:55, 1643 JR 26:203-205). Certainly some palaeobotanical samples do not reflect dietary items.

Quantification problems which hamper faunal remains are greatly exaggerated for palaeobotanical samples (Fritz 1994:22-23; Yarnell 1982). Only plant parts which have been charred by fire are preserved and these would represent only a very small proportion of the plants eaten by the Iroquoians, which they cooked mainly by boiling (Tooker 1967:67-71). Secondly, fire would consume completely most plant material exposed to it. Greens, tubers and fleshy fruits are probably under-represented because they were rarely cooked and because they lack hard parts which could survive exposure to fire. The dominance of corn over other cultigens in archaeological contexts might reflect, in part, that corn was frequently roasted in embers or ashes (Biggar 1929:129; Wrong 1939:72). Like corn, squash was cooked by boiling (Biggar 1929:131; Wrong 1939:107) or in ashes (Brébeuf 1636 JR 10:103), but the centrally-located squash seeds seem not to have been burnt during cooking. Beans were boiled or ground and added to corn flour (Wrong 1939:105), inhibiting their chances for preservation. In addition to the fortuitous nature of plant preservation, the limitations of MNIs, which were discussed for animal remains, are accentuated in plants because the numbers of their identical parts are greater and show more variation than like parts in animals. For example, each corn stalk "bears two or three ears, each ear yielding one hundred, two hundred, sometimes four hundred grains and there are some that yield more" (Wrong 1939:104). Similarly, there are many seeds on a single raspberry or strawberry. The palaeoethnobotanists Vaughn Bryant and J.Philip Dering have recently concluded that presence/absence of remains (ubiquity technique) is the most precise quantification that palaeoethnobotanical material allows (1995:38). Crane and Carr (1994:68) and Fritz (1994:25) also recommend the ubiquity method. Furthermore, since the sampling methods from the Keffer and McKeown sites were not the same, comparison of the numbers of seeds between the two sites would not be meaningful. Different screen mesh sizes were used for retrieving seeds (Wright and Wright 1993:2; Ounjian 1988). In addition, for the Keffer material D. Wright "decided to limit the process of seed separation in each individual floatation sample to a maximum time limit of one hour" (1991:4) for forty of the sixty-one floatation samples taken from nine areas on the site (ibid.:5). The majority of these (58%) happened to be from House 20. A different selection method was used at McKeown; an experimental sampling technique of taking one litre of matrix per feature resulted in very limited seed recovery (Ounjian, personal communications 1995). Considering both the intrinsic limitations of palaeobotanical quantification and the particular difficulties due to differing methodologies used for the Keffer and McKeown materials, the plant remains from these two sites will be considered in general terms only.

Nutritional Values of Plants at the Two Sites

There were many wild species represented in the palaeobotanical materials from both the Keffer and McKeown sites, despite the sampling limitations (Table 8-32). Table 8-33 gives the nutrient composition of the Iroquoian cultivated and domesticated plant foods for which published values were located. Non-duplicating sources and North American studies have been used for this table, except for the sunflower oil figures which are based on an English sample. Changes result from preserving and cooking and, where available, the values for food treated in ways recorded in the ethnohistorical literature have been included. Since much of the food was boiled and the broth was consumed, the loss of nutrients would have been less than in modern European meals where the cooking water is usually discarded.

Maize is a good source of energy but a poor source of protein (Styles 1994:48). Corn kernels contain mainly carbohydrate (starch) but they have limited amounts of protein and provide more fat than many other plants and thus yield large numbers of calories (Table 8-33). However, because corn lacks the essential amino acids, lysine and tryptophan, its protein is not readily available to human consumers, making its nutrient value low when consumed by itself. This can be raised by adding ashes, which could have been included accidentally by some roasting (Wrong 1939:101, 106, 108) and baking methods (ibid.:105) or purposefully by being added to cooking water (duPeron 1639 JR 15:163). As well, mixing maize with ash "does significantly improve the iron content of the resulting food" (Ezzo 1994:271) and the calcium content (ibid.:270). When corn is combined with beans, as was the case in Huronia (Biggar 1929:125) and at McKeown (Wright and Wright 1993:5), a complete protein results because beans are high in lysine and tryptophan. Conversely, corn supplements beans' low sulphur-bearing amino acids, methionine and cystine, and thus together, these "two sisters" become very nourishing (Manglesdorf 1974:1-2; Ezzo 1994:271). Beans also contribute calcium, B vitamins, riboflavin and nicotinic acid which are deficient in corn.

The third sister in Iroquoian mythology and horticulture was squash, which is much less nutritious than the other two in all categories (Table 8-33). However, squash contributes some calories and the seeds are good sources of protein and oil. Fecteau gives even higher values than those found in Table 8-33. According to him, squash seeds provide 50% unsaturated oil and 35% protein (Fecteau 1985:36). Oily seeds are a very good source of phosphorous (Styles 1994:47). Squash has some vitamin C and is rich in vitamin A, unlike beans, fish, meat or most fruit. Corn has only moderate amounts of vitamin A (Heidenreich 1971:166, Tables 12 and 13). Similarly, sunflower seeds are rich in protein and fat (Table 8-33) and are an "excellent source of iron" (ibid.:39).

In all the categories listed in Table 8-33, the cultivated crops have higher values than the wild plants, except for the carbohydrate contents of wild rice and maple syrup. Many of the berries, and in particular hawthorn, have higher carbohydrate values than does squash. Despite these specific anomalies, the information in Table 8-33 allows the conclusion that the cultigens were the main sources of carbohydrate, protein and fat and that they provided the most plant calories.

Non-cultigens were reportedly added to corn dishes to improve flavour (Wrong 1939:105; Biggar 1929:126). Common fleshy fruits, such as strawberries, raspberries and blackberries (Brébeuf 1636 JR 10:103; Biggar 1929:50; Wrong 1939:72, 74, 238), in addition to adding flavour to regular meals and small cakes, were fed to the sick (Wrong 1939:237). Likely the high vitamin C content in such fruits aided recovery. These fruits are the best represented non-cultigens on most Iroquoian sites (Monckton 1992:44; D. Wright 1991:18, Table 5). Cranberries would also be a good source of vitamin C. Other fruits, such as elderberries, blueberries, gooseberries, currants, mulberries, cherries of various sorts, plums, apples, hawthorn and ground cherries (Tooker 1967:65; Monckton 1992:27, Table 3.1; D. Wright 1991:18), were also gathered. The eating of fresh grapes and the preserving of them was observed (Wrong 1939:83). Occasionally acorns, which had been boiled several times to take away the bitter taste, and tree bark, possibly willow (Tooker 1967:62), were consumed (Wrong 1939:108). Balsam firs are particularly rich in vitamin C (Kuhnlein and Turner 1991:364) and a drink made from a tree called *anneda*, prepared by the St. Lawrence Iroquoians, cured Cartier's crew of scurvy (Lescarbot 1907-1914:2:153; see also Biggar 1929:264). There is little mention of herbs in the ethnohistorical sources (Tooker 1967:62), but it was recorded that the Hurons ate chives which they had baked in ashes (Wrong 1939:239).

Many fruits were eaten raw but some were dried for winter consumption. "It should be noted that per unit weight, dried fruit is a concentrated source of nourishment comparable to corn meal in most of the dietary factors. While it is almost as rich in calories, it exceeds maize in calcium, vitamin A, riboflavin, niacin, and ascorbic acid" (Monckton 1992:86). Storage of the fruit would not affect the calcium component, but would result in substantial loss of ascorbic acid, possibly 81% (ibid.). Since fruits ripen primarily in summer, are found growing in open areas around fields or at forest edges, and were, in early contact times, collected by women, it is probable that females had a higher intake of fresh fruits, and thus of vitamin C, than males and might therefore have been better able to withstand diseases.

Many plants appear to have been collected for their leaves and flowers. Of such greens, lamb's quarters or goosefoot (*Chenopodium*) was an early domesticate throughout eastern North America (B. Smith 1992:103-131), but there is no mention of its cultivation in southern Ontario or Quebec in the early European accounts. However, chenopodium seeds are common on Ontario sites (Monckton 1992:46), including Keffer (D. Wright 1991) and McKeown (Ounjian 1988). This plant is very nutritious, having the largest amounts of vitamin A of any of the common plants eaten by Native peoples and good quantities of vitamin C too (Canada, Ministry of National Health and Welfare 1994: Appendix L:120-124; Cummings 1994:147). Similarly, knotweed was widely eaten across eastern North America (B. Smith 1992:289-290) and has a high carbohydrate content. It occurs on several southern Ontario Iroquoian sites, including Draper (Fecteau 1978), Seed (Monckton 1992:48), Keffer (D. Wright 1991) and McKeown (Ounjian 1988). In addition to these fairly common plants on Ontario sites, low incidences of many other species occur (Table 8-32; Monckton 1992:27, Table 3.1), indicating that there was considerable gathering of diverse plants. Yarnell (1964:44) estimated that "at least 373 plants [species] native to the Upper Great Lakes region" were used by Native people. Pollen studies have shown that the Keffer site was in a deciduous forest region and the McKeown site in a mixed forest region (McAndrews 1994). The latter was dominated by evergreens, particularly cedar and pine. Nut and fruit trees, such as beech, oak, butternut and cherries, are most common in deciduous forests. In general terms, wild plants were the sources of considerable carbohydrate and vitamins, as well as providers of fats in nuts and of bulk and fibre (Eaton, Shostak and Konner 1988:82-83).

Comparing Plants at the Keffer and McKeown Sites

While the quantities of the palaeobotanical remains at the Keffer and McKeown sites will not be compared here, consideration of the horticultural factors suggests that the Keffer people could have produced more plant food than the McKeown farmers.

From Cartier's observations of 1534, it appears that the Stadaconan Indians had access to maize and beans (Biggar 1924:62-63). They might have grown these vegetables themselves, but Cartier's reference was mixed with information about Brazil and included the names of plants not grown in New France in the 1500s, so it is possible that he was not referring specifically to the Stadaconans (ibid.:183). In any case it is evident that marine mammal hunting and fishing formed a large portion of their subsistence activities (ibid.:114-117, 119-120). Recent archaeological work has confirmed that the easternmost St. Lawrence Iroquoians hunted seals (Plourde 1993) and beluga whales (Tremblay 1993). Farther west, Cartier encountered the Hochelagan St. Lawrence Iroquoians, where he "found that the land began to be cultivated" (Biggar 1924:1534). (He may have meant extensively cultivated.) These people appear to have depended mostly on farming and freshwater fishing (Biggar 1924:160, 199). Such distinctions (Trigger

1972; Trigger and Pendergast 1978), and finer divisions within the St. Lawrence Iroquoians, have been noted by archaeologists also (Chapdelaine 1990). From all these sources, it is apparent that the western St. Lawrence Iroquoians, including the Prescott cluster (Pendergast 1991:56) to which the McKeown site belongs, were heavily dependent on horticulture, as were the proto-Huron/Petuns (Trigger 1990:30).

Monckton has shown, contrary to Sykes (1981), that "the variety of maize cultivated in the Northeast was Eastern Complex or Eastern Eight Row" (Monckton 1992:28), also known as Northern Flint (Demeritt 1991:187). Contrary to this archaeological evidence is Kalm's (1935:102-103) description of two varieties of corn growing in the eastern United States in the mid-1700s: a large one requiring up to six months to ripen (ibid.:103) and a smaller, three month corn (ibid.:104). However, Kalm noted that the distinctions in these two diminished as one moved north and that corn could adapt to harsher climates:

> Maize obtained from Virginia and planted in New England at first ripens with great difficulty and, unless the summer is unusually long, it does not ripen at all. But if one is careful with the maize in the beginning and succeeds in getting it to ripen, it matures earlier and earlier, so that after several years it ripens as early as that native to the region. The same is true if one takes corn from New England to Canada... (ibid.:103-104)

Since the six month corn would not have had time to ripen in Canada, it will be assumed that Eastern Eight Row was the variety grown in Ontario in the protohistoric period. This variety now requires at least 100 to 120 frost free days to mature (Fecteau 1985:24), but accepting Kalm's observations, it probably needed longer sometime in the past. According to Sagard (Wrong 1939:104), Indian "grain ripens in four months, or three in some places". It is probable that the corn first introduced to the proto-Huron/Petuns and proto-St. Lawrence Iroquoians was a longer maturing variety than the corn grown in the 1600s, which had adapted to the cooler climate. As well, by historic times, the Hurons were planting their corn in hills which would offer good drainage (cf. Parker 1910) and greater protection from frost (Heidenreich 1974).

There are several reasons why farming would have been less productive for the McKeown horticulturalists than for those at Keffer. First, geographical location favours the Keffer area. The location of the Keffer site, near the shore of a large lake, would result in a longer growing season than at the McKeown site, which is situated farther north and farther from the Great Lakes. "The lakes also mitigate against late spring and early fall frosts, giving a definite advantage to special fruit and vegetable crops in the areas bordering them" (Chapman and Brown 1966:4). Keffer is located 27 km north of Lake Ontario and McKeown 4.1 km northwest of the St. Lawrence River, and McKeown's latitude is almost 100 kilometres north of Keffer.

Climatically, the Keffer locale was more favourable for horticulture than that of McKeown too. Keffer is in the Lower Lakes climatic region, where winters are relatively mild and short. McKeown is in the Southern Laurentian climatic region, where winters are severe (Pleva 1957:7). "Grenville County, itself, is subjected to greater extremes in climate than the lowland regions of the Great

Lakes" (Richards, Matthews and Morwick 1949:26). Finally, the Toronto area experiences a late fall, which is advantageous for crop maturation. As Sagard observed, maize did not "grow so well and so high, nor is the ear so big or the grain so good in Canada [at Quebec] as [among the Hurons]" (Wrong 1939:104).

Unlike Huronia, where a lack of rain often caused crop failures and famine (Brébeuf 1636 JR 10:35), rainfall around both the Keffer and McKeown sites was more adequate for crops. At present, in both regions, 35 cm falls between May and September (Brown, McKay and Chapman 1980:45, Fig.35), with Grenville County receiving about 2.5 cm more than York County (Chapman and Brown 1966:18-19). Since corn requires 30 to 60 cm of water during the growing season (Fecteau 1985:25), there is just enough moisture in both areas. In terms of this factor, the McKeown location is marginally better than the Keffer locale.

Yarnell (1964:131) considers the frost-free period the most significant environmental condition for prehistoric agriculture in the Great Lakes region. In southern Ontario, presently, the frost-free period ranges between 138 and 177 days (Fecteau 1985:102), allowing time for three or four month maize to ripen. Keffer is in a region where the frost hazard for agriculture is "very low", whereas McKeown is in the riskier "low" hazard area (Ontario, Department of Lands and Forests 1963:8). Although the specific dates of the first and last frost might have changed over the years, the general pattern does not appear to have altered significantly in the past 500 years. The pattern favours agriculture for the proto-Huron/Petuns because the mean date for the occurrence of the last spring frost is five days later in the McKeown locality than in the Toronto region and the first fall frost date is ten days earlier around McKeown (Chapman and Brown 1966:Figs.10 and 11). There are presently 139 frost free days, from May 13 to September 30, around the McKeown site and 159 days, from May 10 to October 15, around Toronto (Brown, McKay and Chapman 1980:34, Figs. 25 and 26). While only 120 frost free days are needed for Northern Flint Corn to ripen now, the growing period must be longer than this before horticulture can be relied upon, as Yarnell has argued (1964:129-133). More than 120 days are needed to allow for an unusually late spring frost, perhaps after planting, and an early fall frost, perhaps before the kernels have matured. If cooler temperatures (possibly of the Little Ice Age) reduced the frost free period, this would have resulted in crop failures for the proto-St. Lawrence Iroquoians more often than for the proto-Huron/Petuns.

In addition to the number of frost free days, the number of warm summer days is important for corn maturation. "Corn requires a minimum soil temperature of 10°C for germination and root development ... There must be at least 60 frost-free and warm days (22°-25°C daytime) to attain grain maturation after flowering" (Dubé *et al.* 1982:12). Corn heat units (CHU) or growing degree days (GDD) are those over 50°F (10°C) and it has been estimated that at least 200 GDD were required for prehistoric maize in the northeastern States (Demeritt 1991:187). Because temperatures in the summer months from A.D. 1450 to 1550 are not known, the GDD cannot be accurately calculated but, based on latitude and current temperature differentials, it can be assumed that, whatever these were, they were higher immediately north of Lake Ontario than around the McKeown site. At present, the mean annual CHUs are 2900 to 3100 at Toronto and 2500 to 2700 in Grenville County; similarly, there are over 210 growing days at Toronto compared to just over 200 around Prescott (Brown, McKay and Chapman 1980:37-38). Thus, at both locales, there are sufficient GDD for corn agriculture, but conditions are more favourable in the Proto-Huron/Petun area.

Corn can be grown on many soils as long as there is good drainage (Dubé *et al.* 1982:13) to allow early planting and inhibit fungal and bacterial diseases. While clay soils with good drainage are excellent for corn (ibid.), the lack of ploughs and draft animals restricted aboriginal cultivators in Ontario to loamy and sandy soils which could be worked with hand tools. Heidenreich (1971) has shown that most Huron sites are located close to such soil types. Drainage at Keffer was excellent; it was located on two elevations both of which sloped towards the Don River tributary on the west side of the site (Finlayson, Smith and Wheeler 1987:8). The site is on a "bevelled till plain. Soils in the site area have been classed as Oneida clay loam. Subsoil on the upper terrace of the site is clay and on the lower area is sand" (Finlayson, Smith, Spence and Timmins 1986:1). This stone-free, neutral, grey-brown podzolic soil is excellent for growing corn (Dubé *et al.* 1982:13; Hoffman and Richards 1955:40-1 and Soil Map). In Grenville County, large areas close to the South Nation River are poorly drained (Richards, Matthews and Morwick 1949:29). However, although there is a bog to the south and east, the McKeown site is located on a well-drained, sandy loam podzol which is stone-free. In this soil type, three to four inches of light brown sand and sandy loam is underlain by yellowish brown sand over coarse grey sand with some carbonates (*ibid.*:Soil Map). Like that around Keffer, this soil is good for corn. In fact, Pendergast has suggested that the proto-St. Lawrence Iroquoians moved to the Prescott area precisely because the soil was well-suited to their horticultural practices (1991:56). However, as discussed below, the Canada Land Inventory maps show that Keffer is situated in a large area of the best soils for agriculture (Canada, Department of Regional Economic Expansion 1968), whereas McKeown is in an area of mixed soils many of which are in Class 4 or worse (Canada, Department of Regional Economic Expansion 1966).

The maize introduced into Ontario changed over time, likely in response to both the more northerly environmental conditions and human selection. For example, "maize kernels in Huronia were on average about 35% larger than those at the Southern Division settlement [Seed site]" (Monckton 1992:30), which suggests that Huron maize productivity might have been higher in the historic period than it was during the proto-historic period (ibid.:33). Sagard's longer period for maturation than that of present day corn might also indicate a selective improvement over time. Thus, risks of a maize with small kernels not maturing before the fall frosts should have decreased over time. However, Warrick (1990) has shown that Native Ontario population increased dramatically in the 1300s and did not fluctuate greatly again until the decreases of the 1630s. Thus, increases in kernel sizes and possible reductions in the length of time needed for corn maturation do not correlate with Warrick's human population growth finds. Gains in the productivity of corn may have been offset by a general shift northward in Huron/Petun settlement after A.D. 1400.

Assuming that the natural adaptation of the maize to its environment resulted in a faster ripening corn and one which could withstand the cooler summers of Ontario, the period of time since its introduction to the proto-Huron/Petun and St. Lawrence Iroquoian regions is important. While controversy still surrounds the evidence for the earliest corn in Ontario, D. Smith and Crawford have published a date of A.D. 780 run on corn remains from the Grand Banks site, which they claim "is the earliest as well as one of the few, direct dates on corn in the northeast" (D. Smith and Crawford 1995:63) and recently have received the even earlier dates of A.D. 540 and 570 on additional corn samples from the same site (Crawford and Smith 1996:785). Katzenberg, *et al.* (1995) using stable isotope evidence from human bones dating between A.D./B.C. to A.D. 500 at Monarch Knoll burial in Kitchener and A.D. 1500 at the McKenzie village, concluded that "the transition to maximum utilization of maize (with collagen $\delta^{13}C$ around -10o/oo) took place over a period of 600 years starting at about A.D. 650" (ibid.:341). Certainly, by A.D. 1000 many southern Ontario sites yield the remains of cultigens (Fecteau 1985:135) and it is generally agreed that by A.D. 1300 horticulture was well-established north of Lake Ontario. In contrast, Fecteau gives a late, A.D. 1400 to 1500 date for the first cultigens on St. Lawrence Iroquoian sites (ibid.:139). Clermont (1990:76) concurs that the St. Lawrence Iroquoians accepted horticulture generations after other southern Ontario Indians, although he thinks this occurred before A.D. 1400. Pendergast (1991:56) has suggested that between "A.D. 1350 and A.D. 1400 there was a marked change in settlement patterns. The riverine-oriented campsites showing a Middleport influence were replaced by small agriculturally oriented inland villages and campsites". By 1425, large villages, such as the Berry site (Pendergast 1967), appeared in the Summerstown area (Pendergast 1991:56). If Pendergast is correct that "the Roebuck site dated *ca.* A.D. 1450 is the earliest village in the Prescott village cluster" (1993a:21), the inhabitants of McKeown would have had little experience growing crops in this locality. The cultigens grown by the McKeown horticulturalists would not have had as many generations to adapt to the local environment and the St. Lawrence Iroquoians would not have had as long to select traits or to have gained experience in growing these crops as would the corn and the women, respectively, in the Keffer locale. The longer period of interaction between humans and plants could have resulted in more productive cultigen yields for the Keffer farmers.

As discussed above, in order to be nutritionally valuable, a corn diet must by augmented with beans. However, beans, although mentioned frequently in the historical accounts, are not found archaeologically in the Great Lakes region until A.D. 1000 to 1100 (Fecteau 1985:131) and possibly only after A.D. 1400 in the St. Lawrence Iroquoian regions (ibid.:139). The earliest reported bean in Ontario is a charred cotyledon from the Younge Tradition Dick site located in Essex County and dated by two radiocarbon dates to A.D. 1020 and 1170 (ibid.:9; Reid 1983). Although the Dick site had been ploughed for many years disturbing the site features (Murphy and Ferris 1990:249), such an origin date for Ontario beans is in accord with their earliest appearance in New York, on several Owasco period sites (Monckton 1992:9) and at A.D. 1020 at the Gnagey site in Pennsylvania (D. Smith and Crawford 1995:66). Attempts to date the first appearance of beans in archaeological contexts are hampered by their "low probability of being preserved in the archaeological record. As a result, its relative abundance or absences in archaeobotanical assemblages may be misleading" (B. Smith 1992:293). Certainly, beans are not found as frequently or as densely on Iroquoian sites as corn. Fecteau (1985:8-9) reports only 46 of 136 southern Ontario sites he examined, dating between A.D. 1020 to 1650, yielded beans, whereas all but three had corn. Beans were abundant only at the Auger site and from one pit at the Lawson site. The Auger site was burnt down (Latta 1985), resulting in the preservation of many more beans than would be the case had they not been carbonized. This evidence suggests that beans were probably much more common on sites than their preserved numbers indicate. Despite the poor preservation of beans, the archaeological evidence throughout eastern north America strongly suggests that they began to be cultivated throughout this region much later than corn. Because beans are a warm season crop, intolerant of frosts, they must be planted later than corn, when the soil has warmed to about 20°C. (Dubé *et al.* 1982:29). Considering these requirements and the fact that better yields of beans are obtained on loams and clay loams than on sandy soils (ibid.:30), they would be more productive in the Keffer region than the McKeown area. However, some beans require only 50 to 60 days to mature and others 80 days (Fecteau 1985:32, 120). Thus, even if these were planted in mid or late June, they should have had time to mature in both localities.

The third sister, squash, has a wide range of types, even within the only species known archaeologically. The first cucurbits in Ontario date to the same time as the beans (Monckton 1992:9; D. Smith and Crawford 1995:66). Some squash varieties mature in only 48 days, while others require 120, and they tolerate a wide range in temperatures (ibid.:37). Thus, squashes probably thrived in both the Keffer and the McKeown fields. Furthermore, at least in Huronia in the 1630s "squashes last sometimes four and five months, and are so abundant that they are to be had for almost nothing, and so good that, on being cooked in the ashes, they are eaten as apples in France" (Brébeuf 1636 JR 10:103).

Sunflower "is a mild to warm season crop" (Dubé *et al.* 1982:11) and because it is resistant to low temperatures it can be grown beyond the climatic limits for corn (ibid.). In Ontario, the earliest sunflower achenes have been reported from the Younge Tradition Dymock Village I site, located on the Thames River in southwestern Ontario and dated to the early 11th century (Fox 1982; Monckton 1992:9). B. Smith (1992) argues that sunflowers were domesticated in the northeast centuries before the introduction of maize to the area but evidence for this is lacking to date in Ontario. Sunflowers require fertile, deep, well-drained soils, of which loams and clay loams are the best. Considering these features, it is likely that sunflowers could have been grown easily at either site. However, they require 80 to 120 days to mature (Fecteau 1985:102), which might have meant harvests were more certain in the Keffer area than in the McKeown region.

In general, both cultivated and wild plants thrive best in warmer climates, decreasing rapidly as one moves north (Yarnell 1964:76-77). For example, most of the nut trees, "have a southerly distribution in the region [of the upper Great Lakes]" (ibid.:142). It is likely that the wild plants gathered by Native peoples were found in greater variety and abundance in the Toronto area than around Prescott. This might be reflected in the greater number of wild plant species represented at Keffer than McKeown (Table 8-32), but differences in collecting and identifying techniques do not allow a firm conclusion about this. It appears that the Keffer people had a greater source of wild plants to gather than the McKeown people did, as well as better returns for their horticultural labours.

Monckton has shown that wild plants, particularly brambles and fruit trees, would have benefitted from their association with humans and become concentrated around villages to such a degree that people might have returned to abandoned villages to gather berries and other fruits (Monckton 1994:212-213). Accepting this argument, the recent settlement of the McKeown peoples in the Prescott area would mean that they had fewer abandoned villages in close proximity from which to harvest fruits, whereas people on the south shore of Lake

Ontario had many earlier sites to exploit, making wild plant procurement easier for the Keffer women. Thus in the vegetable as well as the meat portions of their diets the Keffer villagers were likely better nourished than the McKeown people and with less effort.

CHAPTER 9

EXTENDING THE COMPARISON OF SUBSISTENCE AT THE KEFFER AND MCKEOWN SITES

Introduction

In the previous chapter, it was argued that both the quantity and quality of the diet at the proto-historic Keffer site exceeded that at the St. Lawrence Iroquoian McKeown site. Examination of the conditions around the two sites suggested that horticulture was likely to have been more productive, especially during adverse growing seasons, in the vicinity of the Keffer site and that a greater variety and a higher density of wild plants likely grew there as compared to the McKeown area, as they do now. In this chapter, faunal samples from other, approximately contemporaneous sites in proximity to Keffer and McKeown are considered to determine whether they support the findings from these two main sites.

Although zooarchaeology has a long history in Ontario (chapter 3), very few faunal reports have been published (Stewart 1993; Cooper and Savage 1994). In order to broaden the comparisons in this chapter, it has been necessary to use unpublished reports. The vast majority of these are Savage's undergraduate students' papers which result from the authors' first experiences with faunal analysis. These papers were written from the early 1970s to the present. Over this period there were many additions to the reference skeletal collection, allowing more precise identifications, and zooarchaeological samples, generally, were collected with more care. Thus, some samples and identifications, particularly the earlier ones, support only general comments. Almost certainly there are errors in some of the identifications. Most students did not check their initial determinations and Savage examined only specimens that were identified as species which were out of their ranges and a few, randomly picked, others. In addition, the required course minimum of 500 specimens identified below class was seldom exceeded and sometimes not met. However, in all the sites used for comparison here the zooarchaeological sample exceeded the minimum limit of about 300 NISP found to be sufficient by Amorosi *et al.* (1996:134). Thus, these papers can be used only for general impressions of the animals exploited at the sites. For this reason, I have not reproduced all the specific numbers tabled in them; rather I have rank ordered the animals based on their NISPs (Tables 9-1 and 9-2). In addition, a few licence reports submitted to the Ontario Ministry of Culture, Tourism and Recreation contain summaries of the zooarchaeological specimens recovered mostly under salvage situations. These too are neither reviewed nor published, so their data must be used with caution. Yet, without these less robust results, no regional perspective is possible and interpretations based on the few recently floated faunal samples only might be misleading (ibid.:131-132). Furthermore, Amorosi *et al.* (ibid.:139-143) have demonstrated that differences between investigators even they are students and the work is separated by many years resulting in new identification techniques and more complete reference comparative material, "might be less of a problem that one might fear" (ibid.:142).

Faunal Samples from Other *ca.* A.D. 1500 Sites Near the Keffer Site

The Draper Site and the White Site

To the west of the Keffer site (Figure 9-1), near the town of Pickering, are two contemporaneous sites with published faunal reports. These are the Draper, AlGt-2, and White, AfGw-67, sites (Burns 1979a, 1979b). From the Draper site, one incompletely excavated longhouse and a few overlapping midden squares produced a sample of 4,118 faunal remains. Eight-five percent of these were mammalian, with only 8.3% fish, 2.9% invertebrates, 2.4% avian, 1% turtle and traces of amphibians, by NISP (Burns 1979a:124).

Burns was surprised at the low fish percentage, especially since at the White site, discussed below, fish comprised half the sample (ibid.:123). In addition, "due to inaccessibility to adequate reference collections of fish", Burns' determined the origins of only "the easiest ones to identify" (ibid.:136). Most frequent, both by NISP and MNI, were catfish sp. (*Ictaluridae*), suckers (Catostomidae), walleye/sauger (*Stizostedion* sp), bowfin, yellow perch and pike/muskellunge (ibid.:136). The identification methods appear to have ignored members of the Salmonidae family, including whitefish which was so prominent in the Keffer sample. Otherwise, the Draper fish were like those from Keffer (Table 6-4) in the numerous catfish remains and the other species which occurred there.

There are a few discrepancies in the reptilian remains between the Keffer and Draper sites. At both, painted turtles dominated the small samples, but snappers and wood turtles were identified from Keffer only, as opposed to Blanding's and map (*Malaclemys geographica*) turtles at Draper only.

The three wild bird species with the highest NISP, at both sites, were wild turkey (Draper NISP=26) , passenger pigeon (Draper NISP=6) and ruffed grouse (Draper NISP=4) (Table 6-11; Burns 1979a:Table III). At both sites, these were followed by Canada goose (Draper NISP=2) and duck bones (two teal bones at Draper). Common loon (NISP=2) was proportionately more common at Draper. The other wild birds found there, represented by single specimens, were bufflehead, hawk owl and robin. (The five domestic chicken bones must have been intrusive.)

At both sites, deer dominated the mammalian remains (Draper NISP=929, MNI=11) followed by dog (Draper NISP=136+, MNI=3) both in NISP and MNI (Table 6-7; Burns 1979a:Table II). At the Draper site, deer and dog were followed by bear (NISP=60), woodchuck (NISP=44), beaver (NISP=41), muskrat (NISP=17), hare (NISP=12+), raccoon (NISP=12) and timber wolf (NISP=12). The remaining species in descending order of number of specimens were red squirrel, deer mouse and fisher (NISP=4 each), otter, red fox and grey fox (NISP=3 each), mink and eastern chipmunk (NISP=2 each) and grey squirrel (NISP=1). The minimal representation of these last species repeats their relative insignificance at Keffer. However, unlike Keffer, in the Draper material there were wapiti (NISP=4) and timber wolf specimens, there were proportionately more bear remains, the NISP rank ordering of woodchuck and beaver was reversed, and no examples of moose were found. Timber wolf might have been exploited at Keffer and not separated from the other large *Canis* sp. remains. Wapiti and moose remains at the Draper and Keffer sites, respectively, were few; apparently neither was commonly hunted. Thus, the mammal representation is very similar at these sites, with the major difference being the higher proportion of black bear specimens in the Draper sample.

As Burns cautioned, it might be prudent to wait for more work at the White site before drawing any conclusions from the 1,756 skeletal remains excavated from one midden (Burns 1979b:161). In contrast to the Draper site, only 30% of the White site's vertebrate specimens were mammalian (NISP=514); the majority were fish (50.3%, NISP=865), and avian remains were much more common (NISP=235), forming 13.7% of the total. Similarly, the amphibians (NISP=75) were 4.4% of the total and reptiles (all turtles, NISP=20) were 1.2% (ibid.:Table I). Since Burns commented that the unusually good amphibian representation was a result of the use of floatation at the White site (ibid.:161), it can be supposed that the great dominance of mammal specimens for the Draper site was produced, at least in part, by the excavation procedures applied to this sample.

The particular species of fish identified at the White site repeated the Draper pattern, likely reflecting , at least in part, the same selective identification techniques (ibid.:165). Catfish (NISP=32; MNI=3) were followed by suckers (NISP=14; MNI=2), pike (NISP=5; MNI=1), trout and perch (NISP=1 each), but a vast majority of the fish remains were not identified beyond class (NISP=812).

The amphibian bones were from either frog or toad and the turtle specimens included some from snapping turtle (NISP=2), although again painted turtle pieces were most common (NISP=6). There were also two examples of Blanding's turtle.

The avian remains were very markedly dominated by passenger pigeon, with 108 bones from at least seven birds. These were followed by six wild turkey bones with a MNI of one and four ruffed grouse specimens with a MNI of two. There was a single specimen for each of Canada goose, white-winged scoter, sandhill crane and pileated woodpecker.

The mammalian remains were like those at the Draper and Keffer sites, except that there were slightly more dog (NISP=39) than deer (NISP=35) specimens (Burns 1979b:Table II). Following these were beaver and rabbit/hare (NISP=17 each). Combining red fox (NISP=3) with those identified only as fox sp. (NISP=7), fox specimens were slightly more common than woodchuck and muskrat (NISP=8 each). Following these were squirrels (grey NISP=4; red NISP=3) and mice (*Peromyscus* NISP=4; *Microtus* NISP=3). There was only one black bear specimen and one from deer, wapiti or moose; single specimens of marten and otter were also recognized.

Faunal Remains from Seven Additional Sites in the Toronto Area

There are seven sites located within York Regional Municipality (Figure 9-1) dating to *ca.* A.D. 1500 and for which a combined total of 24 student papers or licence reports with faunal sections are available (Cooper and Savage 1994). These sites are Aurora, BaGu-2, (Chiles 1993); Boyd, AkGv-3, (Litherland 1982; Hughes 1982); McKenzie, AkGv-2, (Finn and Balmer 1974; Dodds 1975; Noseworthy 1982; Friesen 1983); Over, AiGu-120, (McLean 1992); Ratcliff, AlGt-157, (McGreevy 1981; Williams 1983); Risebrough, AkGu-10, (Kapches 1974); and Seed-Barker, AkGv-1, (Morrison and Nelson 1976; Badone 1977; Berg 1980, 1985; Gibbard 1984; Noseworthy 1984; Sutton 1986; Hamers 1987; Conolly 1989; Primavesi 1990; Choi 1991; Carr 1993; Doherty 1994). The Over site faunal report was not available, but in a summary of the 500 zooarchaeological specimens examined from this site, Cooper and Savage (1994:70) wrote, "Although many of the materials recovered are of insecure context, analysis strongly implies a general subsistence economy similar to that of the Keffer site (AkGv-14)". Only one of the reports includes floated material (one of 13 student reports on samples from the Seed-Barker site), resulting in a likely erroneous impression that the proto-Huron/Petuns did little fishing. However, from these papers, some conclusions about the main animals that were exploited can be deduced. Where there is more than one report for a site, the results have been combined, unless otherwise stated.

Considering both the excavation and sample selection techniques, comparisons are probably most valid for the mammalian remains. Whitetail deer was the most commonly identified mammal on all the sites except Risebrough, where it ranked only third after dog and beaver (Table 9-1). Domestic dog ranked highly at the remaining sites, except Ratcliff where there were few dog specimens. When those remains identified as *Canis* sp. are added to the more precisely identified dog ones, the combined figures come closer to those for whitetail deer, but do not surpass them. The whitetail deer numbers could also be increased with the addition of those identified to the family Cervidae only, but a minority of these might be moose, which was noted in small amounts at McKenzie, Ratcliff and Seed-Barker. A Cervidae identification might also include some wapiti specimens since this animal was in third place at McKenzie (after *Canis* sp.) and Ratcliff, fourth at Boyd and fifth at Seed-Barker (when dog and *Canis* sp. are combined). There was only one specimen identified as caribou (*Rangifer tarandus*) in all these reports. This was from the Seed-Barker site.

At Keffer, deer and dog NISPs were followed by those of beaver and then woodchuck. Beaver followed the Cervidae remains at Aurora, McKenzie and Ratcliff. Woodchuck was in this spot at Boyd, Risebrough (with red squirrel) and Seed-Barker. At the latter, beaver followed woodchuck. Thus Cervidae (mainly whitetail deer), dog, beaver and woodchuck were consistently the top four mammals.

In the Keffer mammalian sample, these were followed by muskrat and then raccoon and red squirrel. This high ranking of muskrat appears to be atypical of the sites in this region. For three, no muskrat specimens were identified and, where they were recognized, they ranked with the last group of species (Risebrough, possibly Boyd) or low on the list (second last at McKenzie; position 14 out of 21 at Seed-Barker). Since the student samples favoured larger mammals, it should be expected that squirrels would be under-represented. However, the Risebrough paper has red squirrels in fourth place with woodchuck, and at Seed-Barker, red squirrels rank in the middle. Raccoon was not identified in the Risebrough sample; it ranked with the last group at Ratcliff and with the third to last group at McKenzie. It was twelfth at Seed-Barker and sixth at Boyd. It ranked fifth and last at Aurora. For raccoon and animals with lesser NISPs, the evidence suggests that these species were not consistently exploited. A large variety of medium to small mammals were hunted, but none appears to have been taken much more often than any other.

The importance of black bear to the proto-Huron/Petuns is difficult to determine. At Keffer, this large meat provider, ranked by NISP, was only tenth behind eastern chipmunk, red fox/fox sp. and grey squirrel. Similarly, at McKenzie and Risebrough, bear bones were ranked in the third or second to last group but at Seed-Barker, they placed sixth, in the top third of the mammal rankings. At Boyd they were fifth and at Aurora fourth. Their highest placement was second at Ratcliff. However, the material from this site was very selectively surface collected between rows of growing corn; its sample is probably the least representative of all of those compared here. Thus, the evidence indicates that black bears might have been more significant to the proto-Huron/Petuns than was supposed based on the Keffer sample, but that, in general, bears were less frequent prey than deer, dogs, beaver, woodchuck and wapiti. All these mammals, including bears and excepting domestic dogs, appear to have been purposefully hunted, whereas the scattered ranking of the remaining mammals suggests that they were taken more opportunistically. The fact that more species were recognized at Keffer than any of the other sites probably reflects the different collecting and identification procedures rather than any real difference in selective hunting.

It is unfortunate that collecting and identifying methods acted against the smaller zooarchaeological specimens, because the differences in fish and bird remains between the Keffer and McKeown sites cannot be confirmed or negated as part of a larger pattern by this larger site sample. For example, whitefish was recognized at the Seed-Barker site only where it ranked with the least common group, probably because their bones are smaller and harder to identify than many other species' (Table 9-1). However, as was true at Keffer, catfish specimens were the most frequently reported fish from all these proto-Huron/Petun sites, except for Risebrough and Ratcliff where perch remains were the most common. Most of the other fish species at Keffer were also found on the neighbouring sites. This was true for brown bullhead, bowfin, walleye, freshwater drum, northern pike, largemouth bass and pumpkinseed. However, from the Seed-Barker sample, Atlantic salmon, rainbow trout and brook trout can be added to the list of species exploited by the proto-Huron/Petuns in the Toronto region.

The identification of bird remains appears to have been omitted by some students, but the available results are similar to those from Keffer (Table 9-1). In two sites (McKenzie and Seed-Barker), passenger pigeon specimens dominated, whereas at two others (Ratcliff and Risebrough) wild turkey bones were the most frequent. For the fifth site with avian identifications (Boyd), pigeon and turkey bones were equally common (with black duck). At McKenzie, swans and Canada goose outranked wild turkey as did ducks at Seed-Barker. At most of these sites, bones of ducks, ruffed grouse and various birds of prey were found. Red-tailed hawk (*Buteo jamaicensis*) can be added to the variety of birds exploited by the proto-Huron/Petuns, since it was identified at both the McKenzie and Risebrough sites. These studies support the conclusion, based on the Keffer remains, that wild turkey, passenger pigeon, grouse and various geese and ducks were the most significant birds for the proto-Huron/Petun people.

The reptile remains confirm the Keffer evidence that painted turtles followed by snappers were the reptiles most often collected and that some wood turtles were occasionally taken too (Table 9-1). Identifications of the McKenzie and Seed-Barker sites' faunal samples confirmed the Draper evidence that Blanding's and map turtles were exploited. Map turtle was also identified at McKenzie. Wood turtle was identified at McKenzie and Seed-Barker.

The Parson Site

Similar faunal exploitation patterns were repeated at the Parson site, AkGv-

8, located in the Humber River drainage area (Figure 9-1) and dating to about A.D. 1500 (S. Thomas 1994). At this site, 50 percent of 245 specimens identified beyond class were mammalian and

> white-tailed deer and dog accounted for half of the mammal NISPs, beaver and muskrat for 13%, other small herbivores for 18%. Most of the bony fish assemblage is typical of Black Creek and upper Humber tributaries, indicating local opportunistic exploitation. Upland game birds dominate the avian component...(Cooper and Savage 1994:71)

but ducks were also common.

The MacLeod Site

To the east of the Toronto group, in present-day Oshawa, is the MacLeod site, AlGr-1 (Figure 9-1). From it, 3,373 faunal remains were excavated by shovel or trowel from the plough zone (P. Reed 1993:31). In common with other macrofaunal samples, this one was dominated by mammals from 21 species, of which the most common were dog (NISP=214) and whitetail deer (NISP=108), followed by woodchuck (NISP=53), muskrat (NISP=36) and beaver (NISP=32). Eastern chipmunk (NISP=25) ranked surprisingly high in the middle group, with grey squirrel (NISP=21), black bear (NISP=18), red squirrel (NISP=17) and snowshoe hare (NISP=12). As at other proto-Huron/Petun sites, grey and red foxes (NISP=6 each), raccoon (NISP=4), marten (NISP=3), mink (NISP=2), river otter and fisher (NISP=2 each) and skunk (NISP=1) were present in lesser quantities. Similarly, there was only one moose specimen, and two were identified as wapiti.

Surprisingly, more avian than fish bones were identified by the two students who worked on this material (Mychajlowycz 1980; Murray 1990). Of the

125 avian remains, 83 were identified to 18 species. Passenger pigeon (NISP=22) and wild turkey (NISP=19) were more common by NISP than pigeon hawk (NISP=11) or Canada goose (NISP=10). Ruffed grouse (NISP=4) ranked fifth, followed by a variety of ducks (pintail, black duck, greater scaup, bufflehead and red breasted merganser), a few hawks (Cooper's and redtail) and other birds (blue jay, hairy woodpecker, common loon, sandhill crane, red necked grebe and eastern meadowlark) each represented by one or two specimens.

The 32 fish specimens were identified to 12 species (P. Reed 1993:Table 16:35). Yellow perch (NISP=8) was the most common of these, followed by brown bullhead (NISP=5), channel catfish (NISP=4) and sauger (NISP=3). There were two specimens for each of bowfin, American eel, white sucker and smallmouth bass. One specimen was identified for muskellunge, longnose gar, largemouth bass and silver redhorse.

The 16 turtle specimens identified were from four species: painted (NISP=10), snapping (NISP=4), Blanding's and map (NISP=1 each) and the nine amphibian bones included toad and frog bones. The most common invertebrate recognized was freshwater clam and there were a few terrestrial and freshwater snails.

While the MacLeod fauna are somewhat similar to those of sites in the Toronto area, the very high proportion of dog remains, the ranking of muskrat above beaver and the presence of American eel bones were unexpected. The higher number of avian than fish bones probably reflects excavation techniques, in part; yet it must be conceded that birds might have been hunted more here than they were in the Toronto area.

Brodie's General Observations

The published reports on faunal remains from sites in the Toronto area dating to *ca*. A.D. 1500 began with one by Brodie and his observations remain a good summary of the faunal findings for this area. In 1902, Brodie reported on "animal remains found on Indian village sites" based on his personal observations over half a century on ten sites in "the county of York and the township of Pickering" (Brodie 1902:44-51). He accepted the artifactual nature of many bivalve shells found on these sites but also noted that many of the shells were burnt, which suggested that invertebrates were eaten. Regarding fish, he claimed vertebrae *only* survived and salmon and trout were the only species he recognized. His infrequent observations of fish bones likely reflect his selective collecting of skulls, mandibles and artifacts. Snapping and mud [painted] turtles were the only reptile remains he reported, which were the two species most frequently identified in the Keffer material also. Although, he saw many small bird bones, tarsi, humeri and ulnae of large birds were the only ones he identified (ibid.:48). Using these elements, he recognized great blue heron, wild turkey and fish hawk [osprey] from artifactual bones.

In his brief comments on each mammal species found, Brodie noted that beaver skulls, jaws and incisors were abundant on all sites, as were the lower jaws of deer, black bear remains and the skulls and incisors of red squirrels. "Many" bones of red fox and wolf or Indian dog were found and there were "numerous" wild rabbit skull fragments. Muskrat remains were found on all sites, porcupine were only "more or less common" and ground hog occurred most frequently on the southern sites. There were "several elk" [wapiti], wolverine, and mink pieces and a "few" squirrel skull fragments "doubtfully referred to the grey squirrel species". There were also a "few" marten and wild cat [lynx] skull specimens. All the moose remains were from Whitchurch village sites, as were the few skunk skull pieces. The very few otter skulls were "doubtfully identified" and similarly, the chipmunk identifications were "usually uncertain". Raccoon and fisher were also recognized, but Brodie gives no indication of how common they were.

Brodie's observations forecasted the Keffer mammal rankings, although there are some noticeable differences. Those species which he described as "abundant" or "many" conform to the most frequent ones on sites in the Toronto region, with the exception of red squirrel, which was not common on most of these sites. As well, elk [wapiti] and wolverine were lacking in the Keffer fauna and absent or rare in the samples from the other Toronto area sites. However, the general pattern of the importance of the salmon family, the particular large birds (wild turkey especially) and turtle species identified, and the dominance of beaver, deer, bear and dogs among the mammals with few otters, lynx, skunk and chipmunks, conforms generally to the Keffer pattern.

Faunal Remains from Other *ca.* A.D. 1500 Sites Near the McKeown Site

Located near McKeown in the Prescott cluster of what Pendergast has termed the Border St. Lawrence Iroquoians (Pendergast 1991) are four sites for which zooarchaeological studies exist (Figure 9-2). Based on his early work in the area, Wintemberg published information on the animal remains from the Roebuck site, BeFv-4, (Wintemberg 1936) and two of Savage's students (Theodor 1989; Bissell 1989) have reported in greater detail on two samples from this site. Except for my McKeown site articles, this is the only published source for sites in this cluster, but Guy Agin has completed a M.Sc. thesis on the zooarchaeological remains from the McIvor site, BfFv-1, (Agin 1991) and there have been two student reports on different samples from the Cleary site, BfFv-4, (Fry 1987; Garden 1988) and one on the Driver site, BeFu-2, (Neill 1983).

Slightly farther north, located between the Prescott and Summerstown clusters, are the Beckstead village, BfFt-1 and the Steward fishing camp, BfFt-2 (Figure 9-2). A faunal analysis for Beckstead has been published (D'Andrea *et al.* 1984) based on the individual class reports of the four authors (D'Andrea 1982; Procopio 1982; Ackerman 1982; Clements 1982). Both an M.A. thesis (Junker-Andersen 1984) and a publication (Junker-Andersen 1988) on the faunal remains from the Steward site are available.

There has been considerable discussion about the proper sequence of St. Lawrence Iroquoian sites. A pottery seriation, emphasizing the Steward site ceramics has been discussed by J. Jamieson (1990) and the radiocarbon dates have been reviewed by Pendergast (1993b). It appears that the Roebuck site predates the McKeown village and that the McIvor village postdates it. It is possible that the Roebuck village dates to the fourteenth century (J. Jamieson 1982; Timmins 1985), several generations prior to McKeown, but Pendergast places Roebuck around A.D. 1450 (Pendergast 1993b:16). The Roebuck site zooarchaeological material will be summarized first.

The Roebuck Site

Digging the Roebuck middens in 1912 and 1915, Wintemberg found "bones of mammals, birds, reptiles, amphibians, and fish, and shells of land and freshwater mollusks" (Wintemberg 1936:13). Wintemberg listed the mammals in order of decreasing abundance as: Virginia deer [whitetail], beaver, dog, black bear, raccoon, marten, muskrat, porcupine, otter, fisher, mink, woodchuck, varying hare, red squirrel, lynx, moose, wapiti, wolf, skunk, wolverine, red fox, grey fox, chipmunk, grey squirrel, seal and bison. Some of the supposedly dog leg bones were admittedly large and possibly wolf. Thus, dog should possibly be lower in the order. Wintemberg's inclusion of seal indicates some access to marine mammals, but this must have been very limited, given its placement on his list and the lack of any sea mammal specimens in all the other Grenville cluster samples identified to date. The inclusion of bison in this list is also surprising. No bison bones were identified in any other faunal sample considered in this study.

Bird bones were not common, but Wintemberg noted thirteen species. These were, by decreasing NISPs: Canada goose, ruffed grouse, sandhill crane, loon, bald eagle, passenger pigeon, swan, raven, herring gull, broad-winged hawk, red-shouldered hawk, pileated woodpecker and an unidentified species of duck.

"Bones of the snapping turtle, painted turtle, and wood turtle [were] the only reptilian remains found" (ibid.:14) and "the amphibian remains consist[ed] of a few bones of a frog smaller than the bull-frog and probably [were from] either the leopard or pickerel frog" (ibid.:15).

Wintemberg commented that fish bones and scales were common. Seven species providing these were: yellow pickerel [walleye], common catfish, pike, buffalo fish, carp (*Carpiodes* sp.), gar pike and chub or horned dace. He added that there was no doubt that suckers, brook trout and other small species, including sunfish, were also used. Wintemberg noted that freshwater clam shells were abundant and most common of these was *Elliptio complanatus*.

The two student reports both have whitetail deer and beaver as the top two species by a considerable margin, but some of their identifications of the mammals in their combined sample of 3,765 faunal remains from both middens and house floors are problematical. One student (Theodor) has woodchuck third whereas the other (Bissell) did not identify any woodchuck specimens, while conversely Bissell has fisher in third place whereas it was absent in Theodor's identifications. Based on the occurrence of only two fisher specimens in the larger McKeown sample, it seems probable that Theodor's identifications are more accurate, but fisher remains were common in the McIvor and Beckstead zooarchaeological samples (discussed below). Both students found very few *Canis sp.* specimens, which is like the McKeown sample. Black bear was third in the McKeown sample and possibly third in the specimens Wintemberg reported. But Theodor ranked black bear fifth after marten and Bissell had it in seventh spot after raccoon, dog and muskrat. Both students, like Wintemberg, had red squirrels, chipmunks and grey squirrels at the bottom of their lists. One reported a single wapiti specimen, which is similar to the infrequency of this animal in Wintemberg's sample and its absence at McKeown. Although Wintemberg identified a few moose bones, neither student identified any to this species. Thus, the specific mammals in these three samples are generally similar, although the medium-sized ones which are represented by few specimens are inconsistent in their ordering. As at McKeown, porcupine was in the middle group, as were marten and mink.

Few bones of birds or fish were identified by the students. The six avian species recognized by them included four which Wintemberg listed (sandhill crane, loon, ruffed grouse and raven) as well as two new species: great horned owl and pintail duck. Of the fish, both students found mostly bones of members of the family Catostomidae (NISP=32), particularly redhorses, followed by almost equal numbers of Percidae (NISP=20), specifically yellow perch and walleye, and Ictaluridae (NISP=19), particularly channel catfish and brown bullheads. In both students' samples, these were followed by Salmonidae (NISP=15), particularly *Salvelinus namaycush*, according to Bissell; by Centrarchidae (NISP=12), particularly largemouth bass and pumpkinseed, and finally by a few bones of northern pike (NISP=3), burbot (NISP=3) and minnows (NISP=2). Lake sturgeon, longnose gar, pumpkinseed and freshwater drum were represented by a single specimen each. It is interesting that eels were not identified by either student or by Wintemberg.

A few small animal specimens completed the samples. Reptiles and amphibians were not identified by one student and the turtle identifications of the other are indefinite. In both samples, the invertebrates were dominated by the freshwater clam, *Elliptio complanata*, with only a few other species mentioned. This confirms Wintemberg's findings and repeats the McKeown evidence.

The McIvor Site

The McIvor site is a palisaded village site, located 9.5 km northeast of the Roebuck village site, dating to shortly after A.D. 1500 (J. Jamieson 1990; Agin 1991). Pendergast placed the site in the late St. Lawrence Iroquoian period from A.D. 1525 to 1550 (Pendergast 1976:54) and Chapdelaine concurred, suggesting a 1500 to 1550 date (Chapdelaine 1989:240), as has Agin (1991:28).

From J. Wright's 1964-65 excavations of the McIvor site, Agin obtained for analysis 5,721 zooarchaeological specimens. These were excavated from house pits and middens or surface collected. Considering the early date of these excavations and assuming a lack of floatation and fine mesh screening, it is not surprising that mammal remains dominated (NISP=5006; %=87.5), followed by fish (NISP=613; %=10.7), bird (NISP=72; %=1.3) and reptile (NISP=30; %=0.5) specimens. No amphibians or invertebrates were identified.

The frequencies of the species identified at the McIvor site (Agin 1991) were predictable. Whitetail deer dominated the mammals with an NISP of 1,576, followed by 368 beaver, 87 woodchuck, 79 muskrat and 70 black bear specimens. In the middle range, there were 28 specimens for each of marten and fisher, 25 porcupine, 24 raccoon and 23 red squirrel. There were only 22 dog specimens but some of the few *Canis* sp. pieces might also be from dog. Still this is a proportionately low number relative to the proto-Huron/Petun samples. Similarly, only a single moose element was identified, but surprisingly, there were 16 caribou specimens. There were 14 snowshoe hare specimens, 13 from river otter and ten mink. The remaining were four chipmunk, three lynx and one skunk specimen. Thus, excepting caribou, the top McIvor mammal rankings are very similar to those of the McKeown sample; the muskrats and woodchucks reverse their orders and bears come immediately before this pair at McKeown, rather than immediately after it as at McIvor. Most of the last ranked McKeown species were not represented in this McIvor site sample (i.e. grey squirrel, mice, fox), but the fisher is an exception, since it was fairly well-represented, as it was in some of the Roebuck material.

Like the mammals, the most frequently recognized birds were the expected ones. Canada goose dominated (NISP=27), followed by great blue heron (NISP=23) and ruffed grouse (NISP=10). There were two bones of black duck and one each of pintail and bald eagle.

Only the snapping turtle was noted among the reptilian remains and the fish bones were not identified beyond class.

The Cleary Site

The Cleary site is a palisaded village located almost midway between the Roebuck and McIvor sites. From Cleary, approximately 10,000 faunal specimens were excavated in 1980 by J. Jamieson. One of Savage's students (Fry 1987) identified 723 of these (of which 109 were invertebrate shells) and another (Garden 1988) selected a sample of 503 remains of which 36 were Mollusca. In both samples, mammal remains dominated, but almost a quarter of the specimens were from fish; less than one percent were avian or reptilian. In one sample (Fry's) amphibians contributed a surprisingly high 1.2 percent, but in the other (Garden's) this class accounted for only 0.1 percent.

Combining the students' results, deer (NISP=543) followed by beaver (NISP=121) were once again the most frequently represented mammal species. If all the *Canis* sp. remains (NISP=24) were dog, then this animal was highly ranked in third place, but some might be wolf. Four specimens were identified as dog (Garden) and one as wolf (Garden). Excluding the possible dogs or wolves, black bears ranked third with muskrat (NISP=19 each), followed by marten (NISP=17). Woodchuck was recognized by Fry only, who identified nine specimens to this species. Species represented by seven to five specimens were raccoon and fisher (NISP=7 each), snowshoe hare and red squirrel (NISP=6 each) and chipmunk, otter and porcupine (NISP=5 each). Porcupine was recognized by Fry only. At the bottom of the lists were mink, mice and long-tailed weasel. Neither student noted any moose, caribou or wapiti remains.

More fish were reported for this site than for many of the others. From the combined total of 248 identified beyond class, it is clear that *Catostomus* dominated (NISP=140). Both *Catostomus* and *Moxostoma* sp. were identified, but the former was much more common. As at Roebuck, catfish (NISP=47) and perch (NISP=43) families were next in NISP. This is a higher ranking for catfish than at McKeown, where pike and sunfish were above the still significant numbers of catfish. At Cleary, pike (NISP=6), *Salvelinus* sp. (NISP=4) and quillback (NISP=3) followed perch and the one remaining species, lake sturgeon, was represented by a single element. No eel bones were recognized.

Very few specimens from the remaining classes were identified. Of the 11 bird bones, three were ruffed grouse, three were duck (one each of black duck, common goldeneye and hooded merganser), and there was one each of passenger pigeon, Cooper's hawk and barred owl. The amphibian remains (NISP=5) were all from either frog or toad. The only turtle recognized was the snapping turtle (NISP=1) and most of the invertebrates were pieces of *Elliptio complanata* shells (NISP=14), although one shell was identified as *E. dilatata*.

The Driver Site

The Driver site is the final one located in the Prescott cluster to be reviewed. It is located on the St. Lawrence River, about 14 km east of McKeown. Just over half the 1,294 faunal remains retrieved by trowelling and 1/4 inch screening were identified beyond class by one of Savage's students (Neill 1983). Reflecting its function as a fishing camp, 37 percent of the faunal remains were fish. Over 30 percent were invertebrate, just over 30 percent were mammalian, one percent was avian, 0.2 percent was amphibian and none was reptilian.

Whitetail deer (NISP=40) and beaver (NISP=23) again dominated the mammalian remains. As at the sites previously reviewed, they were followed by many fewer examples of muskrat (NISP=8), hare (NISP=7) and woodchuck (NISP=4). There were only three specimens identified to the genus *Canis* and, except for the two chipmunk and raccoon specimens, all the rest of the wild mammals (grey wolf, black bear and skunk) were represented by a single specimen. There were no moose remains.

The 180 fish bones identified beyond class included 76 American eel bones. This is unlike most of the other sites, but similar to the Steward fishing camp (discussed below); eel was found in some numbers in the McKeown sample too. Catostomidae remains dominated the non-eel fish sample, with one for each of *Catostomus* and *Moxostoma* and 55 identified only to the family. As at McKeown, suckers were followed by members of the Percidae, including *Stizostedion* sp. (NISP=18) and yellow perch (NISP=10). Again repeating the McKeown rankings, pike and bass were the next most frequent fish (NISP=7). Only one catfish bone was identified and no other fish species were recognized.

Most of the invertebrates were Elliptio shells and 42 were further identified as *E. complanata*, whereas only one was *E. dilatata*. There were 68 additional shells recognized to this genus and a few other specimens.

Only three avian bones were included in this sample. Two of these were identified as grouse and the other was some sort of duck. Thus, Driver, despite being identified as a fishing camp, had a zooarchaeological sample similar, in the species represented, to the large McKeown village.

The Steward Site

The Steward site is another fishing camp (J. Jamieson 1982; Junker-Andersen 1984, 1988). It is located between the Prescott and Summerstown clusters and is thought to have been used by Iroquoians from these areas for about 500 years with possible peaks of occupation around A.D. 1150, 1385 and 1550 (J. Jamieson 1982:40-41). The Steward site is located about 150 meters north of the Saint Lawrence River, at the present-day town of Morrisburg, Ontario (Junker-Andersen 1988:97). This is about 25 km down-river from the Driver site (ibid.:98) and the Prescott cluster.

The faunal remains from Steward were salvaged in 1979 from a midden deposit (Junker-Andersen 1984:5-6). The matrix was screened through a 6 mm mesh. The less than four percent of the matrix which was floated (ibid.:18-19) increased the fish and amphibian representation, but unfortunately the fish vertebrae were not identified (ibid.:22). Finally, although J. Jamieson (1982) stressed the stratified nature of this site, Junker-Andersen (1984) combined the faunal remains to obtain larger totals and because he felt the remains could not be accurately sorted to their original levels (ibid.:25).

In the 18,242 zooarchaeological remains analyzed by Junker-Andersen (1984), members of all the animal classes and at least 55 species were identified.

Over 22% of these remains were invertebrates, but fish were 52.5%, mammals 18.4%, birds 0.9%, amphibians 0.5% and turtles 0.1%. The abundant bivalves were all of the family Unionidae with a huge majority being *Elliptio complanata* (ibid.:Table 2:245).

Similar to other St. Lawrence Iroquoian sites, the 9,576 fish specimens were dominated by Catostomidae (NISP=554). Based on the study of a small number of scales, the majority of the bones were likely from redhorse suckers. These were followed by bones of the American eel (NISP=274). A fall exploitation of this species has been proposed as the main reason for the Steward site's existence. Next, by NISP, was the genus *Micropterus* spp. (NISP=206), especially the smallmouth bass, with poor representation of the small members of the sunfish family (NISP=60), such as rock bass, pumpkinseed, bluegill and/or black crappie. There were 60 additional Centrarchidae specimens, making this family a very significant one. Almost as frequent as bass remains were those of the family Ictaluridae (NISP=202), including brown bullheads, channel catfish and possibly yellow bullheads. "Also abundant among the Steward fauna is the Yellow Perch, *Perca flavescens*" (ibid.:47), with a NISP of 168 specimens. Other fish represented in fewer numbers were lake sturgeon (NISP=86), walleye/saugers (NISP=43) and members of the family Cyprinidae (NISP=43), pike (*Esox* sp. NISP=22) and freshwater drum (NISP=7). Only one *Coregonus* sp. bone was identified (ibid.:Table 2:245). Thus, redhorses and eels were heavily fished here, but the Centrarchidae, Ictaluridae and Percidae families were also significant.

The 3,361 mammalian remains originated in at least 24 species. Unlike the other village sites, beaver (NISP=390) ranked first, above whitetail deer (NISP=316), but it is not clear from the thesis whether the beaver figure has been inflated by modified or curated incisors. This beaver/deer reversal might reflect the site's function as a fishing station, but at the Driver fishing camp, such a reversal was not found. The Steward site is also unusual in the high, third placement of *Canis* sp. remains (NISP=107), which included both dog and wolf elements, but which the analyst felt were mainly dog (ibid.:59-60). Woodchuck (NISP=69), meadow vole (NISP=48) and chipmunk (NISP=39) followed *Canis* spp. ahead of black bear (NISP=27), which is ranked much lower here than on the village sites but similar to its lowest ranking at Driver. Hare/rabbit (NISP=19), marten (NISP=14) and river otter (NISP=11) formed a middle group of mammals. Considering that deer was not ranked first, the presence of moose (NISP=8) was surprising. A few red fox (NISP=7), grey squirrel (NISP=5) and mink (NISP=4) specimens were identified, followed by single specimens of shrew, long-tailed weasel and wolverine.

Among the 164 avian remains, 54 were identified beyond class. The ruffed grouse dominated these (NISP=19), followed by passenger pigeon (NISP=6), blue or snow geese, crow or raven and Picidae family bones (NISP=5 each). One at least of the Picidae specimens was from the yellow-shafted flicker. There were two specimens each from common loon, pied-billed grebe, Canada goose and red-tailed hawk. Represented by single specimens were white-winged scoter, sandhill crane, killdeer, barred owl, grosbeak or finch and one of the perching birds.

The remaining classes were represented by few specimens. Small frogs and bullfrogs (NISP=11) were included in the sample. Snapping turtles (NISP=5), including one very large individual, were the most common reptilian remains. There was a single specimen for each of the stinkpot, Blanding's and painted turtle.

The Beckstead Site

The last site to be reviewed here is Beckstead. It is a palisaded village site located on Fritz Markle Creek, a tributary of the South Nation River (Pendergast 1984:1-2), "about 20 km northwest and inland from the Steward site" (Junker-Andersen 1988:100). Because student papers have been summarized in the published report (D'Andrea *et al.* 1984), it alone will be referenced here. The remains were excavated from the living area of the site, but unfortunately neither screening nor floatation was used in the salvage excavations of 1977 from which the 8,216 studied faunal remains came.

As at other village sites excavated with similar techniques, mammalian specimens (NISP=4823) were most frequent, reaching 58.7 percent of the total. Fish (NISP=2257) were second at 27.5 percent and the 726 shells formed 8.5 percent. Amphibians (NISP=147; 1.8%) were much more common than the birds (NISP=86; 1.0%) or the three reptiles (0.04%).

The mammal species from Beckstead were surprising. Most noticeable was that whitetail deer (NISP=152) was ranked fourth after black bear (NISP=373), beaver (NISP=238) and fisher (NISP=165), which was also very common in one of the Roebuck samples. As at McKeown, no bones were identified as domestic dog and those recognized as *Canis* sp. (NISP=42) were fewer than those identified to river otter (NISP=73) or marten (NISP=65). After *Canis* sp. were muskrat (NISP=25), raccoon (NISP=17), red squirrel (NISP=13), meadow vole (NISP=8), grey squirrel and porcupine (NISP=6 each) and woodchuck and mink (NISP=5 each). Cottontail rabbit (NISP=4), deer mouse (NISP=1), jumping mouse (NISP=1) and bobcat (NISP=1) were poorly represented. No moose or wapiti specimens were identified.

Of the fish, those identified to the family Catostomidae totalled 135, with an additional 54 sucker bones from the genus *Catostomus* and 17 more precisely identified as longnose sucker, making suckers the majority among the fish bones. Suckers were followed by the bass family specimens, Centrarchidae (NISP=155), with an additional one recognized as *Micropterus* sp. and another as largemouth bass. There were also two temperate bass bones (*Morone* sp.). Eel bones (NISP=123) were common in the Beckstead houses. Of the 35 catfish specimens, 17 were further identified as channel catfish and one as yellow bullhead. Three of the 14 pike bones were further recognized as northern pike and there were five walleye specimens. There were two lake sturgeon bones and one example each of order Cypriniformes and freshwater drum.

There were very few amphibian or reptilian specimens. However, the 147 amphibian remains formed a higher proportion here than on other sites and these were all either frog or toad bones. Fewer turtle remains were identified here than on other sites, and of the three noted, one only was further specified as snapping turtle.

The avian identifications were more like those from the other sites. Ruffed grouse was the most common (NISP=17), followed by passenger pigeon and yellow-bellied sapsucker (NISP=2 each). There were three duck bones not identified to species and one Canada goose element. The common tern and a woodpecker of some sort had one bone each.

In sum, the small bird sample and the dominance of sucker bones among the fish is like the other zooarchaeological collections from the Prescott area but the ranking of the mammal species and the large proportions of fish and amphibian bones are unusual. The inclusion of scales for some fish species (particularly bass) but not all, might explain the relatively high ranking of bass within the fish class and of the fish class in the total vertebrate sample. Beckstead appears to be atypical of the general zooarchaeological pattern of the other St. Lawrence Iroquoian village sites.

Defining Differences between the proto-Huron/Petuns and the proto-St. Lawrence Iroquoians

Using the broader data base of sites found in the two areas dating to around A.D. 1500, many similarities in the animals exploited by the proto-Huron/Petuns and proto-St. Lawrence Iroquoians were found, but there were also differences that were fairly consistent (Figure 9-3).

For both groups, mammals provided most of the meat and whitetail deer remains were the ones most often identified. Both groups also made much use of beaver and woodchuck. Both collected red squirrel and hares fairly often. Small mammals, such as chipmunks, grey squirrels, mice, voles and shrews, occurred in very limited numbers on sites in both areas, as did members of the cat family (bobcat and/or lynx).

Various other mammals were relied upon to differing degrees. The main differences were in the numbers of dog and/or *Canis* sp., bear, muskrat and porcupine specimens. Fisher, raccoon and red squirrel seem to have been exploited differently by the two groups as well. Dogs were very common on proto-Huron/Petun sites, usually being ranked second by NISP, but occasionally even out-ranking deer, as at both the White and Risebrough sites. Dog and *Canis* sp. remains were present on St. Lawrence Iroquoian sites but, except for Steward, their numbers were few and their rank low in most of the sites' mammalian lists. Black bear remains occurred in both areas. On proto-Huron/Petun sites, the placement of bear varied in the mammalian NISP lists, but, in general, black bear specimens were much less frequent than those of deer, dog, beaver and woodchuck and often were poorly represented. Bear percentages were consistently higher in the Prescott cluster sites, where they usually ranked in the third to fifth positions. Although bear specimens were very infrequent at the Driver and Steward fishing camps, black bear was the top ranked animal at the Beckstead village. Similarly, muskrat was commonly identified on proto-St. Lawrence Iroquoian sites, often ranking third or fourth, but occasionally falling lower (possibly sixth at Roebuck and eighth at Beckstead). Although muskrat was well-represented at Keffer such remains were infrequent at the other proto-Huron/Petun sites, where muskrat often ranked with the last-place group, as at McKenzie, Risebrough and Boyd. Porcupine remains were absent or very uncommon on the proto-Huron/Petun sites reviewed here, whereas they were found on most proto-St. Lawrence Iroquoian sites. Similarly, fisher specimens were more frequently found on proto-St. Lawrence Iroquoian sites and, occasionally, many were identified. Fisher placed as high as third both in one Roebuck sample and at Beckstead. Red squirrels ranked higher at many proto-Huron/Petun sites than at most proto-St. Lawrence Iroquoian ones, but the pattern is not consistent. Conversely, raccoons were absent or rare on many proto-Huron/Petun sites, although they were with the middle group of mammals at Draper and Keffer, whereas they were represented on all the proto-St. Lawrence Iroquoian sites considered here, except Steward, and their numbers consistently placed them with the middle group of mammals. Mammals represented in even fewer numbers than these middle-sized ones do not show distinctive patterns of exploitation. However, a greater variety of species is found on most proto-Huron/Petun sites than on most proto-St. Lawrence Iroquoian ones, including Keffer and McKeown.

There are also differences in the very poorly represented large Cervidae. Moose appeared more often on proto-Huron/Petun sites, although a few moose specimens were found at Roebuck, McIvor and Steward. Wapiti occurred in small numbers at many proto-Huron/Petun sites (Draper, McKenzie, Ratcliff, Seed-Barker) and was mentioned by Brodie for sites in the general area. Conversely, wapiti was found on only one (Roebuck) of the proto-St. Lawrence Iroquoian sites. Caribou remains were found on a single site in each area. Thus, while both groups exploited whitetail deer heavily, other members of the deer family appear to have been taken more often by proto-Huron/Petuns than by proto-St. Lawrence Iroquoians, although neither group appears to have made much use of these other cervids.

As was true of the mammalian exploitation, while many of the same fish species were exploited by both groups, their proportions varied. The proto-Huron/Petuns fished primarily bullheads and suckers, and appear to have had a special interest in whitefish. Moderate fishing of pike, perch, bass and walleye is indicated. The proto-St. Lawrence Iroquoians moved to special sites, such as Driver and Steward, to fish American eels and suckers, particularly redhorse suckers, and they also took bass and catfish. Bass were much more common on these sites than on the proto-Huron/Petun ones, but catfish bones were far rarer. Very few eel bones were found on proto-Huron/Petun sites and conversely, no whitefish were definitely identified from any of the proto-St. Lawrence Iroquoian sites reviewed here. Both groups made only limited use of freshwater drums, bowfins and minnows.

Like the mammals and fish, the few bird remains show differences by species. Proto-Huron/Petun avian samples are dominated by wild turkey and passenger pigeon bones, with some ruffed grouse and ducks on most sites and limited numbers of other birds. Proto-St. Lawrence Iroquoian avian samples are dominated by Canada goose, ruffed grouse and passenger pigeon with a variety of other birds.

The number of examples for the remaining classes was small for all the sites. Both groups made use of a variety of turtles, a few snakes and frogs and/or toads. However, the proto-Huron/Petuns selected painted turtles most often followed by snapping turtles, whereas the proto-St. Lawrence Iroquoians apparently preferred snappers and then painted turtles. Finally, it appears that the proto-St. Lawrence Iroquoians ate invertebrates more than did the proto-Huron/Petuns, who were more apt to make artifacts from the shells.

Summary and Conclusions

The consideration of other, often less carefully retrieved and identified, zooarchaeological samples from sites close to Keffer and McKeown, in both space and time, has added support to the subsistence differences noted for the proto-Huron/Petuns and proto-St. Lawrence Iroquoians based on the Keffer and McKeown faunal material. Thus, arguments made in the previous chapter for the proto-Huron/Petuns having a better meat diet than the proto-St. Lawrence Iroquoians are bolstered by the increased comparative data.

Only minor modifications to the conclusions reached on the basis of those two sites' zooarchaeological samples need to be made to incorporate the additional zooarchaeological evidence. Muskrats were more common at Keffer than at many of the other proto-Huron/Petun sites, although there was variation in their proportions among these sites, and wapiti were represented at many proto-Huron/Petun sites despite their not being identified in the Keffer sample. The addition of wapiti to the proto-Huron/Petuns' list of exploited mammals is significant because it is such a large mammal, providing much meat with each individual eaten. Although no nutrient composition studies have been located for wapiti, based on those of other members of the deer family (Table 8-31), wapiti meat likely has a very high protein content and is a good provider of calories. Conversely, since muskrats are not large and their nutrient composition is relatively low in their class (Table 8-31), their decline in importance with the addition of the other sites is not as significant. Dogs were more common among the proto-St. Lawrence Iroquoians than their very low representation at McKeown suggested, but they were still much less frequent among this group than among the proto-Huron/Petuns in the Toronto area. Thus, the consideration of the zooarchaeological samples from these neighbouring sites has confirmed that there were consistent differences in animal exploitation between the proto-Huron/Petuns and the proto-St. Lawrence Iroquoians. Some were differences in kinds of species, but most were differences in degrees of exploitation of the same species.

These zooarchaeological investigations suggest several things. The general similarities in the prime animals exploited likely reflect the fact that the proto-

Huron/Petuns and the proto-St. Lawrence Iroquoians were historically and culturally related. They hunted and fished using the same sorts of techniques and equipment and they used their prey to make similar meals and articles of clothing. Possibly they held common beliefs about the animals on which they relied. An ecological explanation can also be offered. The most economical explanation of the specific differences in the animal remains on their sites would be that these related, but different Iroquoian peoples hunted in areas that supported different animal populations. If their hunting territories had overlapped, greater similarities in the zooarchaeological remains would have been possible. For example, if the Prescott cluster people had exploited areas farther south and/or southwest, they would have been able to take wild turkeys. But, unlike the long distance hunting trips reported for the Hurons in the 1600s by Champlain and Sagard, in the late 1400s and early 1500s, habitats closer to the village sites appear to have been exploited. This in turn suggests that prey were not scarce in the vicinities of the villages. This was likely because the human population was not as densely clustered and the villages were more dispersed than they were in seventeenth century Huronia. A richer natural environment in the Toronto region undoubtedly supported greater wildlife densities and thus increased the possibilities for successful hunts closer to home.

A similar situation appears to apply to fishing. From the Driver and Steward sites, it is known that some proto-St. Lawrence Iroquoians left their villages and lived for at least short periods each year in special fishing camps.

However, these were closer to their village sites than the seventeenth century Huron village of Cahiagué was to the islands in Georgian Bay where the historic Hurons fished. Similarly, the Keffer inhabitants must have travelled away from their village to catch whitefish, but again their going down to Lake Ontario was not as far as Huron fishers travelled. The faunal analysis supports the interpretation that around A.D. 1500 both the proto-Huron/Petuns and the proto-St. Lawrence Iroquoians were feeding themselves using their crops and the wild resources from relatively small catchment areas (Higgs and Vita-Finzi 1972).

It would be interesting to compare the results reported here with well-excavated, large, zooarchaeological samples from historic Huron village sites to see if their greater human population density and reduced prey populations, as reported in the historical records, resulted in a different pattern of faunal remains. Unfortunately, the evidence is not robust from Huronia for this type of research. Most sites lack floatation samples, and for most only student analyses are available. Better excavated samples and more thorough zooarchaeological studies are needed. With most excavations in Ontario now including floatation sampling and more reports including sections on the faunal material recovered, this problem of insufficient zooarchaeological information will be overcome. Thus, the correspondences and/or discrepancies between the written material on subsistence and the zooarchaeological data from Huron sites could be revealed more precisely.

It would also be interesting to study the diet of the proto-Saint Lawrence Iroquoians over a longer time period. According to Pendergast (1991), the proto-

St. Lawrence Iroquoians moved to the Prescott region for better conditions, particularly soils, for growing their crops. This suggests produce might have been inadequate in their previous location, which was about 80 km to the northeast in the Summerstown cluster of sites. But the short growing season in the Prescott region might have presented difficulties for the maturation of crops, particularly in cooler periods such as the proposed Little Ice Age. At McKeown the lack of dogs, which can serve both as aids for hunting and as a renewable meat resource, particularly when hunting and fishing returns are low, combined with the domination of the McKeown fish sample by sucker, a small fish, and the evidence that the McKeown villagers were eating clams, traditionally considered a starvation food, allow the supposition that these people might have been experiencing hardship in feeding themselves. Thus, it would be interesting to compare the McKeown zooarchaeological remains with those from both earlier and later St. Lawrence Iroquoian sites to determine whether there was a decline in the quantity and quality of food for these people.

CHAPTER 10

CONCLUSIONS

The main question addressed in this study was the possible distinctiveness of the diets of two groups of Iroquoian people living in adjacent parts of southern Ontario around A.D. 1500. Using subsistence information recorded in early ethnohistorical documents and three types of archaeological evidence, the diet of the proto-Huron/Petuns occupying the Keffer site was found to be both different from and more nutritious than that of the proto-St. Lawrence Iroquoians at McKeown. A review of zooarchaeological data from contemporaneous, neighbouring sites has revealed that these differences extended to the general proto-Huron/Petun population of the Toronto area and the proto-St. Lawrence Iroquoians of the Prescott cluster.

Osteological information has supported the zooarchaeological evidence of different diets for these two groups. In particular, differences in the degrees of dental attrition and the number of caries indicate a diet with more cooked maize for the proto-Huron/Petuns than for the proto-St. Lawrence Iroquoians. Cranial attributes, both metric and non-metric, suggest that there was some genetic exchange between the proto-Huron/Petuns and the proto-St. Lawrence Iroquoians, but that there may have been more interaction within the proto-Huron/Petun population than among the proto-St. Lawrence Iroquoians. With greater interaction, the populations of individual proto-Huron/Petun villages and the subgroup as a whole might have been maintained more easily in years when crops or natural resources were scarce at some but not all sites across the region.

Insufficient information has been published on osteological differences by sex to determine whether Iroquoian males and females consumed different foods. Katzenberg (1995) has concluded that dietary differences by gender are not evidenced in the chemical studies of Ontario prehistoric bones, yet there are limited data supporting such a difference (for example, the strontium levels of the sexed Serpent Mound bones and the carbon values of the Surma burials). Morphologies of the bones and teeth (for example, tooth wear and caries) also suggest gender differences in diet. If more skeletal data on sex are gathered, it seems likely that more evidence will be discovered supporting different food intakes for males and females.

Palaeoethnobotanical evidence, also, is as yet poorly documented for these two groups. The available samples from Keffer and McKeown indicate the same domestic plants at each, except tobacco which has not been reported for McKeown. Yet a greater variety of wild plant seeds were identified from Keffer. Based on a comparison of the two geographical locations' microclimates, soils and the amount of time crops require to mature, particularly corn and beans, it has been demonstrated that the proto-Huron/Petuns around Toronto were more favourably located for a corn-based horticultural system than were the proto-St. Lawrence Iroquoians around Prescott. The Canada Land Inventory maps on the Soil Capability for Agriculture for the two areas (for Toronto, Canada, Department of Regional Economic Expansion 1968; for Ogdensburg, Canada, Department of Regional Economic Expansion 1966) show the Keffer site in a Class 1 area and McKeown in a complex area of Class 1 and Class 4 soils. For the Canada Land Inventory maps, capability ratings range from the most productive Class 1 through to the most severely restricted Class 7. Thus for the agricultural capability maps, Class 1 soils have no significant limitations for a wide variety of crops, whereas Class 4 soils have severe limitations and are only low to fair in productivity for only a fair range of crops. Similarly, the Canada Land Inventory maps depicting Land Capability for Forestry (for Toronto 1971b; for Ogdensburg 1971a) show Keffer in a Class 2 region, where lands have slight limitations to the growth of forests, and McKeown in a Class 4 area, where there are moderately severe limitations to forest growth. More fruit and nut-bearing trees can be grown in the Toronto region. Although climate and topography are not determining, they can be influential factors in population growth and settlement patterns (Trigger 1963). The longer growing season in the Toronto area and the ameliorating affect of Lake Ontario would be beneficial for crops and would also promote a greater diversity and abundance of wild plants compared to vegetation in the Prescott area. Furthermore, there had been a longer period of synergism between cultivated plants and the proto-Huron/Petuns than between such plants and the proto-St Lawrence Iroquoians. In addition, the longer occupation of the Toronto region would have resulted in the fortuitous creation of more abandoned village habitats and thus more areas suitable for the growth of important wild food plants such as berries. Monckton (1994) has argued that such deserted areas were the primary locations for Huron gathering activities and likely the same factors applied in the fifteenth century.

Relying primarily on the zooarchaeological data, many similarities in proto-Huron/Petun and proto-St. Lawrence Iroquoian subsistence have been demonstrated. As was the case with other Iroquoians, mammals provided most of the meat and deer was the most important prey. Based on reports in the early ethnohistorical sources, it is evident that deer were hunted for both their meat and their skins, which were essential for clothing. Similarly, both ethnohistorical and zooarchaeological data indicate that beaver were very frequent prey of both Iroquoian groups. Woodchuck were often exploited too. Both groups made only limited use of birds and even less of reptiles, amphibians and invertebrates.

More importantly, patterns of differences between the proto-Huron/Petuns and the proto-St. Lawrence Iroquoians have been found. The proto-St. Lawrence Iroquoians appear to have eaten more invertebrates than the proto-Huron/Petuns and there are differences in species utilization within the vertebrate classes. This is certainly true of the mammals. Faunal remains of *ca.* A.D. 1500 proto-Huron/Petun sites include large numbers of domestic dog specimens; on some sites, these even outnumber the whitetail deer remains, whereas the opposite is true of proto-St. Lawrence Iroquoian samples, where dog and *Canis* sp. remains usually are few. Conversely, proto-Huron/Petun sites are characterized by few black bear bones, whereas these are common on proto-St. Lawrence Iroquoian village sites. Porcupine specimens are infrequent in proto-Huron/Petun samples, but fall within the middle group of represented mammals at proto-St. Lawrence Iroquoian sites. Muskrat is common at only some proto-Huron/Petun village sites but at most proto-St. Lawrence Iroquoian ones, sometimes ranking as high as third. Similarly, mustelids (e.g. fishers) are only occasionally common in proto-Huron/Petun samples, whereas at proto-St. Lawrence Iroquoian sites mustelids are more consistently found within the middle ranking group of mammals. Furthermore, at some proto-St. Lawrence Iroquoian sites, fishers rank in the top group. Red squirrel remains are more common on most proto-Huron/Petun sites. Such sites consistently have a few examples of wapiti and moose, but these are usually absent from proto-St. Lawrence Iroquoian faunal assemblages.

Many of these mammalian differences likely reflect the relative availabilities of species in the catchment areas of the two sites. The ranges of the represented species extend over both the Toronto and Prescott areas, except for the rock vole which lives farther north. However, the densities of animals often vary across their ranges. Ungulates, the most significant meat providers to both the proto-Huron/Petuns and the proto-St. Lawrence Iroquoians, occur in greater numbers in the Keffer region. According to the Canada Land Inventory maps on Land Capability for Ungulates, Keffer is located in a Class 2 land area, which has only very slight limitations to the production of ungulates (Canada, Department of Regional Economic Expansion 1971c), and McKeown is in a Class 3 land area, where ungulate productivity is moderately high but may be reduced in some years.

Furthermore, an area of Class 1 lands for ungulates abuts the Keffer area on one side, whereas a Class 4 region surrounds nearly all of the McKeown area. Thus, larger populations of deer, and in the past wapiti, should occur around Keffer than McKeown. Moose, however, might be denser around McKeown since they prefer boreal forests to primarily deciduous ones. Thus, the greater variety of the deer family species often found on proto-Huron/Petun sites might reflect greater opportunities to hunt the various members of the deer family. The same explanation does not, however, fit the greater occurrence of moose in the Toronto region sites. Cultural factors, such as a special effort to procure moose by the proto-Huron/Petuns or conversely little such effort by the proto-St. Lawrence Iroquoians, might explain the differences, but it must be remembered that the moose remains are few in both regions.

The rankings of some other mammals also can be attributed to environmental factors. The higher rankings of martens and porcupines at proto-St. Lawrence Iroquoian sites coincides with their preference for coniferous trees, since there are more conifers in the Canadian biotic province than in the Carolinian forests. That fishers were represented only at McKeown likely reflects this same factor. Fishers feed on hare which are more common in the McKeown area because hares' prefer habitats with spruce or cedar swamps. Such swamps are rare in the Toronto region and common in the South Nation River drainage area. Similarly, water systems in the Prescott area favour higher concentrations of beaver and muskrat, both of which ranked higher at McKeown than Keffer.

Finally, based on environmental factors, one would expect black bear, which "is perhaps more omnivorous than any other native mammal" (Peterson 1966:221), to be equally numerous around Toronto and Prescott. However, Radisson's descriptions suggest that bear were very common in the area immediately south of Prescott and the greater representation of bear remains on proto-St. Lawrence Iroquoian sites may reflect this. In addition, bears become scarcer in heavily farmed areas and it is thought that there was less farming in the Prescott than the Toronto area. Other differences, particularly those of dog, woodchuck, fox, grey squirrel, raccoon, and otter cannot be attributed to catchment area differences. Thus, while many of the mammal rankings can be explained by environmental opportunity, cultural factors were important too, particularly regarding the dog remains and the rankings of some of the medium-sized meat providers.

Most of the fish species identified at Keffer and McKeown have ranges which extend into both sites' catchment areas. A possible exception to this is the American eel, which can be found in Lake Ontario but mainly at its eastern end. Conversely, members of the trout family, including lake trout and whitefish, inhabit deep lakes and only rarely spawn in rivers. Most Proto-Huron/Petun fish samples are dominated by catfish, but whitefish bones are frequent on sites where floatation and careful identification occurred. Following these dominant species are suckers at some proto-Huron/Petun sites and yellow perch at others. Proto-St. Lawrence Iroquoian fish samples are dominated by suckers (particularly redhorse) and American eel followed by a variety of other fish, including the same species as those exploited by the proto-Huron/Petuns. However, the proto-Huron/Petuns appear to have made more use of suckers than the proto-St. Lawrence Iroquoians did of catfish. Eels are rarely identified from proto-Huron/Petun sites and whitefish rarely from proto-St. Lawrence Iroquoian sites. The difference in eel and whitefish representation between the two types of sites likely reflects the local availability of these fish, but such an ecological explanation is not sufficient for the differences in catfish and sucker exploitation. Thus, both the proto-Huron/Petuns and the proto-St. Lawrence Iroquoians exerted much of their fishing efforts on species which were restricted in their distributions. These specializations might have increased between A.D. 1500 and the historic period when reports stressed the importance of trout and whitefish to the Huron and eels to the St. Lawrence Iroquoians. Obviously for fishing, the different environmental opportunities affected, but do not fully explain, the subsistence activities.

Bird remains were even more distinctive between the two groups. On proto-Huron/Petun sites remains of passenger pigeons and wild turkeys are most common, followed by bones of grouse and then ducks and geese. On proto-St. Lawrence Iroquoian sites, Canada goose, passenger pigeon and various duck bones dominate. On sites of both groups, ruffed grouse are common. These avian differences mirror differences in the ranges and the distribution of the population within the ranges of the represented birds. All, except the wild turkey, are found around both Toronto and Prescott. In general, according to the Canada Land Inventory maps for waterfowl, both Keffer (Canada, Department of Regional

Economic Expansion 1971d) and McKeown (Canada, Department of Regional Economic Expansion 1970b) are located in areas with severe limitations for waterfowl (Class 7). The South Nation River includes sections which are Class 4 and 5, but the Don River is worse having Class 5 capabilities only. As well, the numerous marshes in the Prescott area would have attracted large numbers of migrating geese and ducks. Thus, environmental factors could account for the greater hunting of waterfowl among the proto-St. Lawrence Iroquoians as opposed to more emphasis on turkeys, grouse, pigeons and other land birds by the proto-Huron/Petuns.

Finally, both groups collected turtles. But the proto-Huron/Petuns selected painted turtles more often than snappers, whereas on proto-St. Lawrence Iroquoian sites snappers were more frequent. There is no obvious ecological explanation for this difference. Both species occur in both regions. Further, since snappers prefer larger bodies of water, such as small lakes and large streams, whereas painted turtles inhabit smaller bodies of water, particularly marshes and ponds (Froom 1978), the rankings of these two species on these sites are the reverse of what would be predicted, based on availability.

Except for turtles and a few species in the other classes as described above, most of the differences between the prey species of the proto-Huron/Petuns and the proto-St. Lawrence Iroquoians appear to have been determined more by ecological variations between the two areas in which they lived than by different cultural choices. This is strongest for the birds and fish, where the main species exploited are either restricted in the distributions or their densities are greatest in the areas where they contributed most to the faunal samples. This applies particularly to wild turkey, whitefish and lake trout near Toronto and waterfowl and American eel near Prescott. Among the mammals, mixed forest creatures are more common on sites around Toronto, whereas those preferring the boreal forest with some swamps are more common on the Prescott sites. An important conclusion which can be drawn from this comparison is that the main differences between the meat diets, and probably the plant diets too, of these two peoples resulted from ecological differences in the regions that they inhabited. However, the occurrence of more dogs among the proto-Huron/Petuns suggests a cultural difference that was significant to subsistence. There are other culturally determined differences, such as some of the medium-sized mammals hunted, the particular turtles gathered, and the use of invertebrates between the two peoples, but these involve animals which are not as significant to the diet.

Investigation of the nutritive values of the animals and plants consumed revealed that the diet of the proto-Huron/Petuns not only included a greater quantity of food per nuclear family but also that that food was likely more nutritious. More work on the nutritive qualities of many wild foods is needed, however, to compliment that available for the domesticated animals and cultivated plants before this last point can be stated more conclusively.

Thus, the main objectives of the research have been accomplished. It is evident that the proto-Huron/Petuns and the proto-St. Lawrence Iroquoians can be differentiated by their subsistence patterns, differences are found in their zooarchaeological samples, and these differences probably affected their relative viability. In addition, it is evident that the most significant differences, with the exception of number of dogs, and possibly the hunting of wapiti and moose, were not specifically cultural but reflect the opportunities in the local catchment areas.

One initial objective of my research was to investigate subsistence by gender. From the ethnohistorical data, it is known that the Iroquoians' subsistence activities were divided strictly according to gender (Trigger 1990:65). Because Iroquoian males were often away, hunting, fishing, trading or seeking captives, while the women remained in the villages or their surrounding fields, the diets of the sexes would have been different, at least for part of the year. When the men left home, they sometimes carried rations of ground corn meal with them (Brébeuf 1635 JR 8:77-79, 1636 JR 10:89; du Peron 1639 JR 15:153), but often they fed on deer they hunted or fish they caught. Since among the seventeenth century Huron hunting and raiding trips could last as long as four months and the annual fishing trip to Georgian Bay had a duration of about six weeks, for almost half the year the sexes were eating separately. Furthermore, the women did most of the gathering, so they likely ate more fresh fruits and nuts than the males. Remaining in the vicinity of the village throughout the year, the normal diet of women would have been corn soup. Woodchuck remains, which were very common, might represent female food primarily. Woodchuck would have been taken in the warm weather, as they go into hibernation early to reappear only late in the spring.

These animals were not mentioned in the ethnohistorical sources as a hunted species, possibly because women caught them in or near their corn fields. While women may have consumed less meat and fish than men and more woodchuck than deer, it might also be that women less often went hungry, because they were in close proximity to horticultural produce throughout the year. Thus, the historical Huron males and females likely had different diets. Yet, since hunting and fishing appear to have been pursued closer to the villages around A.D. 1500, discrepancies at this earlier time may not have been as great. Nevertheless, a study of the Roebuck skeletal remains indicates that females there consumed more corn than did males. The potential for engendering proto-historic Iroquoian subsistence through osteological studies exists, but it has only begun to be realized. At present, evidence for gender-based diets rests almost exclusively with the ethnohistorical data.

Indications that the exploitation patterns of *ca.* A.D. 1500 were somewhat different from those of the historic period lend support to Ramsden's (1993) argument that historical information is not particularly valuable for interpreting prehistoric archaeological remains. The ethnohistorical information concerning fish in the St. Lawrence area is rich for marine species, but unfortunately sparse concerning freshwater fish or fishing. In this respect ethnohistorical data are not very useful for interpretations relating to the proto-St. Lawrence Iroquoians living in the Prescott region. On the other hand, sturgeon were absent from the zooarchaeological samples, but from the ethnohistorical sources it appears that sturgeon were significant to both groups. The ethnohistorical data and the zooarchaeological findings were also at odds with regard to the frequency of shad among the St. Lawrence Iroquoians and lake trout and burbot among the Hurons. According to the ethnohistorical sources, these species were heavily utilized by these respective peoples, but none of these fish was common in any of the zooarchaeological samples reviewed here. It is possible that the remains of these species were not preserved. The sturgeon endoskeleton is cartilaginous and so decays rapidly (but they have dense exoskeletal scutes which preserve well on many sites) and bones of lake trout and shad are very fragile. Alternatively, it is possible that shad were fished by the Stadaconans but not the Hochelagans, and it may be that the historic Hurons pursued lake trout and burbot more than the proto-Huron/Petuns did. If so, this discrepancy supports Ramsden's position that information derived from the written material cannot be extended to the archaeological data.

Yet, the position that using these two sorts of data in combination gives a more complete picture of subsistence practices has support. In general, the majority of the species mentioned historically were also present in the zooarchaeological samples and the historical information that subsistence cycles and activities were different between the St. Lawrence Iroquoians and the Hurons has been confirmed by the zooarchaeological evidence. In chapter 2, based on ethnohistorical data, it was concluded that a late summer eel fishery was most significant to the St. Lawrence Iroquoians, whereas a later fall lake fishery was most important to the Hurons. The fish remains analyzed in this study corroborate this conclusion. Eels had a high rank among the fish remains at proto-St. Lawrence Iroquoian sites, as did whitefish at proto-Huron/Petun sites. There are many other concurrences. Deer were mentioned in the ethnohistorical sources as the most significant mammal for both peoples and bear hunting was reported as being very common among the more eastern groups. There was little mention of bird hunting, which corresponds to the few avian zooarchaeological samples. Furthermore, wild turkey was mentioned for the western area and migrating birds for the eastern area. In general, observations that the environment of the north shore of Lake Ontario was richer in prey than that of Huronia and Huronia's was richer than that of the St. Lawrence Valley has been supported by this study's findings of a greater quantity of meat per family at Keffer than McKeown. Thus, the zooarchaeological studies indicate that, at least with regard to subsistence, many of the historical observations are accurate and appear to relate to conditions back at least to *ca.* A.D. 1500.

As noted in the introduction, another aspect of this study was to consider how well the opposing theories of Malthus and Boserup relate to Iroquoian horticultural populations. Most considerations of the relationship between population and agriculture have adopted one of these two opposed positions. The Malthusian assumption is that population is the dependent variable, increasing when food sources improve and crashing when the sustainable limits of an environment are exceeded. According to Boserup, population is the independent variable and population pressure results in innovative changes in food production and in the social systems of the growing population.

Malthus' argument that difficulty in maintaining subsistence acts as an inhibiter to population growth might explain the demise of the St. Lawrence Iroquoians. As has been determined by zooarchaeological research and supported by the available palaeoethnobotanical, human osteological and ethnohistorical evidence, proto-St. Lawrence Iroquoians of the Prescott cluster were not nourishing themselves as well as the proto-Huron/Petuns of the Toronto area. Thus, it could be concluded that the population in the St. Lawrence area "crashed" because the environment could not support it, at least in numbers that were competitive in terms of the intertribal warfare that began in the sixteenth century or in terms of the new diseases resulting from greater contact with Europeans. That the *ca.* A.D. 1500 population which moved into this region relied to a considerable extent on horticulture is important. Located on the northeastern margin of an area suited to growing corn, these people appear to have tried to extend a mode of production beyond the region that could sustain it reliably. Thus, Malthus' position that population levels depend on their environments gains support in this instance.

Boserup's position that cultural innovations are important also deserves consideration. She proposed that new methods of producing food would both be stimulated by and alleviate population pressure, but for the St. Lawrence Iroquoians, this does not appear to have occurred. First, there is no evidence of population pressure for the St. Lawrence Iroquoians. Secondly, it appears that their use of a subsistence system that was relatively new to both them and the Prescott region was detrimental to maintaining their population. Pendergast has proposed that the proto-St. Lawrence Iroquoians moved to the Prescott area because the soils there were better for their crops. But despite moving, they were still in an area that was not as favourable as the north shore of Lake Ontario to an horticultural economy. In accord with the Malthusian argument, the population of the proto-Huron/Petuns expanded more than did that of the proto-St. Lawrence Iroquoians. Contrary to Boserupian explanations, the "innovation" of moving to the Prescott region to practice horticulture was not a successful strategy for the St. Lawrence Iroquoians.

Both the proto-St. Lawrence Iroquoians' move to the Prescott area and the proto-Huron/Petuns' relocation to Huronia could be interpreted as responses to population growth beyond the capacities of the local environments, a solution that Binford (1968b:330-36) thought applied in such circumstances. After A.D. 1400, the proto-Huron/Petuns moved from the north shore of Lake Ontario to an environment with soils even more suitable for growing corn. In Huronia there are more sandy and sandy-loam soils, the best in southern Ontario for corn. Furthermore, maize excavated from sites in Huronia exhibits larger cobs with kernels more than a third larger than those found farther south, and it likely matured more rapidly than earlier corn types. Given these conditions, according to the Malthusian argument, the relocation of the proto-Huron/Petuns to Huronia should have resulted in population growth. This did not happen. As Warrick (1990) has shown, the proto-Huron/Petun population increased dramatically in the fourteenth century, when the proto-Huron/Petuns expanded numerically and geographically, occupying the whole of the Toronto-Kingston-Huronia triangle, and then remained constant at around 30,000 people until the epidemics beginning in 1634. After A.D. 1400, their settlements became more concentrated in Huronia, where their population neither increased not declined. While this seems contrary to the Malthusian model, other environmental factors, such as a shorter frost-free period and the greater likelihood of droughts in Huronia (Heidenreich 1971:57-59) than on the north shore of Lake Ontario, might account for the lack of the population growth. The limit on Iroquoian population might have been determined by the availability of animals, particularly deer for their skins (Gramly 1977; Trigger 1981; Webster 1979, 1981) rather than the productivity of their crops. In historical times large game was reportedly scarce in Huronia and deer were scarce on prehistoric sites there too (Robertson *et al.* 1995:77). Thus, the absence of substantial population growth in Huronia can be explained using Malthusian ideas; population in southern Ontario remained the same regardless of where the people settled because it had reached the limit supportable by the available game.

Using the Malthusian model, one would expect that the introduction of horticulture into southern Ontario would result in population increases. But Crawford's research has shown that corn was introduced to the Princess Point people along the Grand River as early as A.D. 540 and Warrick has shown that population did not increase dramatically until the 14th century. Even if horticulture was introduced suddenly into southern Ontario later, at A.D. 900 (Snow 1994a, 1995) or A.D 600 (Snow 1996), there should have been a marked increase in population before the 1300s, but this is not the case. Conversely, if one accepts the argument that domestication proceeded slowly (Cohen 1977), beginning with local wild plants as far back as the Archaic period (B. Smith 1992), then the increase in population should have been gradual too, but Warrick has demonstrated a *rapid* increase in the 1300s. Thus, horticulture and population do not appear to be closely interdependent in the pre-A.D. 1300 period. Malthusian explanations can be applied to some aspects of the proto-Iroquoian populations in southern Ontario but the rapid increase in the proto-Huron/Petun population *centuries after* the introduction of maize seems to weaken the Malthusian model.

However, Iroquoian demographics might have shown a population increased only after beans were added as a cultigen, since the combination of corn with beans provides a nutritionally valuable source of food that corn alone lacks. Despite their poor representation on archaeological sites, it is evident (chapter 8) that beans were cultivated from at least the beginnings of the 11th century. Thus, there remains a difference of approximately three centuries between the addition of beans and the period of rapid population growth in southern Ontario in the fourteenth century (Warrick 1990:363-364). Yet, there appears to have been an even greater period between the first appearance of corn in Ontario and its widespread adoption. Allowing for a time lag between the first occurrence of beans and their widespread cultivation in Ontario, analogous to the evidence for corn, it can be argued that population grew as a result of the improvement in the diet with the addition of beans. Plant remains from the Middleport Wiacek site demonstrate that, between A.D. 1350 to 1450 (Lennox *et al.* 1986:132-158; Robertson *et al.* 1995:67-74), the cultivation of corn, beans, squash and sunflowers was well-established in the area around Barry and these people are thought to have moved there from the north shore of Lake Ontario. Unfortunately, the majority of the southern Ontario sites with archaeobotanical evidence date to the sixteenth century (Monckton 1992:9) and work in the Lower Grand River area on much earlier sites has emphasized the introduction of maize to Ontario (Crawford and Smith 1996, D. Smith and Crawford 1995). There is only limited information for the critical period between these times. However, the Malthusian position that population grows after the adoption of agriculture is supported by the Ontario evidence, if the statement is modified. Whereas population did not grow rapidly after the introduction of maize horticulture, it increased greatly after the integration of beans into the horticultural system.

Unfortunately a detailed population history of the St. Lawrence Iroquoians, similar to Warrick's for the Hurons, has not been written but certainly some sort of catastrophe over took the proto-St. Lawrence people not long after their adoption of maize-beans-squash horticulture. There is no evidence that this was caused by overpopulation, as Malthusian logic would predict. Pendergast wrote that the proto-St. Lawrence Iroquoian population probably expanded as a result of the increased importance of agriculture, but the widely scattered distribution of the few St. Lawrence Iroquoian sites suggests that there was no overpopulation of people in this region.

Since it has been argued that the Malthusian model can be supported by much of the Iroquoian information, it is not surprising that Boserup's (1965) arguments seem less applicable to the same data. The occurrence of maize on Ontario sites and the later addition of beans centuries before the population expansion of the 14th century is evidence that the development of agriculture in this region was not a response to population pressure. In addition, because it was constructed to explain population *growth* not its demise, Boserup's model is difficult to apply to the proto-St. Lawrence Iroquoians. However, Boserup's idea of dramatic innovations in cultures is of interest. The historical evidence weakly suggests that the St. Lawrence Iroquoians were not as committed to horticulture as were the Hurons (Trigger 1963) and that, at least among the Stadaconans, the sexual division of labour in relation to subsistence activities was not as well-developed as it was among the Hurons. The Huron's adoption of a strict sexual division of labour between farming females and hunting males could be considered an example of a Boserupian "dramatic innovation". Conversely, the proto-St. Lawrence Iroquoians' greater flexibility in gender roles in respect to subsistence might have been less efficient for a subsistence system which included hunting and fishing as well as gathering and horticulture. The agricultural cycle would have necessitated changes in the traditional hunting and fishing activities.

However, as discussed above, the adoption of horticulture seems to have occurred gradually. Furthermore, if women had been the collectors and domesticators of native plants over hundreds of years prior to horticulture, changes in the roles of men and women might not have been dramatic when foreign food plants began to be grown in the northeast. However, with a change to an horticultural subsistence base, a strong division of labour might have resulted in greater quantities of food being available to the proto-Huron/Petuns.

Perhaps neither theory fits exactly with the Iroquoian data because each describes changes in a population in isolation from outside populations. From osteological and archaeological evidence, it is evident that the proto-Huron/Petuns and the proto-St. Lawrence Iroquoians interacted. St. Lawrence Iroquoian pottery and deer scapula pipes have been excavated from the Keffer site, and Huron style pottery has been recovered from McKeown. In addition, the ethnohistories give many examples of trading, raiding and migration among the Iroquoians. Most explanations of the demise of the St. Lawrence Iroquoians invoke outside influences. In this dissertation, it has been suggested that diet was likely important to the histories of these two groups and it has been concluded that the Malthusian theory of population being dependent on subsistence applies more closely than does Boserup's to the Iroquoian data.

Despite weaknesses in the current zooarchaeological methods and data (more float samples need to be analyzed, and more of the analyzed material needs to be published), this study has demonstrated that much can be learned about differences in subsistence from zooarchaeological remains and that such differences can be significant for distinguishing archaeological populations. As Gould (1990) argued and this study has tried to demonstrate, such a "low level" explanation should receive primary consideration in investigations of cultural change. From this study, it is apparent that differences in diet should be incorporated into comparisons of groups and explanations of population change.

It is hoped that this research will stimulate more work of a similar nature on sites of other time periods. Material from Huron sites dating to the early 1600s could be compared with the historical data to determine how similar these two sources of data are. St. Lawrence Iroquoian sites dating both before and after A.D. 1500 could be studied to determine whether their subsistence base was deteriorating over time. Since, as suggested above, Malthusian limits to population growth may have been determined by the numbers of mammals harvested rather than the quantity of crops grown, changes in the ratios of mammalian zooarchaeological remains (particularly deer and perhaps other fur bearers) to Iroquoian populations over time should be researched. More data on the adoption and spread of the cultivation of beans across Ontario are also needed. In this dissertation, some account has been taken of the effects of fishing camps versus horticultural (village) sites on their faunal contents, but more detailed studies of these differences should be made. As more special purpose sites, such as hunting camps or women's summer field camps, are excavated, their zooarchaeological remains should be compared with those from village sites. Evidence for systematic differences in faunal samples between larger and smaller villages should also be investigated. Settlement size might be correlated with differences in exploitation of the animal classes or particular species. With the many improvements in the processual-based middle range theory relating to collection and analysis, the possibilities for future zooarchaeological comparisons across sites and through time seem endless.

FIGURES

Figure 1-1: Locations of the Keffer and McKeown Sites

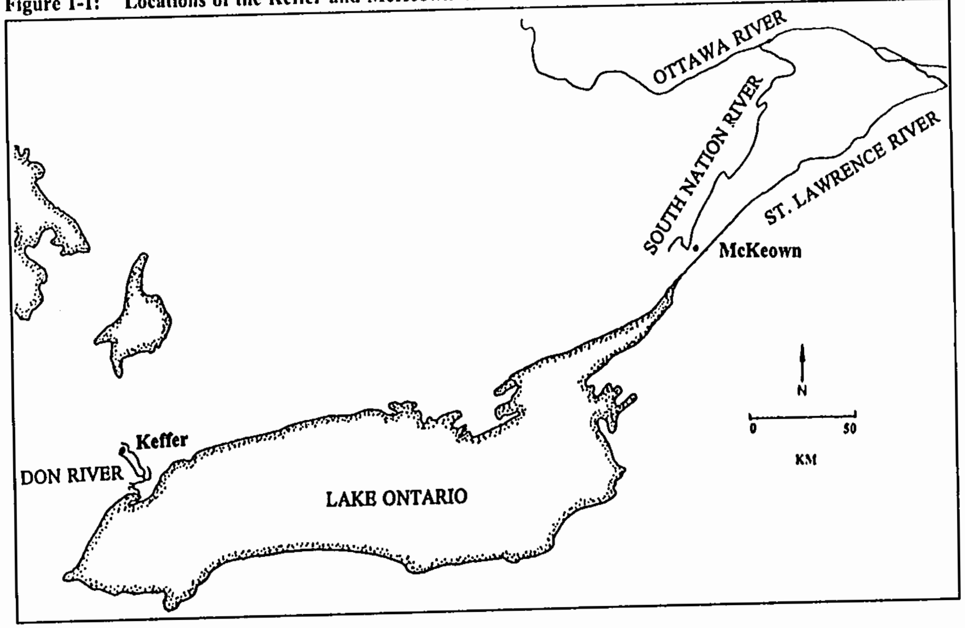
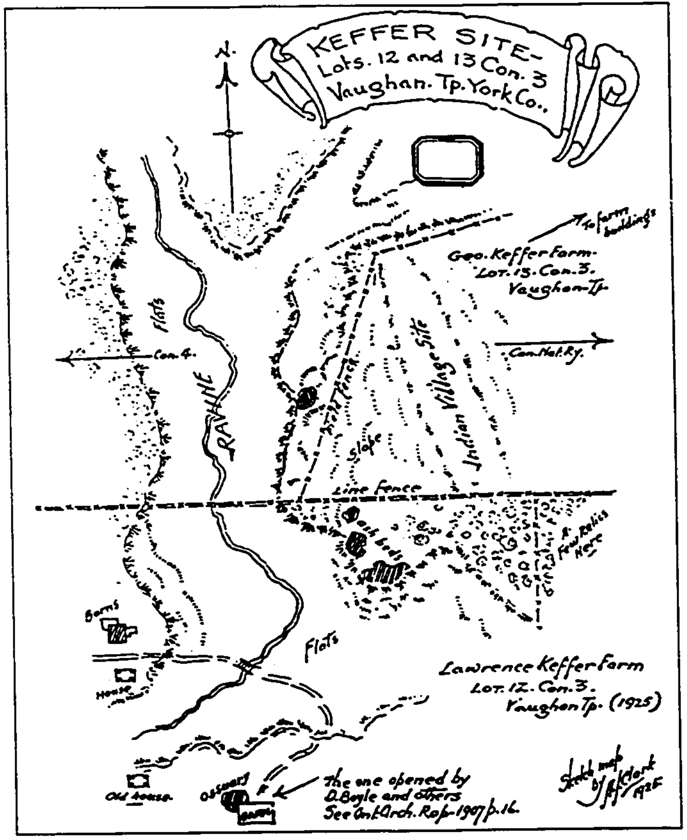


Figure 4-1: A. J. Clark's Map of the Keffer Site



Source: Keffer site, sketch map by A. Clark, 1925 (Box 1 - F7, 57). Reproduced by permission of the Canadian Museum of Civilization.

Figure 5-1: General Characteristics of Extremity Bones of Vertebrates

	FISH	AMPHIBIAN	REPTILIAN	AVIAN	MAMMALIAN
1. WEIGHT (In proportion to size)	Light	Light	Moderately heavy	Light	Heavy
2. APPEARANCE	Semi-translucent	Not semi-translucent	Not semi-translucent	Not semi-translucent	Not semi-translucent
3. SURFACE STRUCTURES	Moderately developed	Poorly developed	Poorly developed, often absent	Well developed, often sharply outlined	Well developed and well outlined
4. CORTEX	No central cancellous bone	Varies, thin to moderately thick	Moderately thick	Thin	Thick
5. MARROW CAVITY	Absent	Varies, relatively large to small	Absent	Large	Relatively small
6. BONE EPIPHYSES	Absent	Absent	Absent	Distinguishable in some species until nearly adult	Distinguishable until young adult

Source: Dr. Howard G. Savage

Figure 6-1: Location of the Keffer Site on the Don River

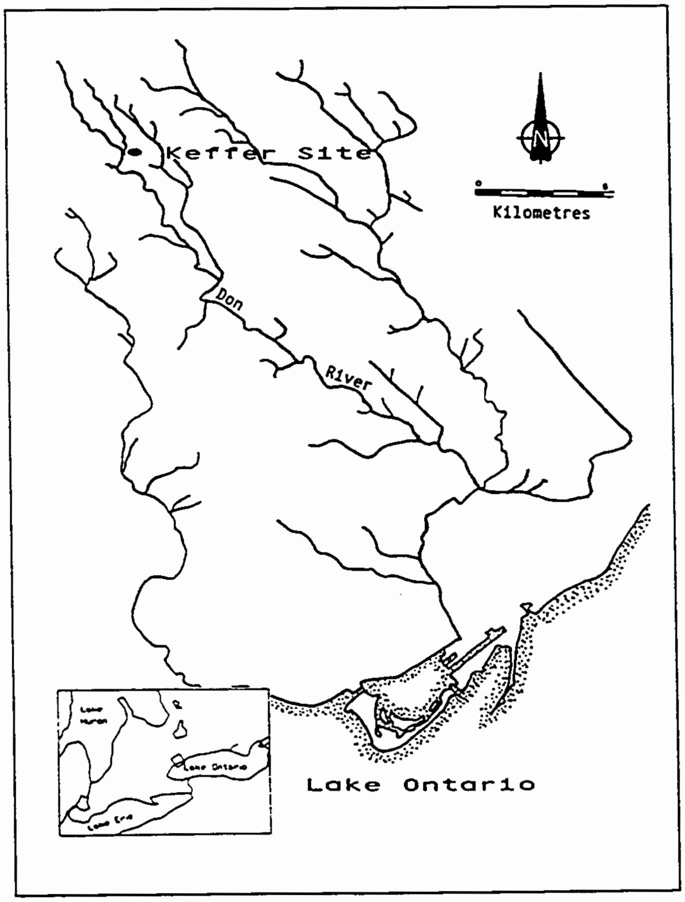


Figure 6-2: Keffer Site Plan Showing Houses and Middens

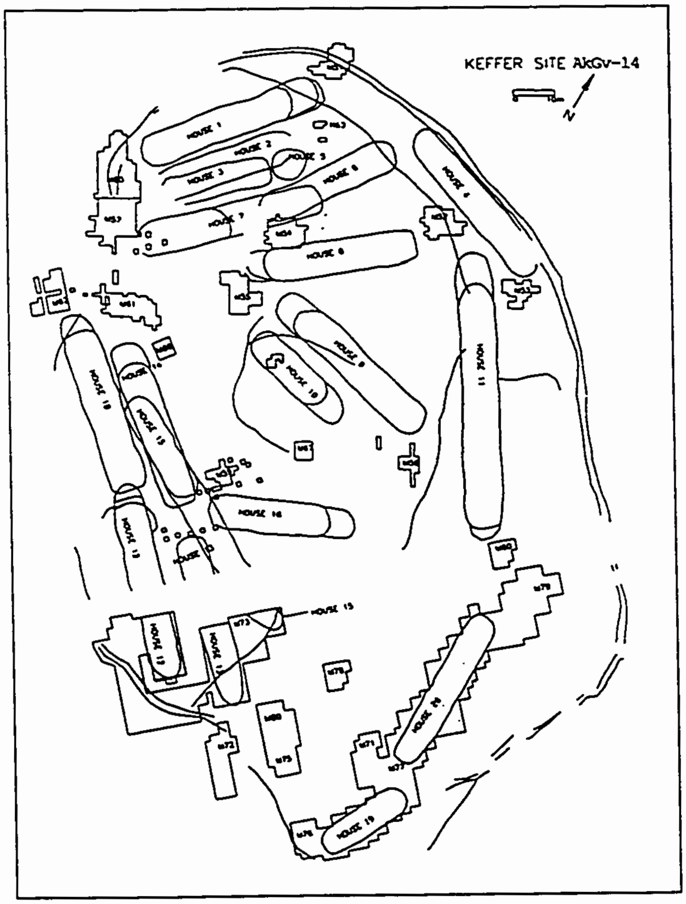


Figure 6-3: Seasonal Availability of the Keffer Site Fish

```
             JAN  FEB  MAR  APR  MAY  JUNE JULY AUG  SEPT OCT  NOV  DEC

            |  deep          into shoal   into deeper       spawning in
Whitefish   |--------        +-+-+-+-+- ---------------        ++++++----
            | waters           waters        waters        shallow waters
            |
            |      in streams           in deep            spawning  in
Brook Trout |+-+-+-+-+-+-+-+-+-+-+-+-+  ---------         ++++++++++++++
            |                           lake waters           streams
            |
            |  deep     surface      deep               spawning in
Lake Trout  |--------- +-+-+-+-   -------------            ++++++    ---
            | waters     waters     waters                 shallow waters
            |
Channel     |      up rivers   spawning
Catfish     |      +-+-+-+-+-+-++++++++++++
            |      to spawn  shallow waters
            |
Brown       |                    spawning   in schools in shallow
Bullhead    |             +-+-+- +++++++++ +-+-+-+-+-+-+-+-+-+-+-+-+-+-+
            |                                  waters all year
            |
            |     up rivers   spawning
Perch       |     +-+-+-+-+ +++++++++
            |     to spawn
            |
            |                      spawning in
Rock Bass   |                         ++++
            |                      shallow waters
            |
Largemouth  |                    spawning peaks
  Bass      |                      ++++++++++++
            |                        in June
            |
            |                     spawning in
Pumpkinseed |                 ....++++++++++++....
            |                   shallow waters
            |
Walleye or  |                    Walleyes then
  Sauger    |                ....+++++++++
            |                     saugers spawn
            |
            |  adults at sea     young moving                adults moving
American Eel|-----------        +++++++++++++++  +-+-+-+-+- +++++++++++
            |  young in mud      up streams                  down streams
            |
Longnose    |               spawning
Sucker      |                 ++++++
            |              in streams
            |
White       |                    spawning
Sucker      |                    ++++++++
            |                   in streams
            |
            |                   spawning      in shallow bays and
Bowfin      |                  +++++++++++  +-+-+-+-+-+-+-+-+-+-+-+-+-
            |                                  marshes year round
            |
Longnose    |                   spawns in
Gar         |                   ++++++++++
            |                     Spring
            |
Northern    |                   spawns in                easiest to hook
Pike        |                   ++++++++++               +-+-+-+-+-+-+
            |                   shallow waters           in the Fall
            |
Freshwater  |                              spawns in
Drum        |                             ++++++++++++++
            |                                Summer
```

KEY: ++++ greatest accessibility; +-+- moderate numbers; --- fewer numbers

Figure 6-4: Seasonal Availability of the Keffer Site Mammals

```
           JAN  FEB  MAR  APR  MAY  JUNE JULY AUG  SEPT OCT  NOV  DEC

          |
Canis sp. |+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
          |
          |
Whitetail |     yarding        solitary           highest densities
Deer      |      ++++++       ---------             +++++++++++++++----
          |     in woods                          prime conditions
          |
          |easy to hunt       spring                             fall
Beaver    |++++++++++++++     ------ +-+-+-+-+-+-+-+-+-+-+-+-+- -------
          |on frozen ponds    moult                              moult
          |
          |in ponds under     spring   in marshes    moving to    fall
Muskrat   |++++++++++++++      ------ ++++++++++++++++++++++++++++ -----
          |    ice            moult                     ponds       moult
          |
          |  hibernating     coats                prime      hibernating
Woodchuck |---------------- -------------++++++++++++------------------
          |                 poor    moult   condition
          |
          | limited          spring                     fall
Red       |+-+-+-+-+-+- ----------------- +++++++++++------------+-+-+-+
Squirrel  | activity         moult                      moult
          |
Eastern   |hibernating
Chipmunk  |-----------++++++++++++++++++++-+-+-++++++++++++++-+-+-------
          |                               moult               moult
          |
          |    in family groups                        solitary
Red Fox   | ++++++++++++++++++++++++++++++++++++++++++++ -+-+-+-+-+-+-+
          |
          |
          |hibernating                                 hibernating
Black Bear|+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-------+-+-+-+-+-+-+-+-+-+-
          |                      moult                  prime
          |
Grey      |
Squirrel  |+++++++++++++++++++++-------+++++++++++++++-------++++++++++
          |                      moult               moult
          |
          |                                                 prime
Raccoon   |+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+++++++++++++++
          |                                               condition
          |
```

KEY: ++++ greatest accessibility and/or prime conditions
+-+- moderate accessibility
---- poor accessibility and/or poor conditions

Figure 6-5: The Keffer Site Mammals by Habitat Zones

CLIMAX CONIFEROUS FOREST	CLIMAX HARDWOOD FOREST	MIXED FORESTS	SECONDARY GROWTH AND OPEN AREAS	WATER SOURCES
Red Squirrel	Red Squirrel	Red Squirrel	Deer	Beaver
	Chipmunk		Woodchuck	Muskrat
Red Fox	Red Fox	Red Fox	Red Fox	Mink
Black Bear	Black Bear		some Bear	
	Grey Squirrel	Grey Squirrel		
Porcupine				
	Raccoon			Raccoon
Marten			Mice	
Snowshoe Hare		Snowshoe Hare	Voles	
Lynx		Lynx	Shrews	
		Bobcat	Moles	

Figure 6-6: Seasonal Availability of the Keffer Site Birds

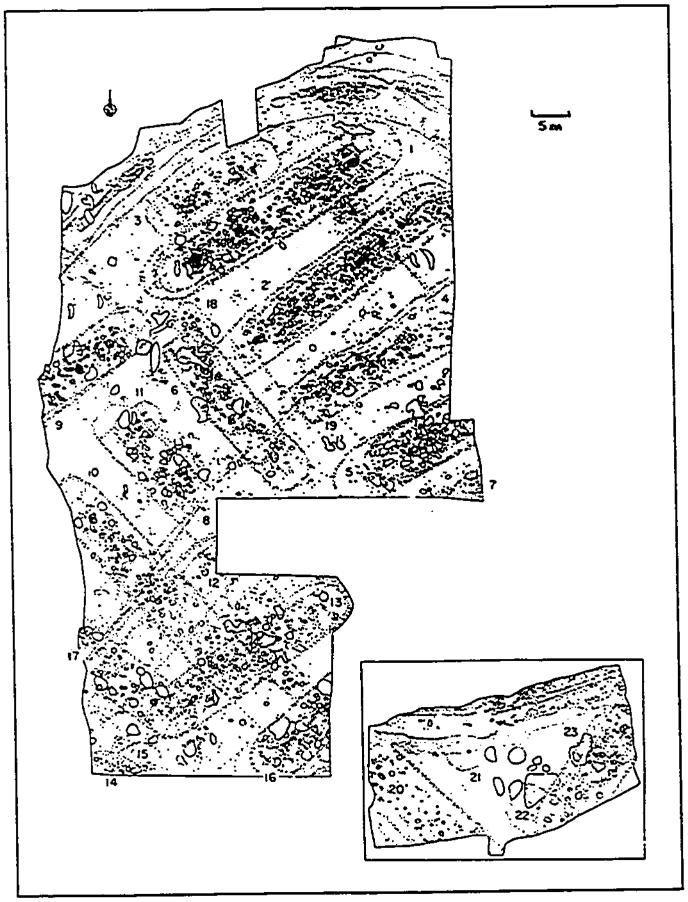
```
             JAN  FEB  MAR  APR  MAY  JUNE JULY AUG  SEPT OCT  NOV  DEC
            |
Wild Turkey |+++++++++++++++++-+-+-+-+-+-++++++++++++++++++++++++++++++++
            |
Passenger   |                  migrates into Ontario
Pigeon      |-------------+++++++++++++++++++++++++++++++++--------------
            |
Ruffed      |                                               in family
Grouse      |+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-++++++++++++++++
            |                                                 groups
Spruce      |
Grouse      |                  not locally available
            |
Green-winged|               migrating                  migrating
Teal        |               +++++++++                 +++++++++++
            |
Northern    |   winters     migrating                     migrating
Pintail     |+-+-+-+-+-+-+-++++++++++                  ....+++++++-+-+-+-
            |
Blue-winged |                        breeding
Teal        |                 ...++++++++++++++++++...
            |
Northern    |some wintering  migrating  breeding      migrating
Shoveler    |...............++++++++++-+-+-+-+-+-+-+-+-+++++++++++......
            |
American    |         migrating  local breeding on  migrating
Widgeon     |          +++++++.......................+++++++++++
            |                       Toronto Island
Ring-necked |          migrating  occasional breeding  migrating
Duck        |           +++++..........................++++++++
            |                     on the Great Lakes
Greater     |  on Lakes    migrating                    migrating
Scaup       |+-+-+-+-+-+-+-++++++++++++++.................+++++++-+-+-+-+
            |Erie and Ontario
            |
Lesser      |small numbers   migrating                  migrating
Scaup       |..............+++++++++++++.................++++++++........
            |
            |
            | on Great                                   migrating
Oldsquaw    |+-+-+-+-+-+-                                ++++++++++++-+-
            | Lakes
            |
White-winged|irregular
Scoter      |........                                               ....
            |small numbers
            |
            |  on the   migrating                       migrating
Bufflehead  |+-+-+-+-+-+-+-+++++++                       +++++++++-+-+-
            |Great Lakes
            |
Red-breasted|                                                  migrating
Merganser   |..........                                         +++.....
            |
```

Figure 6-6 continued

```
             JAN  FEB  MAR  APR  MAY  JUNE JULY AUG  SEPT OCT  NOV  DEC
            |
            |
            | small numbers on        very locally and sporadically
Ruddy Duck  |............................................................
            |   Great Lakes
            |
Jay, Raven, |
Crow        |++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
            |
            |
            |                                           greatest
Common Loon |++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
            |                                            densities
            |
            |
Horned Grebe|+++++++++++                                               ++
            |
            |
            |
Goshawk     |+++++++++++                                               ++
            |
            |
Flicker     |++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
            |
            |
American    |                   breeding
Bittern     |                  ++++++++++++............................
            |
            |
Sandhill    |                   breeding
Crane       |                  ++++++++++++
```

KEY: ++++ greatest accessibility
.... moderate accessibility
unaccessible in southern Ontario

Figure 7-1: McKeown Site Plan



Source: Dr. James Pendergast

Figure 7-2: The Preferred Habitats of Mammals Found on the McKeown Site

CLIMAX CONIFEROUS	CLIMAX HARDWOOD	MIXED FOREST	OPEN AREAS	SWAMPS & MARSHES
Black Bear	Bear		some Bear	some Bear
		some Deer	Deer	Deer
				Beaver
				Muskrat
				Otter
			Woodchuck	
Snowshoe Hare		some Hare		
Porcupine	some Porcupine	some Porcupine		
	Raccoon	some Raccoon	some Raccoon	Raccoon
some Red Squirrel	some Red Squirrel	Red Squirrel		
	Chipmunk		some Chipmunk	
	Grey Squirrel	Grey Squirrel	some Grey Squirrel	
Marten				
				Mink
Fisher	some Fisher	some Fisher		
Red Fox	Red Fox			
		Timber Wolf	Timber Wolf	
			Mouse	
			Vole	Vole

Figure 7-3: Seasonal Availability of the McKeown Site Mammals

```
                Jan  Feb  Mar  Apr  May  June July Aug  Sept Oct  Nov  Dec

Whitetail   |    yarding         solitary           highest densities
Deer        |      ++++++        ---------            ++++++++++++++++---
            |     in woods                          prime conditions
            |
            |easy to hunt       spring                              fall
Beaver      |++++++++++++++     ------ +-+-+-+-+-+-+-+-+-+-+-+-+- ------
            |on frozen ponds    moult                               moult
            |
            |hibernating                                  hibernating
Black Bear  |++++-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
            |                     moult                  prime
            |
            |in ponds under     spring   in marshes      moving   fall
Muskrat     |++++++++++++++     ------ ++++++++++++++++-+-+-+-+-+-+------
            |     ice           moult                   to ponds  moult
            |
            |  hibernating    coats              prime      hibernating
Woodchuck   |---------------------------------++++++++++++++------------
            |                 poor    moult   condition
            |
            |
Snowshoe    |                 moult weight                     moult  weight
Hare        |+-+-+-+-+-+-+-+-+-++++++++++-+-+-+-+-+-+-+-+-+---------+++++++
            |                       peaks                         peaks
            |
            |                                                 prime
Raccoon     |+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+++++++++++++
            |                                               condition
            |
            |    den
Porcupine   |+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
            |   together
            |
Marten and  |
 Fisher     |+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
            |
            |
            | limited          spring                       fall
Red Squirrel|+-+-+-+-+-+- -------------------++++++++++++------------+-+-+
            | activity         moult                        moult
            |
Eastern     |hibernating
Chipmunk    |-----------++++++++++++++++++++-+-+-++++++++++++++++-+-+------
            |                               moult              moult
            |
Grey        |
Squirrel    |++++++++++++++++++++++-------------+++++++++++++++++--------+++++++++
            |                      moult                 moult
            |
            |    in family groups                           solitary
Red Fox     |++++++++++++++++++++++++++++++++++++++++++++++-+-+-+-+-+-+-
            |
            |   in                                                 in
Timber Wolf |++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
            |  packs                                              packs
            |
River Otter |++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

```
KEY:  ++++ greatest accessibility and/or prime conditions
      +-+- moderate accessibility
      ---- poor accessibility and/or poor conditions
```

Figure 7-4: The Preferred Habitats of Fish Found on the McKeown Site

COLD, CLEAR LAKES AND STREAMS	COOL, SWIFT RIVERS AND STREAMS	WARM, SLOW STREAMS, LAKES, PONDS, MARSHES
Lake Whitefish		
Channel Catfish	Channel Catfish	Brown Bullhead
Yellow Perch	Yellow Perch	
	Northern Pike	Northern Pike
Freshwater Drum		Bowfin
	Suckers	Suckers
Pumpkinseed	Pumpkinseed	Pumpkinseed
Largemouth Bass	Largemouth Bass	Largemouth Bass
Smallmouth Bass	Smallmouth Bass	Sunfish
	Rock Bass	Crabbie
	Morone Bass	Morone Bass
	American Eel	American Eel
Walleye and Sauger	Walleye and Sauger	
Cisco		Gar
Trout	Trout	
	Chub	Chub

Figure 7-5: Seasonal Availability of the McKeown Site Fish

```
               Jan  Feb  Mar  Apr  May  June July Aug  Sept Oct  Nov  Dec

Longnose      |               spawning
Sucker        |                ++++++
              |              in streams
              |
White         |                    spawning
Sucker        |                    ++++++++
              |                   in streams
              |
Walleye or    |                Walleyes then
Sauger        |                ++++++++++++
              |                saugers spawn
              |
              |    up rivers       spawning           mainly in lakes
Yellow Perch  |    +-+-+-+-+-+++++++++++++++++---------------------------
              |    to spawn
              |
Northern      |                 spawns in                spawns in
Pike          |                +++++++++++                 +-+-+-+-+-+-
              |               shallow waters                in the fall
              |
Largemouth/   |                       spawning peaks
Smallmouth    |                      +++++++++++++++++
Bass          |                         in June
              |
              |                      spawning in
Pumpkinseed   |               +-+-+-+-+-++++++++----
              |                     shallow waters
              |
              |                       spawning in
Rock Bass     |                         ++++
              |                       shallow waters
              |
Brown         |                spawning      in schools in shallow
Bullhead      |             -+-++++++++++-+-+-+-+-+-+-+-+-+-+-+-+-
              |                                 waters all year
              |
Channel       |     up rivers   spawning
Catfish       |     +-+-+-+-+-++++++++++++
              |     to spawn  shallow waters
              |
              |adults at sea     young moving            adults moving
American Eel  |-+-+-+-+-+-+     ++++++++++++++ +-+-+-+-+- ++++++++++
              |young in mud       up streams              down streams
              |
              | deep           into shoal  into deeper       spawning in
Whitefish     |--------       +-+-+-+-+- ---------------        +++++...
              |waters          waters       waters          shallow waters
              |
              |       in streams                   in deep         spawning  in
Brook Trout   |+-+-+-+-+-+-+-+-+-+-+-+-+ ---------         +++++++++++++
              |                          lake waters         streams
              |
              | deep     surface     deep                 spawning in
Lake Trout    |--------- +-+-+-+-   ------------            ++++++    ----
              |waters     waters     waters               shallow waters
              |
              |                  spawning      in shallow bays and
Bowfin        |                 +++++++++++ +-+-+-+-+-+-+-+-+-+-+-+-+-+-
              |                                marshes year round
              |
Freshwater    |                             spawns in
Drum          |                            +++++++++++++
              |                               Summer
              |
              |                  spawns in
Gar           |                  +++++++++
              |                    Spring
              |
              |                   spawning
Creek Chub    |-+-+-+-+-+-+-+-++++++++++++++-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
KEY:  ++++ greatest accessibility;  +-+- moderate numbers;  --- fewer numbers
```

Figure 7-6: Seasonal Availability of the McKeown Site Birds

```
                    Jan  Feb  Mar  Apr  May  June July Aug  Sept Oct  Nov  Dec

Passenger          |                    migrates into Ontario
Pigeon             |--------------+++++++++++++++++++++++++++++++++------------
                   |
Common             |    a few
Goldeneye          |---------------++++++++++++++++++++++++++++++++++++++------
                   | winter over
                   |
Canada             |
Goose              |------------+++++++++++++-+-+-+-+-+-+-+-+-+-+-+-++++++++---
                   |
Common             |           greatest                              greatest
Merganser          |+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                   |           densities                             densities
                   |
Ruffed             |                                               in family
Grouse             |-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+++++++++++++++
                   |                                                 groups
                   |
                   |
Common Loon        |+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                   |
                   |
Woodpecker         |+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

```
KEY:  ++++ greatest accessibility
      -+-+ moderate accessibility
      ---- poor accessibility
```

Figure 8-1: A Comparison of Meat Per Family at the Keffer and McKeown Sites

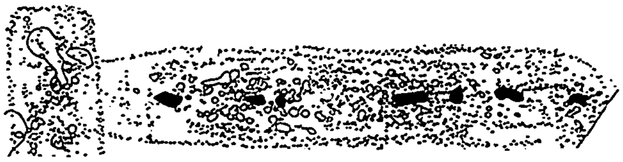
KEFFER HOUSE 20

14 families averaged 36.19 kg/family

(26 families in houses 12, 13, 19 and 20 averaged 23.57 kg each.)

MCKEOWN HOUSE 2

14 families averaged 22.88kg/family



(30 families in houses 2, 10 and 13 averaged 20.04 kg each.)

Figure 8-2: Class Representation at the Keffer and McKeown Sites by NISP

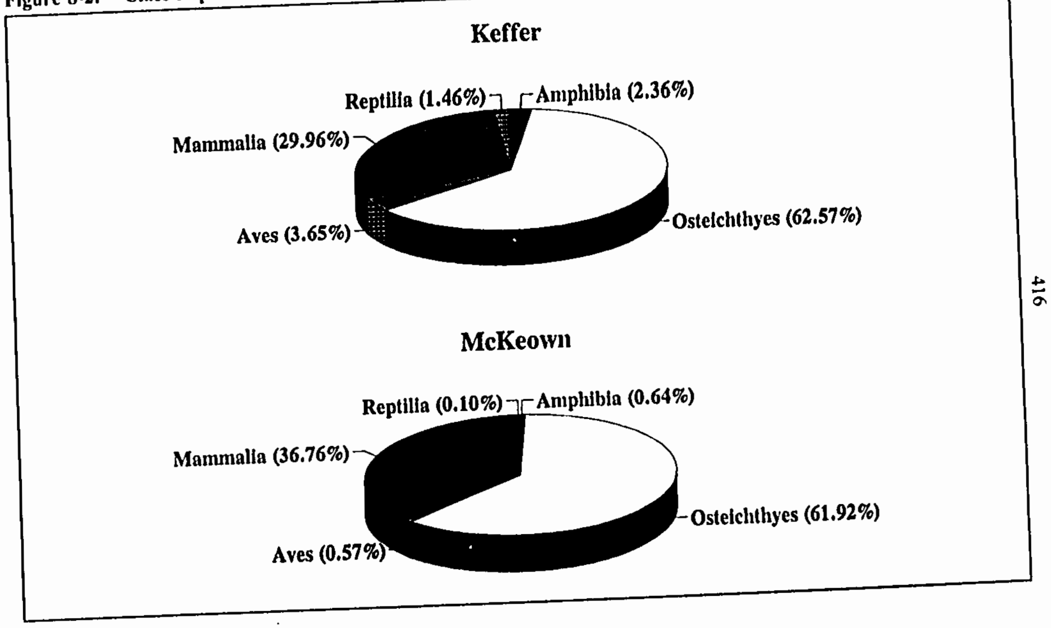


Figure 8-3: Mammalian Meat Weights using MNI at the Keffer and McKeown Sites

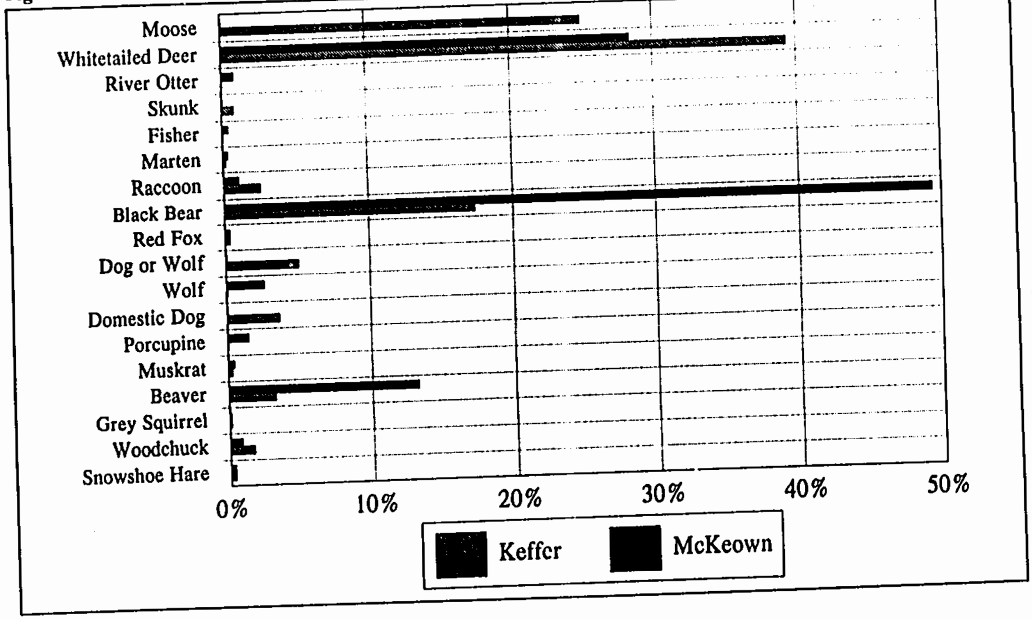


Figure 8-4: Fish Meat Weights using MNI at the Keffer and McKeown Sites

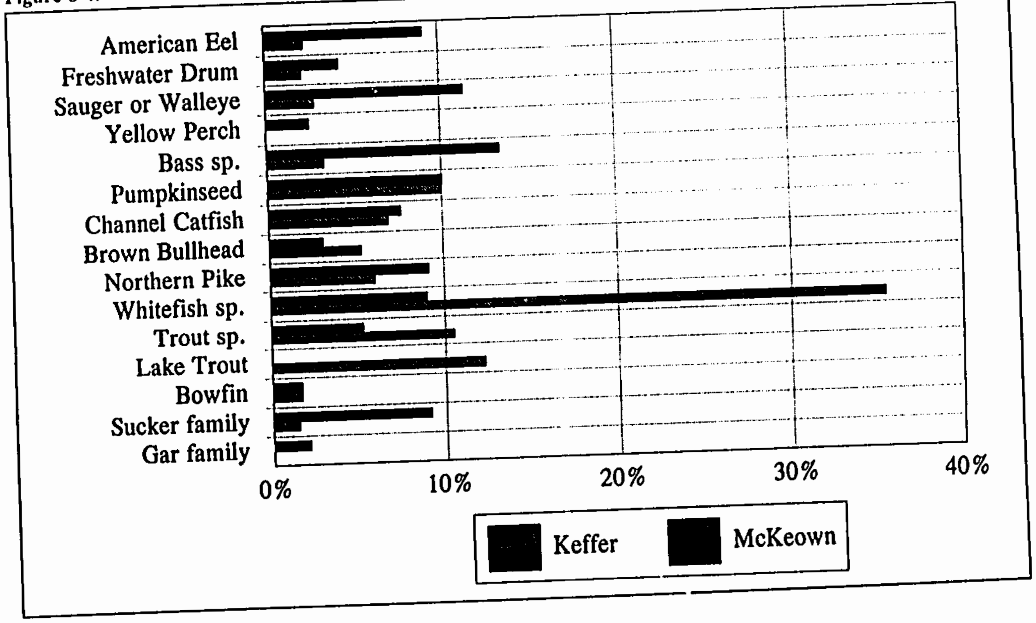


Figure 8-5: Bird Meat Weights using MNI at the Keffer and McKeown Sites

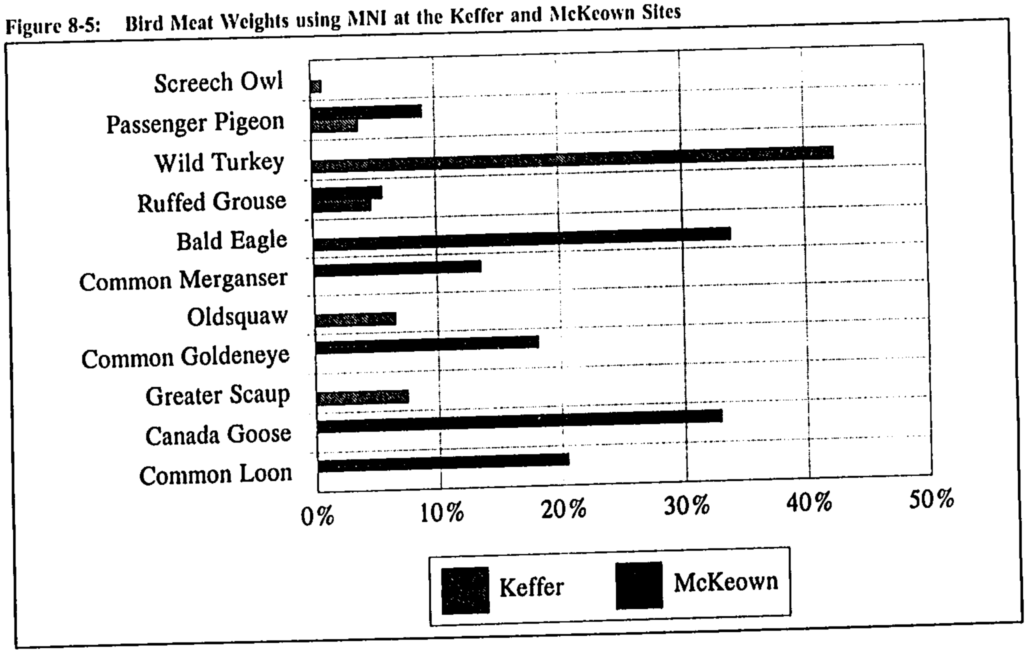


Figure 9-1: Contemporaneous Sites in the Keffer Area

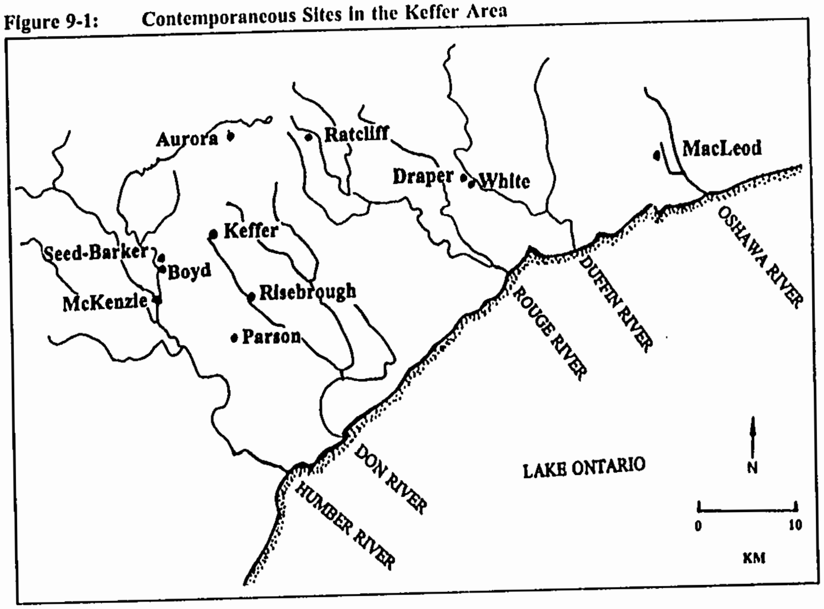


Figure 9-2: Contemporaneous Sites in the McKeown Area

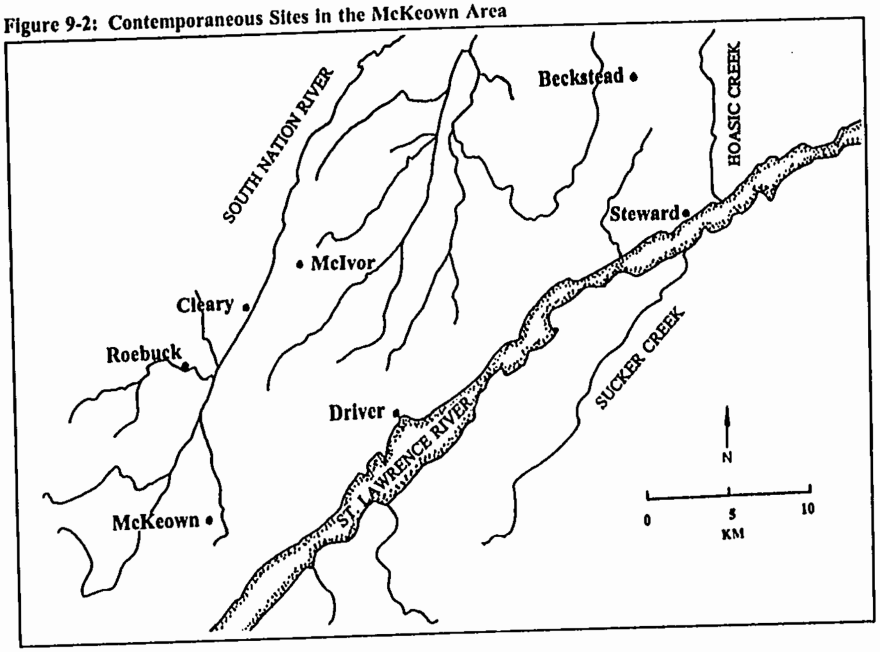


Figure 9-3: A Comparison of Proto-Iroquoian Meat Sources

A COMPARISON OF THE MEAT DIET OF PROTO-HURON/PETUNS AND PROTO-ST. LAWRENCE IROQUOIANS AROUND A.D. 1500

BOTH GROUPS

Mammals largest meat contributors
Deer most important prey
Beaver and woodchuck very common
Fish largest NISPs
Birds minor contributors
Reptiles very minor contributors
Amphibians very minor contributors

PROTO-HURON/PETUNS		PROTO-ST. LAWRENCE IROQUOIANS
	MAMMALS	
very common	dogs	very few
few	black bear	many
some	muskrat	common
few	porcupine	common
rarely common	fisher	usually common
common	red squirrel	few
rare	moose	usually none
rare	wapiti	usually none
	FISH	
dominate	catfish	some
dominate	whitefish	usually none
very common	suckers	*dominate*
very few	American eel	very common
very common	perch	uncommon
	BIRDS	
dominate	passenger pigeon	very common
dominate	wild turkey	very rare
some	Canada goose	dominate
common	ducks	very common
	REPTILES	
dominate	painted turtles	common
common	snapping turtles	dominate

TABLES

Table 2-1: **Bird names from Sagard's *Dictionnaire* with translations into French by Sagard and into English mainly by Tooker (1964:158)**

HURON WORD	SAGARD'S TRANSLATION	ENGLISH TRANSLATION
Sondaqua	Aigle	Eagle
Ahouatantaque	Oyfeau de proye	a bird of prey
Ondetontaque	Coq-d'Inde	Wild Turkey
Tochingo	Grue	Crane/Great Blue Heron
Ahonque	Outarde	Bustard/Canada Goose
Taron	Canart	Duck
Acoiffan	Perdrix	Partridge
Horhey	Cine	Swan
Orittey, Hyo	Tourterelle	Turtledove/Passenger Pigeon
Oraquan	Corbeau	Crow
Tintian	Gay	Woodpecker
Ocoho, Thi	Chat-huant	?
Stinondoa	Oyfeau rouge	Purple Finch
Ouaièra	tefte et col rouge	Red-headed Woodpecker
Uhoiroq	plumage gris meslé et un colier rouge	Downy Woodpecker*

* my translation

Table 2-2: **Mammalian names from Sagard's *Dictionnaire* with translations into French by Sagard and into English mainly by Tooker (1964:158)**

HURON WORD	SAGARD'S TRANSLATION	ENGLISH TRANSLATION
Sconoton	Cerf	Deer*
Sondareinta	Originat, Eslan	Moose
Aufquoy	Caribou	Caribou
Agnouin Arhatfi	Ours	Bears
Anarifqua	Loup	Wolves
Tiron	Chat fauvage	Raccoon**
Agointa	Martre	Marten
Toutayé	Caftor	Beaver
Tfabouinecq	Loutre	Otter
Queutonmalifia	Lapin	Rabbit
Gagnenon	Chien	Domestic Dog
Andafatey	Renard gris	Grey Fox
Hahyuha	Renard noir	Black Fox
Tfinantontonque	Renard avec une raye de poil noirle long du dos	Cross Fox
Aroufen	Efcureux communs	Common Squirrels**
Ohihoin	Efcureux firiffes	Chipmunks
Sahouefquanta	Autres volans	Flying Squirrels
Scanganeffe	Enfans du Diable	Skunk
Ondathra	Rat mufqué	Muskrat
Tfongyatan	Souris	Mouse
Tachro	Efpece de groffe souris	Large Mouse

* Wrong (1939:225:footnote) thinks this was probably the Wapiti and that the animal referred to as the fallow deer was the Virginia deer. The Virginia deer is also known as the whitetail deer.

** Tooker translates this as a kind of leopard or wild cat but Steckley (1986) shows raccoon is the correct translation. In the same article, he gives the translation for black squirrels as otay, showing that aroufen or aroussen (Wrong 1939:223) meant squirrels in general.

Table 2-3: Wild Edible Plants Associated with the Hurons

CHAMPLAIN (FROM BIGGAR 1929)	SAGARD (FROM WRONG 1939)
(page 50)	(from the *Dictionnaire*)
vines	blueberries
plums	strawberries
raspberries	cranberries
strawberries	plums
small wild apples	pears (shadbush fruit)
walnuts	Jerusalem artichoke
may-apple	ground nuts or cow parsnips
(page 51)	little onions/chives
oaks (acorns)	a small herb
beeches (nuts)	roses (rose hips)
small cherries	(page 72)
wild cherries	blackberries
(page 60)	(page 82)
grapes	herbs (purslane, balsam)
(page 126)	beech sap
blueberries	(page 83)
dried raspberries	grapes
	(page 105)
	raspberries
	(page 108)
	acorns
	willow-bark
	(page 237)
	wintergreen
	sand cherry
	(page 238)
	hawthorn
	butternuts
	chestnuts
	hazelnuts
	sweet cherries
	mulberries
	currants

Table 6-1: Keffer Site Faunal Samples by Class and Recovery Technique

CLASS	TOTAL NISP	TOTAL % OF TOTAL	FLOATATION NISP	FLOATATION % OF CLASS	SCREENED NISP	SCREENED % OF CLASS
Osteichthyes	7412	61.1	5188	70.0	2224	30.0
Amphibia	280	2.3	267	95.4	13	4.6
Reptilia	173	1.4	17	9.8	156	90.2
Aves	432	3.6	88	20.4	344	79.6
Mammalia	3549	29.3	476	13.4	3073	86.6
Indeterminate	286	2.4	121	42.3	165	57.7
TOTALS	12132	100.0	6157		5975	

Table 6-2: Keffer Site Chewed Remains by Class

CLASS	CARNIVORE CHEWING NISP	CARNIVORE CHEWING % OF 349	RODENT CHEWING NISP	RODENT CHEWING % OF 349	CARNIVORE AND RODENT CHEWING NISP	CARNIVORE AND RODENT CHEWING % OF 349	CLASS TOTALS
Osteichthyes	2	0.5	0		0		2
Amphibia	0		0		0		0
Reptilia	4	1.1	0		0		4
Aves	5	1.4	13	3.7	0		18
Mammalia	257	73.6	59	16.9	4	1.1	320
Indeterminate	4	3.3	1				5
TOTALS	272		73		4		349
% OF 12132	2.2		0.6		0.0		2.9

Table 6-3: Frequencies of Specimens by Class for Houses and Middens

CLASS	H12	H13	H19	H20	M57	M71	M77
Osteichthyes	105	95	4	197	6287	297	427
Amphibia	0	0	0	1	271	6	2
Reptilia	7	4	0	6	120	26	10
Aves	12	5	5	15	352	16	27
Mammalia	238	270	29	447	1985	174	406
Indeterminate	14	6	13	4	228	10	11
TOTALS	376	380	51	670	9243	529	883

NOTE: Indeterminate means not identified to class on these tables.

Table 6-4: **Keffer Site Faunal Remains by Family**

FAMILY	NISP	% OF TOTAL FAUNAL SAMPLE	% OF SP. IDENTIFIED TO FAMILY
OSTEICHTHYES			
Lepisosteidae (Gars)	3	0.0	0.1
Amiidae (Bowfins)	35	0.3	0.8
Salmonidae (Trouts/Whitefish/Salmon)	1159	9.6	28.1
Esocidae (Pikes)	129	1.1	3.1
Catostomidae (Suckers)	103	0.8	2.5
Ictaluridae (Catfish)	417	3.4	10.1
Anquillidae (Eels)	55	0.5	1.3
Centrarchidae (Sunfish/Bass/Crappies)	180	1.5	4.4
Percidae (Walleye/Saugers)	155	1.3	3.8
Sciaenidae (Drums)	4	0.0	0.1
AMPHIBIA			
Bufonidae (Toads)	1	0.0	0.0
Ranidae (Frogs)	4	0.0	0.1
REPTILIA			
Chelydridae (Snapping Turtle)	14	0.1	0.3
Emydidae (Turtles)	135	1.2	3.3
Colubridae (Snakes)	4	0.0	0.1
AVES			
Gaviidae (Loons)	1	0.0	0.0
Podicipedidae (Grebes)	2	0.0	0.1
Ardeidae (Herons/Bittern)	1	0.0	0.0
Anatidae (Geese/Ducks)	61	0.5	1.5
Accipitridae (Hawks/Eagles)	5	0.0	0.1
Tetraonidae (Grouse)	40	0.3	1.0
Phasianidae (Quails)	1	0.0	0.0
Meleagrididae (Turkeys)	38	0.3	0.9
Gruidae (Cranes)	1	0.0	0.0
Laridae (Gulls)	1	0.0	0.0
Columbidae (Pigeons)	29	0.2	0.7
Tytonidae (Owls)	1	0.0	0.0
Picidae (Flickers/Woodpeckers)	2	0.0	0.0
Corvidae (Jays/Ravens/Crows)	5	0.0	0.1
Icteridae (Blackbirds/Orioles)	2	0.0	0.0
MAMMALIA			
Soricidae (Shrews)	1	0.0	0.0
Talpidae (Moles)	2	0.0	0.0
Leporidae (Hares)	26	0.2	0.6
Sciuridae (Squirrels)	190	1.6	4.6
Castoridae (Beaver)	118	1.0	2.9
Cricetidae (Mice/Muskrat)	85	0.7	2.1
Zapodidae (Mice)	4	0.0	0.1
Erithizontidae (Porcupine)	2	0.0	0.0
Canidae (Wolves/Dog)	440	3.6	10.7
Ursidae (Bears)	49	0.4	1.2
Procyonidae (Raccoon)	41	0.3	1.0
Mustelidae (Weasels)	22	0.2	0.5
Felidae (Cats)	2	0.0	0.0
Cervidae (Deer)	548	4.5	13.3
Bovidae (Cow)	2	0.0	0.0
INDETERMINATE (beyond class)	8012	66.0	
TOTALS	12132	100.0	100.0

Table 6-5: Keffer Site Fish Remains by Species

SPECIES	NISP	% OF FISH	% OF FISH IDENTIFIED AT LEAST TO GENUS	MNI
Indeterminate	5714	77.1		
Longnose gar *Lepisosteus osseus*	3	0.0	0.2	1
Bowfin *Amia calva*	35	0.5	2.1	1
Lake Trout *Salvelinus namaycush*	27	0.4	1.6	1
Trout sp. *Salvelinus* sp.	261	3.5	15.4	5
Whitefish sp. *Coregonus* sp.	574	7.7	33.8	13
Salmon or Trout *Salmo/Salvelinus*	37	0.5	2.2	2
Northern Pike *Esox lucius*	36	0.5	2.1	2
Sucker sp. Catostomidae	64	0.9	3.8	3
Brown Bullhead *Ictalurus nebulosus*	192	2.6	11.3	17
Channel Catfish *Ictalurus punctatus*	11	0.1	0.6	1
Catfish sp. Ictaluridae	173	2.3	10.2	7
American eel *Anguilla rostrata*	55	0.7	4.2	1
Rock Bass *Ambloplites rupestris*	5	0.1	0.3	2
Pumpkinseed *Lepomis gibbosus*	71	1.0	4.2	5
Largemouth Bass *Micropterus salmoides*	6	0.1	0.4	1
Bass sp. *Micropterus*	12	0.2	0.7	2
Yellow Perch *Perca flavescens*	55	0.7	3.2	3
Sauger or Walleye *Stizostedion sp.*	77	1.0	4.5	6
Freshwater Drum *Aplodinotus grunniens*	4	0.0	0.2	1
TOTALS	7412	100.0	100.0	

Table 6-6: Keffer Site Fish Species for Houses and Middens

SPECIES	H12	H13	H19	H20	M57	M71	M77
Longnose Gar *L. osseus*	0	0	0	0	3	0	0
Bowfin *Amia calva*	2	1	0	1	22	2	7
Lake Trout *S. namaycush*	2	0	0	0	1	13	11
Trout sp. *Salvelinus* sp.	29	14	0	32	168	2	16
Whitefish sp. *Coregonus* sp.	14	14	1	19	468	17	41
Salmon or Trout *Salmo/Salvelinus*	0	0	0	0	37	0	0
Northern Pike *Esox lucius*	10	1	0	4	2	7	12
Brown Bullhead *I. nebulosus*	5	13	0	26	28	71	49
Channel Catfish *I. punctatus*	1	3	0	1	1	1	4
Catfish sp. Ictaluridae	0	0	0	0	173	0	0
American eel *Anguilla rostrata*	1	0	0	2	49	0	3
Rock Bass *A. rupestris*	0	0	0	0	2	2	1
Pumpkinseed *Lepomis gibbosus*	2	1	0	3	55	2	8
Bass sp. *Micropterus* sp.	0	3	0	1	0	4	4
Yellow Perch *Perca flavescens*	0	0	0	0	54	1	0
Sauger or Walleye *Stizostedion sp.*	1	3	0	5	32	15	21
Freshwater Drum *A. grunniens*	1	0	0	0	2	0	1
TOTALS	68	53	1	94	1097	137	178

Table 6-7: Keffer Site Mammalian Remains by Species

SPECIES	NISP	% OF MAMMALS	% OF MAMMALS IDENTIFIED TO GENUS OR SPECIES
Short-tailed Shrew *Blarina brevicauda*	1	0.0	0.1
Star-nosed Mole *Condylura cristata*	2	0.1	0.1
Snowshoe Hare *Lepus americanus*	24	0.7	1.7
Grey Squirrel *Sciurus carolinensis*	33	0.9	2.4
Red Squirrel *Tamiasciurus hudsonicus*	41	1.2	3.0
Woodchuck *Marmota monax*	77	2.2	5.6
Eastern Chipmunk *Tamias striatus*	35	1.0	2.5
Beaver *Castor canadensis*	117	3.3	8.5
Deer Mouse *Peromyscus* sp.	6	0.2	0.4
Southern Bog Lemming *Synaptomys cooperi*	1	0.0	0.1
Meadow Vole *Microtus pennsylvanicus*	3	0.1	0.2
Rock Vole *Microtus chrotorrhinus*	2	0.1	0.1
Vole *Microtus* sp.	1	0.0	0.1
Muskrat *Ondatra zibethicus*	59	1.7	4.3
Porcupine *Erethizon dorsatum*	2	0.1	0.1
Domestic Dog *Canis familiaris*	96	2.7	7.0
Wolf or Dog *Canis* sp.	305	8.6	22.1
Red Fox *Vulpes vulpes*	17	0.5	1.2
Fox sp. *Vulpes* sp.	16	0.5	1.2
Black Bear *Ursus americanus*	32	0.9	2.3
Raccoon *Procyon lotor*	41	1.2	3.0
Mink *Mustela vison*	11	0.3	0.8
Marten *Martes americana*	7	0.2	0.5
Skunk *Mephitis mephitis*	4	0.1	0.3
Lynx or Bobcat *Lynx* sp.	1	0.0	0.1
Whitetail Deer *Odocoileus virginianus*	317	8.9	23.0

Table 6-7 continued

SPECIES	NISP	% OF MAMMALS	% OF MAMMALS IDENTIFIED TO GENUS OR SPECIES
Deer sp. *Odocoileus* sp.	119	3.4	8.6
Moose *Alces alces*	6	0.2	0.4
Domestic Cat *Felis catus*	1	0.0	0.1
Domestic Cow *Bos taurus*	1	0.0	0.1
Domestic Sheep *Ovis aries*	2	0.1	0.1
Indeterminate (to genus)	2169	61.1	
TOTALS	3549	100.0	100.0

Table 6-8: Keffer Site Mammalian Species for Houses and Middens

SPECIES	H12	H13	H19	H20	M57	M71	M77
Shrew *B. brevicauda*	0	0	0	0	0	1	0
Snowshoe Hare *Lepus americanus*	0	9	0	4	5	0	6
Grey Squirrel *S. carolinensis*	3	2	0	5	20	2	1
Red Squirrel *T. hudsonicus*	0	0	0	1	31	7	2
Woodchuck *Marmota monax*	3	8	1	7	33	5	20
Eastern Chipmunk *Tamias striatus*	0	1	0	0	30	2	2
Beaver *C. canadensis*	6	5	1	4	94	4	3
Deer Mouse *Peromyscus* sp.	0	0	0	1	5	0	0
Bog Lemming *S. cooperi*	0	0	0	0	1	0	0
Rock vole *M. chrotorrhinus*	0	0	0	0	2	0	0
Vole sp. *Microtus* sp.	0	0	0	0	1	0	0
Muskrat *O. zibethicus*	3	1	0	5	45	1	4
Porcupine *E. dorsatum*	0	0	0	0	1	0	1
Domestic Dog *Canis familiaris*	5	2	0	3	70	6	10
Dog or Wolf *Canis* sp.	19	22	3	28	177	22	34
Red Fox *Vulpes vulpes*	1	2	0	1	11	2	0
Fox sp. *Vulpes sp.*	0	0	0	0	16	0	0
Black Bear *Ursus americanus*	4	0	0	2	23	1	2
Raccoon *Procyon lotor*	10	3	0	6	13	8	1
Mink *Mustela vison*	0	0	0	0	7	0	4
Marten *Martes americana*	1	0	0	0	6	0	0
Skunk *M. mephitis*	0	0	0	2	2	0	0
Lynx or Bobcat *Lynx* sp.	0	0	0	0	1	0	0
Whitetail Deer *O. virginianus*	36	22	6	79	111	30	33
Deer sp. *Odocoileus* sp.	0	0	0	0	119	0	0
Moose *Alces alces*	0	1	0	3	2	0	0
TOTALS	91	78	11	151	826	91	123

Table 6-9: Keffer Site Butchered Faunal Remains by Genus and Species

SPECIES	CUT MARKS		SPIRAL FRACTURE FEATURES		STRAIGHT EDGES		CUTS + FRACTURE FEATURES		CUTS + STRAIGHT EDGES	
	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%
Trout										
Salvelinus sp.					1	0.4				
Whitefish										
Coregonus sp.					1	0.2				
Chicken										
Gallus gallus	1	100.0								
Wild Turkey										
M. gallopavo	1	2.7								
Snowshoe Hare										
Lepus americanus	1	4.2								
Woodchuck										
Marmota monax	1	1.3								
Beaver										
C. canadensis	2	1.7			1	0.9				
Rock Vole										
M. chrotorrhinus	1	50.0								
Domestic Dog										
Canis familiaris	2	2.1								
Wolf or Dog										
Canis sp.	5	1.6			1	0.3				
Red Fox										
Vulpes vulpes	1	5.9								
Black Bear										
Ursus americanus	1	3.1	1	3.1						
Raccoon										
Procyon lotor	1	2.4								
Marten										
Martes americana	1	14.3								
Whitetail Deer										
O. virginianus	14	4.4			1	0.3	1	0.3	1	0.3
Deer sp.										
Odocoileus sp.	6	5.0	3	2.5	2	1.7	1	0.8	1	0.8
Indeterminate (to genus)	25	0.3	23	0.3	4	0.0	1	0.0	2	0.0
TOTALS	63		27		11		3		4	
% OF 12132	0.5		0.2		0.1		0.0		0.0	

Note: Percents are calculated from the total NISP for each taxon.

Table 6-10: Keffer Site Burnt Mammalian Remains by Species

SPECIES	CHARRED		CALCINED		BROWNED		TOTALS
	NISP	% OF SP.	NISP	% OF SP.	NISP	% OF SP.	
Snowshoe Hare *Lepus americanus*	1	4.2					1
Grey Squirrel *Sciurus carolinensis*	3	9.1	5	15.2			8
Red Squirrel *Tamiasciurus hudsonicus*			3	7.3			3
Woodchuck *Marmota monax*			8	10.4			8
Eastern Chipmunk *Tamias striatus*	2	5.7					2
Beaver *Castor canadensis*	4	3.4	26	22.2			30
Muskrat *Ondatra zibethicus*	3	5.1	7	11.9			10
Domestic Dog *Canis familiaris*	4	4.2	7	7.3			11
Wolf or Dog *Canis* sp.	22	7.2	49	16.1	2	0.7	73
Red Fox *Vulpes vulpes*			4	22.5			4
Fox sp. *Vulpes* sp.			1	6.3			1
Black Bear *Ursus americanus*	2	6.3	1	3.1			3
Raccoon *Procyon lotor*	2	4.9	3	7.3	1	2.4	6
Mink *Mustela vison*			3	27.3			3
Marten *Martes americana*			2	28.6			2
Whitetail Deer *O. virginianus*	12	3.8	7	2.2	1	0.3	20
Deer sp. *Odocoileus* sp.	5	4.2	5	4.2			10
Moose *Alces alces*			1	16.7			1
Indeterminate (to genus)	148	6.8	746	34.4	8	0.4	902
TOTALS	208		878		12		1098

Table 6-11: Keffer Site Avian Remains by Species

SPECIES	NISP	% OF BIRDS IDENTIFIED TO CLASS	% OF BIRDS IDENTIFIED TO GENUS OR SPECIES
Common Loon *Gavia immer*	1	0.2	0.6
Horned Grebe *Podiceps auritus*	2	0.5	1.3
American Bittern *Botaurus lentiginosus*	1	0.2	0.6
Canada Goose *Branta canadensis*	8	1.9	5.0
Green-winged Teal *Anas crecca*	1	0.2	0.6
Northern Pintail *Anas acuta*	1	0.2	0.6
Blue-winged Teal *Anas discors*	2	0.5	1.3
Northern Shoveler *Anas clypeata*	1	0.2	0.6
Duck *Anas* sp.	2	0.5	1.3
Redhead *Aythya americana*	1	0.2	0.6
Ring-necked Duck *Aythya collaris*	1	0.2	0.6
Greater Scaup *Aythya marila*	3	0.7	1.9
Lesser Scaup *Aythya affinis*	2	0.5	1.3
Duck *Aythya* sp.	1	0.2	0.6
Oldsquaw *Clangula hyemalis*	10	2.3	6.3
White-winged Scoter *Melanitta fusca*	1	0.2	0.6
Bufflehead *Bucephala albeola*	3	0.7	1.9
Red-breasted Merganser *Mergus serrator*	4	0.9	2.5
Duck *Mergus* sp.	1	0.2	0.6
Ruddy Duck *Oxyura jamaicensis*	1	0.2	0.6
Bald Eagle *Haliaeetus leucocephalus*	1	0.2	0.6
Northern Goshawk *Accipiter gentilis*	3	0.7	1.9
Spruce Grouse *Dendragapus canadensis*	4	0.9	2.5
Ruffed Grouse *Bonasa umbellus*	27	6.3	17.0
Chicken *Gallus*	1	0.2	0.6
Wild Turkey *Meleagris gallopavo*	37	8.6	23.3

Table 6-11 continued

SPECIES	NISP	% OF BIRDS IDENTIFIED TO CLASS	% OF BIRDS IDENTIFIED TO GENUS OR SPECIES
Ringed-neck Pheasant			
Phasianus colchicus	1	0.2	0.6
Sandhill Crane			
Grus canadensis	1	0.2	0.6
Passenger Pigeon			
Ectopistes migratorius	29	6.7	18.2
Screech Owl			
Otus asio	1	0.2	0.6
Yellow-shafted Flicker			
Colaptes auratus	2	0.5	1.3
Blue Jay			
Cyanocitta cristata	1	0.2	0.6
American Crow			
Corvus brachyrhynchos	1	0.2	0.6
Common Raven			
Corvus corax	3	0.7	1.9
Indeterminate (to genus)	273	63.2	
TOTALS	432	100.0	100.0

Table 6-12: Keffer Site Avian Species for Houses and Middens

SPECIES	H12	H13	H19	H20	M57	M71	M77
Horned Grebe *Podiceps auritus*	0	0	0	0	1	0	0
American Bittern *B. lentiginosus*	0	0	0	0	2	0	0
Canada Goose *B. canadensis*	0	0	0	0	6	1	1
Green-winged Teal *Anas crecca*	0	0	0	0	1	0	0
Northern Pintail *Anas acuta*	0	0	0	0	1	0	0
Blue-winged Teal *Anas discors*	0	0	0	0	2	0	0
Northern Shoveler *Anas clypeata*	0	0	0	0	1	0	0
Duck *Anas* sp.	0	0	0	0	2	0	0
Redhead *Aythya americana*	0	0	0	0	1	0	0
Ring-necked Duck *Aythya collaris*	0	0	0	0	1	0	0
Greater Scaup *Aythya marila*	1	0	0	0	1	1	0
Lesser Scaup *Aythya affinis*	0	0	0	0	1	0	1
Duck *Aythya* sp.	0	0	0	0	1	0	0
Oldsquaw *Clangula hyemalis*	1	0	0	0	5	1	3
Scoter *Melanitta fusca*	0	0	0	0	1	0	0
Bufflehead *Bucephala albeola*	0	0	0	0	3	0	0
Merganser *Mergus serrator*	0	0	0	0	4	0	0
Duck *Mergus* sp.	0	0	0	0	1	0	0
Ruddy Duck *O. jamaicensis*	0	0	0	0	1	0	0
Bald Eagle *H. leucocephalus*	1	0	0	0	0	0	0
Northern Goshawk *A. gentilis*	0	0	0	0	3	0	0
Spruce Grouse *D. canadensis*	0	0	0	0	4	0	0
Ruffed Grouse *Bonasa umbellus*	0	1	0	4	17	4	1
Wild Turkey *M. gallopavo*	0	0	1	2	33	0	1
Sandhill Crane *Grus canadensis*	0	0	0	0	1	0	0
Passenger Pigeon *E. migratorius*	0	0	0	2	26	1	0
Screech Owl *Otus asio*	0	0	0	1	0	0	0

Table 6-12 continued

SPECIES	H12	H13	H19	H20	M57	M71	M77
Flicker *Colaptes auratus*	0	0	0	0	2	0	0
Blue Jay *C. cristata*	0	0	0	0	2	0	0
American Crow *C. brachyrhynchos*	0	0	0	0	1	0	0
TOTALS	3	1	1	9	125	8	7

Table 6-13: Keffer Site Avian Remains by Age

SPECIES	AGE ?	OLD ADULT	ADULT	IMMATURE
Common Loon *Gavia immer*			1	
Horned Grebe *Podiceps auritus*	2			
American Bittern *Botaurus lentiginosus*	1			
Canada Goose *Branta canadensis*	2		6	
Green-winged Teal *Anas crecca*			1	
Northern Pintail *Anas acuta*	1			
Blue-winged Teal *Anas discors*			2	
Northern Shoveler *Anas clypeata*			1	
Duck *Anas* sp.	1		1	
Redhead *Aythya americana*			1	
Ring-necked Duck *Aythya collaris*			1	
Greater Scaup *Aythya marila*	1		2	
Lesser Scaup *Aythya affinis*	1		1	
Duck *Aythya* sp.	1			
Oldsquaw *Clangula hyemalis*	5		5	
White-winged Scoter *Melanitta fusca*	1			
Bufflehead *Bucephala albeola*			3	
Red-breasted Merganser *Mergus serrator*	3		1	
Duck *Mergus* sp.			1	
Ruddy Duck *Oxyura jamaicensis*	1			
Bald Eagle *Halieetus leucocephalus*	1			
Northern Goshawk *Accipiter gentilis*			2	1
Spruce Grouse *Dendragapus canadensis*			4	
Ruffed Grouse *Bonasa umbellus*	6		21	
Wild Turkey *Meleagris gallopavo*	10	1	21	5
Chicken *Gallus gallus*	1			

Table 6-13 continued

SPECIES	AGE ?	OLD ADULT	ADULT	IMMATURE	
Ring-necked Pheasant *Phasianus colchicus*			1		
Sandhill Crane *Grus canadensis*	1				
Passenger Pigeon *Ectopistes migratorius*	10		18	1	
Yellow-shafted Flicker *Colaptes auratus*			2		
Blue Jay *Cyanocitta cristata*	1				
American Crow *Corvus brachyrhynchos*			1		
Common Raven *Corvus corax*	1		2		
Indeterminate (to genus)	234		30	9	
TOTALS	285	1	130	16	432
PERCENTS	66.0	0.2	30.1	3.7	100

Table 6-14: Keffer Site Amphibian Remains by Body Parts

SPECIES	BODY PART IND.	SKULL	FORE LIMB	HIND LIMB	IND. LIMB	THORAX	RUMP	AXIAL
Bullfrog *Rana catesbiana*							1	
Frog or Toad *Anura* sp.	8	1	36	123	5	2	63	26
Indeterminate			2	3	2	1	6	1
TOTALS	8	1	38	126	7	3	32	65

NOTE: Indeterminate means identified only to class

Table 6-15: Keffer Site Reptilian Remains by Species

SPECIES	NISP	% OF REPTILES IDENTIFIED TO CLASS	% OF REPTILES IDENTIFIED TO SPECIES
Snapping Turtle *Chelydra serpentina*	14	8.1	10.1
Wood Turtle *Clemmys insculpta*	2	1.2	1.4
Painted Turtle *Chrysemys picta*	118	68.2	85.5
Northern Water Snake *Natrix sipedon*	4	2.3	2.9
Indeterminate (beyond class)	35	20.2	
TOTALS	173	100.0	100.0

Table 6-16: Keffer Site Reptilian Species for Houses and Middens

SPECIES	H12	H13	H19	H20	M57	M71	M77
Snapping Turtle *C. serpentina*	0	0	0	0	14	0	0
Wood Turtle *C. insculpta*	0	0	0	0	2	0	0
Painted Turtle *Chrysemys picta*	7	1	0	6	71	23	10
Water Snake *Natrix sipedon*	0	0	0	0	4	0	0
TOTALS	7	1	0	6	91	23	10

Table 6-17: Keffer Site Mammalian Remains by Body Parts

SPECIES	BODY PART							
	IND.	SKULL	FORE LIMB	HIND LIMB	IND. LIMB	THORAX	RUMP+ TAIL	AXIAL
Short-tailed Shrew *Blarina brevicauda*		1						
Star-nosed Mole *Condylura cristata*			2					
Snowshoe Hare *Lepus americanus*		12		10			2	
Grey Squirrel *Sciurus carolinensis*		11	6	8	1	2	4	1
Red Squirrel *T. hudsonicus*	1	10	4	9		10	5	2
Woodchuck *Marmota monax*	1	43	4	7	2	8	8	4
Eastern Chipmunk *Tamias striatus*		12		13		2	2	5
Beaver *Castor canadensis*	1	71	4	11	1	15	8	6
Deer Mouse *Peromyscus* sp.		5				1		
Southern Bog Lemming *Synaptomys cooperi*		1						
Meadow Vole *Microtus pennsylvanicus*		3						
Rock Vole *Microtus chrotorrhinus*			2					
Vole *Microtus* sp.			1					
Muskrat *Ondatra zibethicus*	2	9	10	19	1	5	10	3
Porcupine *Erethizon dorsatum*		2						
Domestic Dog *Canis familiaris*		56	14	13	2		11	
Wolf or Dog *Canis* sp.		82	74	52	40	32	9	16
Red Fox *Vulpes vulpes*		3	2	6	3	3		
Fox sp. *Vulpes* sp.		2	1		3	4	6	
Black Bear *Ursus americanus*		13	5	8	5		1	
Raccoon *Procyon lotor*		11	8	12	3	3	3	1
Mink *Martes vison*		1	1	3	1			1
Marten *Martes americana*							2	
Skunk *Mephitis mephitis*		3					1	
Lynx or Bobcat *Lynx* sp.			1					
Whitetail Deer *O. virginianus*	1	125	44	18	100	8	4	17

Table 6-17 continued

SPECIES	BODY PART							
	IND.	SKULL	FORE LIMB	HIND LIMB	IND. LIMB	THORAX	RUMP+ TAIL	AXIAL
Deer sp.								
Odocoileus sp.		28	16	16	40	6	3	10
Moose								
Alces alces	4				2			
Indeterminate (to genus)	1285	187	29	41	452	104	16	55
TOTALS	1291	699	230	246	656	203	75	141

Table 6-18: Keffer Site Fish Remains by Body Parts

SPECIES			BODY PART		
	IND.	SKULL	THORAX	TAIL	AXIAL
Longnose Gar *Lepisosteus osseus*		3			
Bowfin *Amia calva*		18	4		
Lake Trout *Salvelinus namaycush*		8	12	6	
Trout sp. *Salvelinus* sp.		48	110	95	11
Whitefish sp. *Coregonus* sp.	1	54	225	252	54
Salmon or Trout *Salmo/Salvelinus*		9	12	9	7
Northern Pike *Esox lucius*		12	19	1	4
Sucker sp. Catostomidae		26	17	10	11
Brown Bullhead *Ictalurus nebulosus*		183	8		1
Channel Catfish *Ictalurus punctatus*		5	5		
Catfish sp. Ictaluridae	1	119	18	22	13
American Eel *Anguilla rostrata*	1	4	20	23	7
Rock Bass *Ambloplites rupestris*		5			
Pumpkinseed *Lepomis gibbosus*	1	61	3	6	
Bass sp. *Micropterus* sp.		14	4		
Yellow Perch *Perca flavescens*		25	11	12	7
Sauger or Walleye *Stizostedion sp.*	1	37	20	7	12
Freshwater Drum *Aplodinotus grunniens*		4			
Indeterminate (to genus)	3835	524	485	137	695
TOTALS	3840	1159	973	574	828

Table 6-19: Keffer Site Avian Remains by Body Parts

SPECIES			BODY PART					
	IND.	SKULL	FORE LIMB	HIND LIMB	IND. LIMB	THORAX	RUMP+ TAIL	AXIAL
Common Loon *Gavia immer*	1							
Horned Grebe *Podiceps auritus*						2		
American Bittern *Botaurus lentiginosus*			1					
Canada Goose *Branta canadensis*	5			1		2		
Green-winged Teal *Anas crecca*						1		
Northern Pintail *Anas acuta*						1		
Blue-winged Teal *Anas discors*			1	1				
Northern Shoveler *Anas clypeata*			1					
Duck *Anas* sp.								
Redhead *Aythya americana*			1					
Ring-necked Duck *Aythya collaris*			1					
Greater Scaup *Aythya marila*			1	1		1		
Lesser Scaup *Aythya affinis*			2					
Duck *Aythya* sp.			1					
Oldsquaw *Clangula hyemalis*			5	2		3		
White-winged Scoter *Melanitta fusca*			1					
Bufflehead *Bucephala albeola*			3					
Red-breasted Merganser *Mergus serrator*		1	3					
Duck *Mergus* sp.		1						
Ruddy Duck *Oxyura jamaicensis*			1					
Bald Eagle *Haliaeetus leucocephalus*				1				
Northern Goshawk *Accipiter gentilis*			3					
Spruce Grouse *Dendragapus canadensis*			2	2				
Ruffed Grouse *Bonasa umbellus*		1	8	11		7		
Chicken *Gallus gallus*						1		
Wild Turkey *Meleagris gallopavo*		2	12	6		6	1	10

Table 6-19 continued

SPECIES	BODY PART IND.	SKULL	FORE LIMB	HIND LIMB	IND. LIMB	THORAX	RUMP+ TAIL	AXIAL
Sandhill Crane *Grus canadensis*		1						
Passenger Pigeon *Ectopistes migratorius*			18	3		7		1
Screech Owl *Otus asio*				1				
Yellow-shafted Flicker *Colaptes auratus*			2					
Blue Jay *Cyanocitta cristata*			1					
American Crow *Corvus brachyrhynchos*			1					
Common Raven *Corvus corax*			2	1				
Indeterminate (to genus)	31	3	40	36	124	30	3	14
TOTALS	37	9	111	66	124	61	4	25

Table 6-20: Keffer Site Reptilian Remains by Body Parts

SPECIES	BODY PART SKULL	RUMP & TAIL	AXIAL	CARAPACE & PLASTRON
Snapping Turtle *Chelydra serpentina*		1		13
Wood Turtle *Clemmys insculpta*				2
Painted Turtle *Chrysemys picta*	1			117
Northern Water Snake *Natrix sipedon*			4	
Indeterminate Turtle		2	1	32
TOTALS	1	3	5	164

Table 6-21: Keffer Site Butchered Faunal Remains by Class

SPECIES	CUT MARKS	SPIRAL FRACTURE FEATURES	STRAIGHT EDGES	CUTS+ FRACTURE FEATURES	CUTS+ STRAIGHT EDGES	CHOPS	TOTALS
Osteichthyes			2				2
Amphibia							0
Reptilia							0
Aves	6	2					8
Mammalia	101	25	6	3	4	2	141
Indeterminate	1						1
TOTALS	108	27	8	3	4	2	152

NOTE: Indeterminate means not identified to class.

Table 6-22: Keffer Site Fish Meat by MNI for All Houses and House 20

SPECIES	MEAT WEIGHTS/ ADULT INDIVIDUAL (kg)	ALL HOUSES			HOUSE 20		
		NISP	MNI	MEAT (kg)	NISP	MNI	MEAT (kg)
Bowfin *Amia calva*	0.91	4	1	0.91	1	1	0.91
Lake Trout *Salvelinus namaycush*	6.53	2	1	6.53	0		
Trout sp. *Salvelinus* sp.	2.80	75	2	5.60	32	2	5.60
Whitefish sp. *Coregonus* sp.	4.72	48	4	18.88	19	1	4.72
Northern Pike *Esox lucius*	1.60	15	2	3.20	4	2	3.20
Sucker family Catostomidae	0.80	6	1	0.80	1	1	0.80
Brown Bullhead *Ictalurus nebulosus*	0.40	44	7	2.80	26	3	1.20
Channel Catfish *Ictalurus punctatus*	3.63	5	1	3.63	1	1	3.63
American Eel *Anguilla rostrata*	1.20	3	1	1.20	2	1	1.20
Pumpkinseed *Lepomis gibbosus*	1.76	6	3	5.28	3	1	1.76
Bass *Micropterus* sp.	1.76	4	1	1.76	1	1	1.76
Sauger or Walleye *Stizostedion sp.*	1.50	9	1	1.50	5	1	1.50
Freshwater Drum *A. grunniens*	1.12	1	1	1.12	0		
TOTALS				53.21			26.28

Table 6-23: Keffer Site Mammal Meat by MNI for All Houses and House 20

SPECIES	MEAT WEIGHTS/ ADULT INDIVIDUAL (kg)	ALL HOUSES			HOUSE 20		
		NISP	MNI	MEAT (kg)	NISP	MNI	MEAT (kg)
Mole *Condylura cristata*	0.01	2	1A	0.01	2	1A	0.01
Snowshoe Hare *Lepus americanus*	1.00	13	1A/1I	1.80	4	1A	1.00
Grey Squirrel *Sciurus carolinensis*	0.40	10	1A/1I	0.70	5	1A	0.40
Red Squirrel *T. hudsonicus*	0.10	1	1A	0.10	1	1A	0.10
Woodchuck *Marmota monax*	2.50	19	3A/1I	9.38	7	1A/1I	4.38
Eastern Chipmunk *Tamias striatus*	0.07	1	1A	0.07	1	1A	0.07
Beaver *Castor canadensis*	17.50	16	1A	17.50	4	1A	17.50
Deer Mouse *Peromyscus* sp.	0.01	1	1A	0.03	1	1A	0.03
Muskrat *Ondatra zibethicus*	1.00	9	1A/1I	1.75	5	1A/1I	1.75
Domestic Dog *Canis familiaris*	10.00	10	2A	20.00	3	1A	10.00
Dog or Wolf *Canis* sp.	10.00	72	2A/1I	27.50	28	1A/1I	17.50
Red Fox *Vulpes vulpes*	1.80	4	1A	1.80	1	1A	1.80
Black Bear *Ursus americanus*	95.30	6	1A	95.30	2	1A	95.30
Raccoon *Procyon lotor*	7.90	19	1A/1I	13.83	6	1A/1I	13.83
Marten *Martes americana*	1.00	1	1A	1.00	0		0.00
Skunk *Mephitis mephitis*	2.30	2	2A	4.60	2	2A	4.60
Whitetail Deer *O. virginianus*	45.40	143	4A/1I	215.65	79	3A/1I	170.25
Moose *Alces alces*	181.60	4	1I	136.20	3	1I	136.20
TOTALS				547.22			474.72

KEY: A Adult
I Immature

Table 6-24: Keffer Site Avian Meat by MNI for All Houses and House 20

SPECIES	MEAT WEIGHTS/ ADULT INDIVIDUAL (kg)	ALL HOUSES			HOUSE 20		
		NISP	MNI	MEAT (kg)	NISP	MNI	MEAT (kg)
Greater Scaup *Aythya marila*	0.80	1	1A	0.80	0		
Oldsquaw *Clangula hyemalis*	0.70	1	1A	0.70	0		
Bald Eagle *H. leucocephalus*	3.60	1	1A	3.60	0		
Ruffed Grouse *Bonasa umbellus*	0.50	5	1A	0.50	4	1A	0.50
Wild Turkey *Meleagris gallopavo*	4.50	3	1A	4.50	2	1A	4.50
Passenger Pigeon *E. migratorius*	0.40	2	1A	0.40	2	1A	0.40
Screech Owl *Otus asio*	0.10	1	1A	0.10	1	1A	0.10
TOTALS				10.60			5.50

KEY: A Adult

Table 7-1: **Faunal Remains by Classes from Three Houses of the McKeown Site**

CLASS	HOUSE 2 WITH FLOAT	HOUSE 10 NO FLOAT	HOUSE 13 NO FLOAT	TOTALS N	TOTALS % OF 9954
Pelecypod	744	102	116	962	9.7
Gastropod	50	6	4	60	0.6
Osteichthyes	2864	1214	259	4337	43.6
Amphibia	42	3	0	45	0.5
Reptilia	4	0	3	7	0.1
Aves	19	20	1	40	0.4
Mammalia	1731	473	371	2575	25.9
Indeterminate	1919	4	5	1928	19.4
TOTALS	7373	1822	759	9954	
% of 9954	74.1	18.3	7.5		

NOTE: Indeterminate means not identified to class.

Table 7-2: **NISPs of Faunal Remains by Families from Three Houses of the McKeown Site**

FAMILIES	HOUSE 2 WITH FLOAT	HOUSE 10 NO FLOAT	HOUSE 13 NO FLOAT	TOTALS N	% OF 9954
INVERTEBRATES					
Mussel (Unionidae)	728	100	116	944	9.5
Clam (Sphaeriidae)		2		2	0.0
Snail (Endodontidae)	2	1	3	6	0.1
Snail (Zonitidae)		1		1	0.0
Snail (Polygyridae)	41	1	1	43	0.4
Snail (Sigmurethra)		1		1	0.0
FISH					
Gar (Lepisosteidae)		1		1	0.0
Bowfin (Amiidae)	5			5	0.1
Trout (Salmonidae)	15	7	5	27	0.3
Pike (Esocidae)	69	43	31	143	1.4
Minnow/Carp (Cyprinidae)		3		3	0.0
Sucker (Catostomidae)	85	100	11	196	2.0
Catfish (Ictaluridae)	52	47	7	106	1.1
Eel (Anguillidae)	6	11	3	78	0.8
Bass (Percichthyidae)	1	3		4	0.0
Sunfish (Centrarchidae)	33	38	29	100	1.0
Perch (Percidae)	229	78	16	323	3.2
Drum (Sciaenidae)		2		2	0.0
AMPHIBIANS					
Frog/Toad (Ranidae)	42	3		45	0.5
REPTILES					
Turtle (Emydidae)	4		1	5	0.1
BIRDS					
Loon (Gaviidae)	1			1	0.0
Duck/Geese (Anatidae)	2	6	1	9	0.1
Grouse (Phasianidae)	3	1		4	0.0
Pigeon/Dove (Columbidae)		8		8	0.1
Woodpecker (Picidae)		1		1	0.0
MAMMALS					
Human (Hominidae)	9			9	0.1
Hare (Leporidae)	20	3	2	25	0.3
Squirrel (Sciuridae)	36		15	51	0.5
Beaver (Castoridae)	55	66	19	140	1.4
Mice/Muskrat (Cricetidae)	36			36	0.4
Porcupine (Erithizontidae)	7		4	11	0.1
Wolf/Coyote/Dog (Canidae)	6		1	7	0.1
Bear (Ursidae)	10	20	6	35	0.4
Raccoon (Procyonidae)	12	5		17	0.2
Weasel (Mustelidae)	11	1	3	15	0.2
Deer (Cervidae)	146	51	44	241	2.4
Indeterminate (to family)	5625	1209	434	7268	73.0
TOTALS	7373	1822	759	9954	

Table 7-3: McKeown Site Fish Remains by Species from Three Houses

SPECIES	HOUSE 2 WITH FLOAT	HOUSE 10 NO FLOAT	HOUSE 13 NO FLOAT	TOTALS	
				N	% OF 4337
Gar family Lepisosteidae		1		1	0.0
Bowfin *Amia calva*	5			5	0.1
Trout sp. *Salvelinus* sp.	1	3	1	5	0.1
Whitefish sp. *Coregonus* sp.	4		3	7	0.2
Salmon or Whitefish *Salvelinus/Coregonus*	3			3	0.1
Northern Pike *Esox lucius*	38	10	20	68	1.6
Pike sp. *Esox* sp.	8			8	0.2
Creek Chub *Semotilus atromaculatus*		3		3	0.1
Sucker family Catostomidae	85	100	11	196	4.5
Brown Bullhead *Ictalurus nebulosus*	35	35	5	75	1.7
Channel Catfish *Ictalurus punctatus*	11	5	2	18	0.4
American Eel *Anguilla rostrata*	93	11	3	107	2.5
Perch or Bass sp. *Morone* sp.	1	3		4	0.1
Rock Bass *Ambloplites rupestris*	3	1		4	0.1
Pumpkinseed *Lepomis gibbosus*	8	11	5	24	0.6
Largemouth Bass *Micropterus salmoides*	3			3	0.1
Crappie sp. *Pomoxis* sp.	2			2	0.0
Bass sp. *Micropterus* sp.	13	17	16	46	1.1
Yellow Perch *Perca flavescens*	86	7	6	102	2.4
Perch sp. *Perca* sp.	1			1	0.0
Sauger or Walleye *Stizostedion* sp.	104	71	10	185	4.3
Freshwater Drum *Aplodinotus grunniens*	1	2		3	0.1
Indeterminate (to genus)	2399	1035	188	3622	83.5
TOTALS	2864	1214	259	4337	

Table 7-4: **Fish Meat Weights by Species from Three Houses of the McKeown Site**

	MNI	MEAT WEIGHTS/ ADULT INDIVIDUAL (kg)	TOTAL MEAT (kg)
Gar family Lepisosteidae	1	1.10	1.10
Bowfin *Amia calva*	1	0.91	0.91
Trout sp. *Salvelinus* sp.	1	2.80	2.80
Whitefish sp. *Coregonus* sp.	1	4.72	4.72
Northern Pike *Esox lucius*	(7) 3	1.60	(11.2) 4.80
Creek Chub *Semotilus atromaculatus*	1	0.18	0.18
Sucker family Catostomidae	6	0.80	4.80
Brown Bullhead *Ictalurus nebulosus*	4	0.40	1.60
Channel Catfish *Ictalurus punctatus*	2	2.00	4.00
American Eel *Anguilla rostrata*	4	1.20	4.80
Perch or Bass sp. *Morone* sp.	1	0.41	0.41
Rock Bass *Ambloplites rupestris*	1	0.18	0.18
Pumpkinseed *Lepomis gibbosus*	3	1.76	5.28
Crappie sp. *Pomoxis* sp.	1	0.41	0.41
Bass sp. *Micropterus* sp.	4	1.76	7.04
Yellow Perch *Perca flavescens*	8	0.16	1.28
Perch sp. *Perca* sp.	1	0.20	0.20
Sauger or Walleye *Stizostedion* sp.	(8) 4	1.50	(12.0) 6.00
Freshwater Drum *Aplodinotus grunniens*	2	1.12	2.24
TOTAL			(65.15) 52.75

NOTE: Bracketed figures are based on vertebral ring counts.

Table 7-5: McKeown Site Mammal Remains by Species from Three Houses

SPECIES	HOUSE 2 WITH FLOAT	HOUSE 10 NO FLOAT	HOUSE 13 NO FLOAT	TOTALS	
				N	% OF 2575
Human *Homo sapiens*	9			9	0.3
Showshoe Hare *Lepus americanus*	20	3	2	28	0.7
Grey Squirrel *Sciurus carolinensis*	3			3	0.1
Red Squirrel *Tamiasciurus hudsonicus*	17			17	0.7
Woodchuck *Marmota monax*	10		13	23	0.9
Eastern Chipmunk *Tamias striatus*	6		2	8	0.3
Beaver *Castor canadensis*	55	66	19	140	5.4
Meadow Vole *Microtus pennsylvanicus*	8			8	0.3
Deer Mouse *Peromyscus* sp.	6	2		8	0.3
Muskrat *Ondatra zibethicus*	22	7	7	36	1.4
Porcupine *Erethizon dorsatum*	14		4	18	0.7
Wolf *Canis lupus*	2		1	3	0.1
Wolf or Dog *Canis* sp.	2			2	0.1
Red Fox *Vulpes vulpes*	2			2	0.1
Black Bear *Ursus americanus*	10	20	5	35	1.4
Raccoon *Procyon lotor*	12	5		17	0.7
Mink *Mustela vison*	1			1	0.0
Marten *Martes americana*	9	1	1	11	0.4
Fisher *Martes pennanti*			2	2	0.1
River Otter *Lutra canadensis*	1			1	0.0
Whitetail Deer *Odocoileus virginianus*	94	42	36	172	6.7
Deer sp. *Odocoileus* sp.	3			3	0.1
Indeterminate (to genus)	1430	328	279	2037	79.1
TOTALS	1731	473	371	2575	

Table 7-6: **Mammal Meat Weights by Species from Three Houses of the McKeown Site**

	MNI	MEAT WEIGHTS/ ADULT INDIVIDUAL (kg)	TOTAL MEAT (kg)
Snowshoe Hare *Lepus americanus*	1A	1.00	1.00
Grey Squirrel *Sciurus carolinensis*	1A	0.40	0.40
Red Squirrel *Tamiasciurus hudsonicus*	2A	0.10	0.20
Woodchuck *Marmota monax*	1YA/1I	2.50	4.40
Eastern Chipmunk *Tamias striatus*	1A/1I	0.07	0.10
Beaver *Castor canadensis*	1A/4I	17.50	69.90
Deer Mouse *Peromyscus* sp.	2A/1I	0.01	0.03
Meadow Vole *Microtus pennsylvanicus*	3A	0.03	0.09
Muskrat *Ondatra zibethicus*	1A/2I	1.00	2.50
Porcupine *Erethizon dorsatum*	1A/1I	4.50	7.70
Wolf *Canis lupus*	1A	13.60	13.60
Wolf or Dog *Canis* sp.	2A		
Red Fox *Vulpes vulpes*	1A	1.80	1.80
Black Bear *Ursus americanus*	2A/1I	95.30	272.10
Raccoon *Procyon lotor*	1I	7.90	5.93
Mink *Mustela vison*	1A	0.50	0.50
Marten *Martes americana*	1A/1YA	1.00	2.00
Fisher *Martes pennanti*	1A	2.20	2.20
River Otter *Lutra canadensis*	1I	5.70	4.28
Whitetail Deer *Odocoileus virginianus*	3A/1I	45.40	150.80
TOTALS			539.53

KEY:
A Adult
I Immature
YA Young adult

Table 7-7: McKeown Site Bird Remains by Species from Three Houses

SPECIES	HOUSE 2 WITH FLOAT	HOUSE 10 NO FLOAT	HOUSE 13 NO FLOAT	TOTALS N	% OF 40
Common Loon *Gavia immer*	1			1	2.5
Canada Goose *Branta canadensis*	1		1	2	5.0
Common Goldeneye *Bucephala clangula*		6		6	15.0
Common Merganser *Mergus merganser*	1			1	2.5
Ruffed Grouse *Bonasa umbellus*	3	1		4	10.0
Passenger Pigeon *Ectopistes migratorius*		8		8	20.0
Indeterminate (to genus)	13	5		18	45.0
TOTALS	19	20	1	40	

Table 7-8: Bird Meat Weights by Species from Three Houses of the McKeown Site

	MNI	MEAT WEIGHTS/ ADULT INDIVIDUAL (kg)	TOTAL MEAT (kg)
Common Loon *Gavia immer*	1	1.8	1.8
Canada Goose *Branta canadensis*	1	2.9	2.9
Common Goldeneye *Bucephala clangula*	2	0.8	1.6
Common Merganser *Mergus merganser*	1	1.2	1.2
Ruffed Grouse *Bonasa umbellus*	1	0.5	0.5
Passenger Pigeon *Ectopistes migratorius*	2	0.4	0.8
TOTALS			8.8

Table 7-9: **Invertebrate Remains by Species from Three Houses of the McKeown Site**

SPECIES	HOUSE 2 WITH FLOAT	HOUSE 10 NO FLOAT	HOUSE 13 NO FLOAT	TOTALS		MNI % OF 1022
Elliptio complanata	27	1	1	29	2.8	16
Elliptio dilatata	13	7	4	24	2.3	11
Elliptio sp.	46	7	9	62	6.1	4
Sphaerium simile		1		1	0.1	1
Sphaerium sp.		1		1	0.1	1
Anguispira alternata	2	1	3	6	0.6	
Mesomphix friabilis		1		1	0.1	
Triodopsis tridentata		1		1	0.1	
Triodopsis albolabris			1	1	0.1	
Indeterminate (to genus)	706	88	102	896	87.7	
TOTALS	794	108	120	1022		

Table 7-10: Mammalian Specimens by Body Regions in the McKeown Site Faunal Remains

SPECIES	BODY PART SKULL	FORE LIMB	HIND LIMB	IND. LIMB	THORAX	RUMP+ TAIL	AXIAL
Showshoe Hare *Lepus americanus*	4	10	4			1	
Grey Squirrel *S. carolinensis*	1		2				
Red Squirrel *T. hudsonicus*	5	4	1		3	1	3
Woodchuck *Marmota monax*	14	1	3	1	1	1	1
Eastern Chipmunk *Tamias striatus*	2		6				
Beaver *Castor canadensis*	39	18	32	6	18	13	9
Deer Mouse *Peromyscus* sp.	1	2	4				1
Meadow Vole *M. pennsylvanicus*	7	1					
Muskrat *Ondatra zibethicus*	12	5	9	1	4	2	3
Porcupine *Erithizon dorsatum*	10	1	5		2		
Wolf *Canus lupus*	1	1			1		
Wolf or Dog *Canis* sp.		2					
Red Fox *Vulpes vulpes*	2						
Black Bear *Ursus americanus*	5	3	5	7	4	6	5
Raccoon *Procyon lotor*	4	2	3	1	5		2
Mink *Mustela vison*			1				
Marten *Martes americana*	1	5	5				
Fisher *Martes pennanti*		1		1			
River Otter *Lutra canadensis*			1				
Whitetail Deer *O. virginianus*	42	25	34	42	13	3	11
TOTALS	150	81	115	59	51	27	35

Table 7-11: Fish and Bird Specimens by Body Regions in the McKeown Site Faunal Remains

SPECIES	BODY PART SKULL	FORE LIMB	HIND LIMB	IND. LIMB	THORAX	RUMP+ TAIL	AXIAL
FISH							
Bowfin *Amia calva*	5						
Trout sp. *Salvelinus* sp.	3				1	1	
Whitefish sp. *Coregonus* sp.							6
Northern Pike *Esox lucius*	39				16	11	2
Creek Chub *S. atromaculatus*	3						
Sucker family Catostomidae	66				52	67	8
Brown Bullhead *Ictalurus nebulosus*	57				9	5	4
Channel Catfish *Ictalurus punctatus*	15						3
American Eel *A. rostrata*	52				20	26	8
Perch or Bass sp. *Morone* sp.	3						1
Rock Bass *A. rupestris*	3				1		
Pumpkinseed *Lepomis gibbosus*	13				4	6	1
Crappie sp. *Pomoxis* sp.					2		
Bass sp. *Micropterus* sp.	37				8	4	
Yellow Perch *Perca flavescens*	67				11	14	10
Sauger or Walleye *Stizostedion* sp.	67				34	74	9
Freshwater Drum *A. grunniens*	3						
FISH TOTALS	433				158	208	52
BIRDS							
Common Loon *Gavia immer*	1						
Canada Goose *Branta canadensis*							1
Common Goldeneye *Bucephala clangula*		6					
Common Merganser *Mergus merganser*		1					
Ruffed Grouse *Bonasa umbellus*			2				2
Passenger Pigeon *E. migratorius*			3				5
BIRD TOTALS	1	7	5				8

Table 7-12: MNIs and Meat Weights for Species from McKeown House 2

SPECIES	MNI	MEAT WEIGHTS/ ADULT INDIVIDUAL (kg)	TOTAL MEAT WEIGHTS (kg)
FISH			
Bowfin			
Amia calva	1	0.91	0.91
Whitefish sp.			
Coregonus sp.	1	4.72	4.72
Northern Pike			
Esox lucius	3	1.60	4.80
Sucker family			
Catostomidae	2	0.80	1.60
American Eel			
Anguilla rostrata	3	1.20	3.60
Brown Bullhead			
Ictalurus nebulosus	1	0.40	0.40
Channel Catfish			
Ictalurus punctatus	2	2.00	4.00
Rock Bass			
Ambloplites rupestris	1	0.18	0.18
Bass sp.			
Micropterus sp.	1	1.76	1.76
Yellow Perch			
Perca flavescens	2	0.16	0.32
Sauger or Walleye			
Stizostedion sp.	2	1.50	3.00
FISH TOTAL			25.29
TURTLE and AMPHIBIAN			
Painted Turtle			
Chrysemys picta	1	0.10	0.10
Frog/Toad	1	tr	0.00
TURTLE AND AMPHIBIAN TOTAL			0.10
BIRDS			
Common Loon			
Gavia immer	1A	1.80	1.80
Canada Goose			
Branta canadensis	1A	2.90	2.90
Common Merganser			
Mergus merganser	1A	1.20	1.20
Ruffed Grouse			
Bonasa umbellus	1A	0.50	0.50
BIRD TOTAL			6.40

Table 7-12 continued

SPECIES	MNI	MEAT WEIGHTS/ ADULT INDIVIDUAL (kg)	TOTAL MEAT WEIGHTS (kg)
MAMMALS			
Showshoe Hare *Lepus americanus*	1A	1.00	1.00
Grey Squirrel *Sciurus carolinensis*	1A	0.40	0.40
Red Squirrel *Tamiasciurus hudsonicus*	1A	0.10	0.10
Woodchuck *Marmota monax*	1YA	2.50	2.50
Eastern Chipmunk *Tamias striatus*	1I	0.07	0.05
Beaver *Castor canadensis*	2I	17.50	26.25
Muskrat *Ondatra zibethicus*	1A/1I	1.00	1.75
Porcupine *Erethizon dorsatum*	1A/1I	4.50	7.70
Wolf *Canis lupus*	1A	13.60	13.60
Red Fox *Vulpes vulpes*	1A	1.80	1.80
Black Bear *Ursus americanus*	1I	95.30	71.48
Raccoon *Procyon lotor*	1I	7.90	5.93
Marten *Martes americana*	1YA	1.00	1.00
River Otter *Lutra canadensis*	1I	5.70	4.28
Whitetail Deer *Odocoileus virginianus*	3A/1I	45.40	150.80
MAMMAL TOTAL			288.64
GRAND MEAT WEIGHT TOTAL			320.43

KEY: A Adult
I Immature
YA Young Adult

Table 7-13: A Comparison of the Three McKeown Houses

	HOUSE NUMBER			
	13	10	2	TOTALS
Building Phase	core	1st expansion	last	3
Maximum Length	30.4m	35.9m	38.8m	
Maximum Width	6.6m	6.5m	6.1m	
Floor Area	206.6m^2	232.5m^2	260.0m^2	670.2m^2
# of Hearths	4	4	7	15
# of Families	8	8	14	30
Macrofaunal NISP	759	1822	1961	4542
NISP with Float	759	1822	7373	9954

Table 8-1: **Meat Weight Contributions by Species by NISP in the Keffer and McKeown Site Macrofaunal Samples**

SPECIES	KEFFER				MCKEOWN			
	4 HOUSES		HOUSE 20		3 HOUSES		HOUSE 2	
	NISP	(kg)	NISP	(kg)	NISP	(kg)	NISP	(kg)
MAMMALS								
Mole	2	0.02	2	0.02	0		0	
Hare	13	13.00	4	4.00	19	19.00	15	15.00
Grey Squirrel	10	4.00	5	20.00	2	0.80	2	0.80
Red Squirrel	1	0.10	1	0.10	8	0.80	8	0.80
Woodchuck	19	47.50	7	17.50	20	50.00	7	17.50
Chipmunk	1	0.07	1	0.07	4	0.28	2	0.14
Beaver	16	280.00	4	70.00	116	2030.00	49	857.50
Deer Mouse	1	0.01	1	0.01	0		0	
Mouse	0		0		2	0.02	0	
Muskrat	9	9.00	5	5.00	31	31.00	17	17.00
Porcupine	0		0		11	49.50	7	31.50
Dog	10	100.00	3	30.00	0		0	
Wolf	0		0		3	40.80	2	27.20
Canis sp.	72	720.00	28	280.00	2	20.00	2	20.00
Red Fox	4	7.20	1	1.80	2	3.60	2	3.60
Black Bear	6	571.80	2	190.60	34	3240.20	9	857.70
Raccoon	19	150.10	6	47.40	17	134.30	12	134.30
Marten	1	1.0	0		11	11.00	9	9.00
Fisher	0		0		2	4.40	0	
Skunk	2	4.60	2	4.60	0		0	
Otter	0		0		1	5.70	1	5.70
Deer	143	6492.20	79	3586.60	171	7763.40	93	4222.20
Moose	4	726.40	3	544.80	0		0	
SUBTOTALS		9127.00		4792.50		13404.80		6219.94
FISH								
Bowfin	4	3.64	1	0.91	5	4.55	5	4.55
Lake Trout	2	13.06	0		0		0	
Trout sp.	75	210.00	32	89.60	4	11.20	0	
Whitefish	48	226.56	19	89.68	5	23.60	2	9.44
Northern Pike	15	24.00	4	6.40	45	72.00	15	24.00
Chub	0		0		3	0.54	0	
Sucker family	6	4.80	1	0.80	157	125.60	39	31.20
Brown Bullhead	44	176.00	26	10.40	48	19.20	8	3.20
Channel Catfish	5	18.15	1	3.63	18	65.34	11	22.00
American Eel	3	3.60	2	2.40	24	28.80	10	12.00
Rock Bass	0		0		2	0.36	1	0.18
Pumpkinseed	6	10.56	3	5.28	17	29.92	0	
Bass sp.	4	7.04	1	1.76	44	77.44	8	14.08
Yellow Perch	0		0		19	3.04	6	0.96
Sauger/Walleye	9	13.50	5	7.50	123	184.50	42	63.00
Freshwater Drum	1	1.12	0		2	2.24	0	
SUBTOTALS		712.03		218.36		648.33		184.61
BIRDS								
Common Loon	0		0		1	1.80	1	1.80
Canada Goose	0		0		1	2.90	1	2.90
Greater Scaup	1	0.80	0		0		0	
Oldsquaw	1	0.70	0		0		0	
Common Goldeneye	0		0		1	0.80	0	
Common Merganser	0		0		1	1.20	1	1.20
Bald Eagle	1	3.60	0		0		0	

Table 8-1 continued

SPECIES	KEFFER				MCKEOWN			
	4 HOUSES		HOUSE 20		3 HOUSES		HOUSE 2	
	NISP	(kg)	NISP	(kg)	NISP	(kg)	NISP	(kg)
Ruffed Grouse	5	2.50	4	2.00	4	2.00	3	1.50
Wild Turkey	3	13.50	2	9.00	0		0	
Passenger Pigeon	2	0.80	2	0.80	8	3.20	0	
Screech Owl	1	0.10	1	0.10	0		0	
SUBTOTALS		22.80		11.90		11.90		7.40
GRAND TOTALS		9861.83		5022.76		14065.03		6411.95

Table 8-2: Rank Ordering of Animals in the Keffer and McKeown Samples by NISPs

KEFFER 4 HOUSES		KEFFER HOUSE 20		MCKEOWN 3 HOUSES		MCKEOWN HOUSE 2	
FISH							
1	Trout sp.	1	Trout sp.	1	Sucker	1	Sauger/Walleye
2	Whitefish	2	Brown Bullhead	2	Sauger/Walleye	2	American Eel
3	Brown Bullhead	3	Whitefish	3	American Eel	3	Sucker
4	Pike	4	Sauger/Walleye	4	Perch	4	Perch
5	Sauger/Walleye	5	Pike	5	Brown Bullhead	5	Pike
6.5	Pumpkinseed	6	Pumpkinseed	6	Pike	6	Brown Bullhead
6.5	Sucker	7	American Eel	7	Bass sp.	7	Bass sp.
8	C. Catfish	9.5	Sucker	8	Pumpkinseed	8	C. Catfish
9.5	Bowfin	9.5	C. Catfish	9	C. Catfish	9	Pumpkinseed
9.5	Bass sp.	9.5	Bowfin	10	Whitefish	10	Bowfin
11	American Eel	9.5	Bass sp.	11.5	Trout sp.	11.5	Trout sp.
12	Drum			11.5	Bowfin	11.5	Whitefish
				13	Drum	13	Drum
				14	Gar		
MAMMALS							
1	Deer	1	Deer	1	Deer	1	Deer
2	Dog/*Canis* sp.	2	Dog/*Canis* sp.	2	Beaver	2	Beaver
3.5	Woodchuck	3	Woodchuck	3	Muskrat	3	Muskrat
3.5	Raccoon	4	Raccoon	4	Black Bear	4	Hare
5	Beaver	5.5	Muskrat	5	Hare	5	Red Squirrel
6	Hare	5.5	Grey Squirrel	6	Woodchuck	6	Porcupine
7	Grey Squirrel	6.5	Beaver	7	Porcupine	7	Raccoon
8	Muskrat	6.5	Hare	8.5	Red Squirrel	8.5	Black Bear
9	Black Bear	9	Moose	8.5	Raccoon	8.5	Woodchuck
10.5	Red Fox	11	Black Bear	10	Marten	10	Marten
10.5	Moose	11	Skunk	11.5	Chipmunk	11	Meadow Vole
12.5	Skunk	11	*Mole*	11.5	Deer Mouse	12.5	Chipmunk
12.5	Mole	14.5	Red Fox	13.5	G. Squirrel	12.5	Deer Mouse
14.5	Chipmunk	14.5	Chipmunk	13.5	Wolf	14	G. Squirrel
14.5	Red Squirrel	14.5	Red Squirrel	17	*Canis* sp.	16	Wolf
		14.5	Deer Mouse	17	Red Fox	16	*Canis* sp.
				17	Fisher	16	Red Fox
				17	Mink	18.5	Mink
				17	Otter	18.5	Otter
BIRDS							
1	R. Grouse	1	R. Grouse	1	P. Pigeon	1	R. Grouse
2	Wild Turkey	2	Wild Turkey	2	Goldeneye	3	C. Goose
3	P. Pigeon	3	P. Pigeon	3	R. Grouse	3	Common Loon
5.5	G. Scaup	5.5	G. Scaup	4	C. Goose	3	Merganser
5.5	Oldsquaw	5.5	Oldsquaw	5.5	C. Loon		
5.5	Bald Eagle	5.5	Bald Eagle	5.5	Merganser		
5.5	*Screech Owl*	5.5	Screech Owl				

KEY: C. Catfish = Channel Catfish
G. Squirrel = Grey Squirrel
R. Grouse = Ruffed Grouse
P. Pigeon = Passenger Pigeon
G. Scaup = Greater Scaup
C. Goose = Canada Goose
C. Loon = Common Loon

Table 8-3: Rank Ordering of the Meat Contributions by Species Using MNIs

KEFFER 4 HOUSES		KEFFER HOUSE 20		MCKEOWN 3 HOUSES		MCKEOWN HOUSE 2	
1	Whitetail Deer	1	Whitetail Deer	1	Black Bear	1	Whitetail Deer
2	Moose	2	Moose	2	Whitetail Deer	2	Black Bear
3	Black Bear	3	Black Bear	3	Beaver	3	Beaver
4	*Canis* sp.	4.5	*Canis* sp.	4	*Canis* sp.	4	Wolf
5	Domestic Dog	4.5	Beaver	5	Wolf	5	Canis sp
6	Whitefish	6	Raccoon	6	Porcupine	6	Porcupine
7	Beaver	7	Domestic Dog	7	Bass	7	Raccoon
8	Raccoon	8	Trout sp.	8	Sauger/Walleye	8	Northern Pike
9	Woodchuck	9	Whitefish	9	Raccoon	9	Whitefish
10	Lake Trout	10	Skunk	10	Pumpkinseed	10	River Otter
11	Trout sp.	11	Wild Turkey	12	Sucker	11	Channel Catfish
12	Pumpkinseed	12	Woodchuck	12	Northern Pike	12	American Eel
13	Skunk	13	Channel Catfish	12	Am. Eel	13	Sauger/Walleye
14	Wild Turkey	14	Northern Pike	14	Whitefish	14	Canada Goose
15	Channel Catfish	15	Red Fox	15	Woodchuck	15	Woodchuck
16	Bald Eagle	16.5	Pumpkinseed	16	River Otter	16.5	Loon
17	Northern Pike	16.5	Bass	17	Channel Catfish	16.5	Red Fox
18	Brown Bullhead	18	Muskrat	18	Canada Goose	18	Bass sp.
19.5	Hare	19	Sauger/Walleye	19	Trout sp.	19	Muskrat
19.5	Red Fox	20.5	Brown Bullhead	20	Muskrat	20	Sucker sp.
21	Bass	20.5	Am. Eel	21	Drum	21	Merganser
22	Muskrat	22	Hare	22	Marten	22.5	Hare
23	Sauger/Walleye	23	Bowfin	23.5	Red Fox	22.5	Marten
24	Eel	24	Sucker	23.5	Loon	24	Bowfin
25	Drum	25	Ruffed Grouse	25.5	Goldeneye	25	Ruffed Grouse
26	Marten	26.5	Grey Squirrel	25.5	Bullhead	26.5	Bullhead
27	Bowfin	26.5	Pigeon	27	Yellow Perch	26.5	Grey Squirrel
28.5	Sucker	28.5	Red Squirrel	28	Merganser	28	Yellow Perch
28.5	Greater Scaup	28.5	Screech Owl	29	Gar	29	Rock Bass
30.5	Grey Squirrel	30	Chipmunk	30	Hare	30	Red Squirrel
30.5	Oldsquaw	31	Deer Mouse	31	Bowfin	31	Chipmunk
32	Ruffed Grouse	32	Mole	32	Passenger Pigeon		
33	Pigeon			33.5	Mink		
34.5	Red Squirrel			33.5	Ruffed Grouse		
34.5	Screech Owl			35.5	Morone Bass		
36	Chipmunk			35.5	Crappies		
37	Deer Mouse			37	Grey Squirrel		
38	Mole			38.5	Red Squirrel		
				38.5	Perch sp.		
				40.5	Chub		
				40.5	Rock Bass		
				42	Chipmunk		
				43	Vole		
				44	Deer Mouse		

Table 8-4: Site Comparisons of Vertebrate Classes by NISPs, minus indeterminates (% of total samples)

CLASS	KEFFER TOTAL WITH FLOAT (N=11846)	KEFFER HOUSE 20 MACROFAUNA (N=666)	MCKEOWN MY TOTAL WITH FLOAT (N=7004)	MCKEOWN HOUSE 2 MACROFAUNA (N=1591)
Osteichthyes	62.6	29.6	61.9	28.7
Amphibia	2.4	0.2	0.6	0.1
Reptilia	1.5	0.9	0.1	0.2
Aves	3.6	2.3	0.6	0.6
Mammalia	30.0	67.1	36.8	70.4
TOTALS	100.1	100.1	100.0	100.0

Table 8-5: Brainerd's Coefficient of Similarity for Macrofaunal Fish NISPs, excluding indeterminates

	MCKEOWN				KEFFER				% DIFFERENCES OF HOUSES	
	THREE HOUSES NISP	%	HOUSE 2 NISP	%	FOUR HOUSES NISP	%	HOUSE 20 NISP	%	AGGREGATE	SINGLE
Bowfin	5	0.96	5	3.40	4	1.80	1	1.05	0.84	2.35
Lake Trout	0		0		2	0.90	0		0	0.90
Trout sp.	4	0.77	0		75	33.78	32	33.68	33.01	33.68
Whitefish	5	0.96	2	1.36	48	21.62	19	20.00	20.66	18.64
Northern Pike	45	8.67	15	10.20	15	6.76	4	4.21	1.91	5.99
Chub	3	0.58	0		0		0		0.58	0
Suckers	157	30.25	39	26.53	6	2.70	1	1.05	27.55	25.48
Brown Bullhead	48	9.25	8	5.44	44	19.82	26	27.37	10.59	21.93
C. Catfish	18	3.47	11	7.48	5	2.25	1	1.05	1.22	6.43
American Eel	24	4.62	10	6.80	3	1.35	2	2.11	3.27	4.69
Bass sp.	44	8.48	8	5.44	4	1.80	1	1.05	6.68	4.39
Morone Bass	3	0.58	0		0		0		0.58	0
Rock Bass	2	0.39	1	0.68	0		0		0.39	0.68
Pumpkinseed	17	3.28	0		6	2.70	3	3.16	0.58	3.16
Yellow Perch	19	3.66	6	4.08	0		0		3.66	4.08
Walleye/Sauger	123	23.70	42	28.57	9	4.05	5	5.26	19.20	23.31
Drum	2	0.39	0		1	0.45	0		0.06	0
TOTALS	519	100.01	222	99.98	95	99.99	95	99.99	131.68	154.71

AGGREGATED HOUSES: 200 - 131.68 = 68.32
SINGLE HOUSES : 200 - 154.71 = 45.29

Table 8-6: Spearman's Rho for Fish NISPs for Macrofaunal Samples from Aggregated Houses

	MCKEOWN	KEFFER	d	d^2
Sucker family	1	6.5	-5.5	30.25
Walleye/Sauger	2	5	-3	9
Brown Bullhead	3	3	0	0
Northern Pike	4	4	0	0
Bass sp.	5	9.5	-4.5	20.25
American Eel	6	11	-5	25
Yellow Perch	7	15	-8	64
Channel Catfish	8	8	0	0
Pumpkinseed	9	6.5	2.5	6.25
Bowfin	10.5	9.5	1	1
Whitefish	10.5	2	8.5	72.25
Trout sp.	12	1	11	121
Chub	13	15	-2	4
Rock Bass	14.5	15	-.5	.25
Drum	14.5	13	1.5	2.25
Lake Trout	16	12	4	16
				371.50

r_s for tied scores = 0.45

Table 8-7: Spearman's Rho for Fish NISPs for Macrofaunal Samples from Single Houses

	MCKEOWN HOUSE 2	KEFFER HOUSE 20	d	d^2
Walleye/Sauger	1	4	-3	9
Sucker	2	9.5	-7.5	56.25
Northern Pike	3	5	-2	4
Channel Catfish	4	9.5	-5.5	30.25
American Eel	5	7	-2	4
Brown Bullhead	6.5	2	4.5	20.25
Bass sp.	6.5	9.5	-3	9
Yellow Perch	8	12.5	-4.5	20.25
Bowfin	9	9.5	-.5	.25
Whitefish	10	3	7	49
Rock Bass	11	12.5	-1.5	2.25
Trout	12.5	1	11.5	132.25
Pumpkinseed	12.5	6	6.5	42.25
				379.00

r_s for tied scores = -0.06

Table 8-8: Spearman's Rho for Fish NISPs for Float-Included Samples from Aggregated Houses

	MCKEOWN	KEFFER	d	d^2
Sucker family	1	6.5	-5.5	30.25
Walleye/Sauger	2	5	-3	9
American Eel	3	11	-8	64
Yellow Perch	4	17.5	-13.5	182.25
Brown Bullhead	5	3	2	4
Northern Pike	6	4	2	4
Bass sp.	7	9.5	-2.5	6.25
Pumpkinseed	8	6.5	1.5	2.25
Channel Catfish	9	8	1	1
Pike sp.	10	17.5	-7.5	56.25
Whitefish	11	2	9	81
Trout sp.	12.5	1	11.5	132.25
Bowfin	12.5	9.5	3	9
Rock Bass	14.5	17.5	-3	9
Morone sp.	14.5	17.5	-3	9
Chub	17	17.5	-.5	25
Largemouth Bass	17	17.5	-.5	25
Drum	17	13	4	16
Gar family	19.5	17.5	2	4
Perch sp.	19.5	17.5	2	4
Lake Trout	21	12	9	81
				754.50

r_s for tied scores = 0.5

Table 8-9: Spearman's Rho for Fish NISPs for Float-Included Samples from Single Houses

	MCKEOWN HOUSE 2	KEFFER HOUSE 20	d	d^2
Walleye/Sauger	1	4	-3	9
American Eel	2	7	-5	25
Sucker	3	9.5	-6.5	42.25
Perch	4	12.5	-8.5	72.25
Pike	5	5	0	0
Brown Bullhead	6	2	4	16
Bass sp.	7	9.5	-2.5	6.25
Channel Catfish	8	9.5	-1.5	2.25
Pumpkinseed	9	6	3	9
Bowfin	10	9.5	.5	.25
Trout sp.	11.5	1	10.5	110.25
Whitefish	11.5	3	8.5	72.25
Drum	13	12.5	.5	.25
				365.00

r_s for tied scores = -0.02

Table 8-10: Spearman's Rho for Fish MNIs for Macrofaunal Samples from Aggregated Houses

	MCKEOWN	KEFFER	d	d^2
Sucker family	1	9.5	-8.5	72.25
Brown Bullhead	4	1	3	9
Bass sp.	4	9.5	-5.5	30.25
Yellow Perch	4	16.5	-12.5	156.25
Sauger/Walleye	4	9.5	-5.5	30.25
American Eel	4	9.5	-5.5	30.25
Northern Pike	7	4.5	2.5	6.25
Channel Catfish	8.5	9.5	-1	1
Pumpkinseed	8.5	3	5.5	30.25
Bowfin	14	9.5	4.5	20.25
Trout sp.	14	4.5	9.5	90.25
Whitefish	14	2	12	144
Chub	14	16.5	-2.5	6.25
Rock Bass	14	16.5	-2.5	6.25
Drum	14	9.5	4.5	20.25
Morone sp.	14	16.5	-2.5	6.25
Crappie	14	16.5	-2.5	6.25
Gar family	14	16.5	-2.5	6.25
Lake Trout	19	9.5	9.5	90.25
				762.00

r_s for tied scores = 0.25

Table 8-11: Spearman's Rho for Fish MNIs for Float-Included Samples from Aggregated Houses

	MCKEOWN	KEFFER	d	d^2
Yellow Perch	1	17	-16	256
Sucker family	2	9.5	-7.5	56.25
Brown Bullhead	4.5	1	3.5	12.25
Bass sp.	4.5	9.5	-5	25
Sauger/Walleye	4.5	9.5	-5	25
American Eel	4.5	9.5	-5	25
Northern Pike	7.5	4.5	3	9
Pumpkinseed	7.5	3	4.5	20.25
Channel Catfish	9.5	9.5	0	0
Drum	9.5	9.5	0	0
Gar family	15	17	-2	4
Bowfin	15	9.5	5.5	30.25
Trout sp.	15	4.5	10.5	110.25
Whitefish	15	2	13	169
Chub	15	17	-2	4
Rock Bass	15	17	-2	4
Perch sp.	15	17	-2	4
Morone sp.	15	17	-2	4
Crappie	15	17	-2	4
Lake Trout	20	9.5	10.5	110.25
				875.50

r_s for tied scores = 0.27

Table 8-12: Spearman's Rho for Fish MNIs for Float-Included Samples from Single Houses

	MCKEOWN HOUSE 2	KEFFER HOUSE 20	d	d^2
Northern Pike	1.5	2.5	-1	1
American Eel	1.5	7.5	-6	36
Sucker family	4.5	7.5	-3	9
Channel Catfish	4.5	7.5	-3	9
Yellow Perch	4.5	12.5	-8	64
Sauger/Walleye	4.5	7.5	-3	9
Bowfin	9	7.5	1.5	2.25
Whitefish	9	7.5	1.5	2.25
Brown Bullhead	9	1	8	64
Rock Bass	9	12.5	-3.5	12.25
Bass sp.	9	7.5	1.5	2.25
Trout sp.	12.5	2.5	10	100
Pumpkinseed	12.5	7.5	5	25
				336.00

r_s for tied scores = -0.09

Table 8-13: Brainerd's Coefficient of Similarity for Mammal NISPs

SPECIES	KEFFER				MCKEOWN				% DIFFERENCES	
	4 HOUSES		HOUSE 20		3 HOUSES		HOUSE 2		AGGREGATE HOUSES	SINGLE HOUSES
	NISP	%	NISP	%	NISP	%	NISP	%		
Hare	13	3.93	4	2.65	28	5.20	15	6.33	1.27	2.40
G. Squirrel	10	3.02	5	3.31	3	0.56	2	0.84	2.46	2.47
R. Squirrel	1	0.30	1	0.66	17	3.16	8	3.38	0.14	2.72
Woodchuck	19	5.74	7	4.64	23	4.28	7	2.95	1.46	1.69
Chipmunk	1	0.30	0		8	1.49	2	0.84	1.19	0.84
Beaver	16	4.83	4	2.65	140	26.02	49	20.68	21.19	18.03
M. Vole	0		0		8	1.49	0		1.49	0.66
D. Mouse	1	0.30	1	0.66	8	1.49	0		1.19	0.66
Muskrat	9	2.72	5	3.31	36	6.69	17	7.17	3.97	3.86
Porcupine	0		0		18	3.36	7	2.95	3.36	2.95
Wolf	0		0		3	0.56	2	0.84	0.56	0.84
Dog	10	3.02	3	1.99	0		0		3.02	1.99
Canis sp.	72	21.75	28	18.54	2	0.37	2	0.84	21.38	17.70
Red Fox	4	1.21	1	0.66	2	0.37	2	0.84	0.84	0.18
Black Bear	6	1.81	2	1.32	35	6.51	9	3.80	4.70	2.48
Raccoon	19	5.74	6	3.97	17	3.16	12	5.06	2.58	1.09
Mink	0		0		1	0.19	0		0.19	0
Marten	1	0.30	0		11	2.05	9	3.80	1.75	3.80
Fisher	0		0		2	0.37	0		0.37	0
Skunk	2	0.60	2	1.32	0		0		0.60	1.32
R. Otter	0		0		1	0.19	1	0.42	0.19	0.42
Deer	143	43.20	79	52.32	175	32.53	93	39.42	10.67	13.08
Moose	4	1.21	3	1.99	0		0		1.21	1.99
TOTALS	331	99.98	151	99.99	538	100	237	99.98	85.78	81.17

AGGREGATE HOUSES: 200 - 85.78 = 114.22
SINGLE HOUSES : 200 - 81.17 = 118.83

KEY: G. Squirrel = Grey Squirrel
R. Squirrel = Red Squirrel
M. Vole = Meadow Vole
D. Mouse = Deer Mouse
R. Otter = River Otter

Table 8-14: Spearman's Rho for Mammal NISPs for Float-Included Samples from Aggregated Houses

MAMMAL	MCKEOWN	KEFFER	d	d^2
Whitetail Deer	1	1	0	0
Beaver	2	5	-3	9
Muskrat	3	9	-6	36
Black Bear	4	10	-6	36
Hare	5	6	-1	1
Woodchuck	6	3.5	2.5	6.25
Porcupine	7	21.5	-14.5	210.25
Red Squirrel	8.5	16.5	-8	64
Raccoon	8.5	3.5	5	25
Marten	10	16.5	-6.5	42.25
Chipmunk	12	16.5	-4.5	20.25
Deer Mouse	12	16.5	-4.5	20.25
Vole	12	21.5	-9.5	90.25
Grey Squirrel	14.5	7.5	7	49
Wolf	14.5	21.5	-7	49
Canis sp.	17	2	15	225
Red Fox	17	11.5	5.5	30.25
Fisher	17	21.5	-4.5	20.25
Otter	19.5	21.5	-2	4
Mink	19.5	21.5	-2	4
Moose	22.5	11.5	11	121
Skunk	22.5	13.5	9	81
Domestic Dog	22.5	7.5	15	225
Mole	22.5	13.5	9	81
				1450.00

r_s for tied scores = 0.34

Table 8-15: **Spearman's Rho for Mammal NISPs for Float-Included Samples from Single Houses**

MAMMAL	MCKEOWN HOUSE 2	KEFFER HOUSE 20	d	d^2
Whitetail Deer	1	1	0	0
Beaver	2	7.5	-5.5	30.25
Muskrat	3	5.5	-2.5	6.25
Hare	4	7.5	-3.5	12.25
Red Squirrel	5	15.5	-10.5	110.25
Porcupine	6	20.5	-14.5	210.25
Raccoon	7	4	3	9
Black Bear	8.5	12	-3.5	12.25
Woodchuck	8.5	3	5.5	30.25
Marten	10	20.5	-10.5	110.25
Meadow Vole	11	20.5	-9.5	90.25
Chipmunk	12.5	15.5	-3	9
Deer Mouse	12.5	15.5	-3	9
Grey Squirrel	14	5.5	8.5	72.25
Wolf	16	20.5	-4.5	20.25
Canis sp.	16	2	14	196
Red Fox	16	15.5	.5	.25
Mink	18.5	20.5	-2	4
Otter	18.5	20.5	-2	4
Moose	21.5	9.5	12	144
Domestic Dog	21.5	9.5	12	144
Skunk	21.5	12	9.5	90.25
Mole	21.5	12	9.5	90.25
				1401.50

r_s for tied scores is 0.30

Table 8-16: Spearman's Rho for Mammal MNIs for Float-Included Samples from Aggregated Houses

	MCKEOWN	KEFFER	d	d^2
Beaver	1	14	-13	169
Whitetail Deer	2	1	1	1
Deer Mouse	4.5	14	-9.5	90.25
Muskrat	4.5	6.5	-2	4
Vole	4.5	21.5	-17	289
Black Bear	4.5	14	-9.5	90.25
Eastern Chipmunk	9.5	14	-4.5	20.25
Woodchuck	9.5	2	7.5	56.25
Red Squirrel	9.5	14	-4.5	20.25
Porcupine	9.5	21.5	-12	144
Canis sp.	9.5	6.5	3	9
Marten	9.5	14	-4.5	20.25
Hare	16.5	6.5	10	100
Grey Squirrel	16.5	6.5	10	100
Wolf	16.5	21.5	-5	25
Red Fox	16.5	14	2.5	6.25
Raccoon	16.5	6.5	10	100
Fisher	16.5	21.5	-5	25
Mink	16.5	21.5	-5	25
Otter	16.5	21.5	-5	25
Mole	21.5	14	7.5	56.25
Domestic Dog	21.5	3	18.5	342.25
Skunk	23.5	6.5	17	289
Moose	23.5	14	9.5	90.25
				2097.50

r_s for tied scores =0.02

Table 8-17: Spearman's Rho for Mammal MNIs for Float-Included Samples from Single Houses

	MCKEOWN HOUSE 2	KEFFER HOUSE 20	d	d^2
Whitetail Deer	1	1	0	0
Beaver	3.5	12	-8.5	72.25
Muskrat	3.5	4	-.5	.25
Porcupine	3.5	19.5	-16	256
Canis sp.	3.5	4	-.5	.25
Hare	11	12	-1	1
Chipmunk	11	12	-1	1
Woodchuck	11	4	7	49
Grey Squirrel	11	12	-1	1
Red Squirrel	11	12	-1	1
Wolf	11	19.5	-8.5	72.25
Red Fox	11	12	-1	1
Black Bear	11	12	-1	1
Raccoon	11	4	7	49
Marten	11	19.5	-8.5	72.25
Otter	11	19.5	-8.5	72.25
Mole	19	12	7	49
Deer Mouse	19	12	7	49
Domestic Dog	19	12	7	49
Skunk	19	4	15	225
Moose	19	12	7	49
				1070.50

r_s for tied scores = 0.17

Table 8-18: Brainerd's Coefficient of Similarity for Bird NISPs

SPECIES	KEFFER				MCKEOWN				% DIFFERENCES	
	4 HOUSES		HOUSE 20		3 HOUSES		HOUSE 2		AGGREGATE	SINGLE
	NISP	%	NISP	%	NISP	%	NISP	%	HOUSES	HOUSES
Common Loon	0		0		1	6.25	1	16.67	6.25	16.67
C. Goose	0		0		1	6.25	1	16.67	6.25	16.67
Goldeneye	0		0		1	6.25	0		6.25	0
Merganser	0		0		1	6.25	1	16.67	6.25	16.67
G. Scaup	1	7.14	0		0		0		7.14	0
Oldsquaw	1	7.14	0		0		0		7.14	0
Bald Eagle	1	7.14	0		0		0		7.14	0
R. Grouse	5	35.71	4	44.44	4	25.00	3	50.00	10.71	5.56
Turkey	3	21.43	2	22.22	0		0		21.43	22.22
P. Pigeon	2	14.29	2	22.22	8	50.00	0		35.71	22.22
Screech Owl	1	7.14	1	11.11	0		0		7.14	11.11
TOTALS	14	99.99	9	99.99	16	100.0	6	100.01	121.41	111.12

AGGREGATE HOUSES: 200 - 121.41 = 78.59
SINGLE HOUSES : 200 - 111.12 = 88.79

KEY: C. Goose = Canada Goose
G. Scaup = Greater Scaup
P. Pigeon = Passenger Pigeon

Table 8-19: Spearman's Rho for Bird NISPs for Float-Included Samples from Aggregated Houses

	MCKEOWN	KEFFER	d	d^2
Passenger Pigeon	1	3	-2	4
Goldeneye	2	9.5	-7.2	56.25
Ruffed Grouse	3	1	2	4
Canada Goose	4	9.5	-5.5	30.25
Common Loon	5.5	9.5	-4	16
Merganser	5.5	9.5	-4	16
Wild Turkey	9	2	7	49
Greater Scaup	9	5.5	3.5	12.25
Oldsquaw	9	5.5	3.5	12.25
Bald Eagle	9	5.5	3.5	12.25
Screech Owl	9	5.5	3.5	12.25
				224.50

r_s for tied scores = -0.13

Table 8-20: Brainerd's Coefficient of Similarity for Mammal Meat using Meat Weights Given in Tables 6-23 and 7-12

SPECIES	KEFFER 4 HOUSES %	KEFFER HOUSE 20 %	MCKEOWN 3 HOUSES %	MCKEOWN HOUSE 2 %	% DIFFERENCES AGGREGATE HOUSES	% DIFFERENCES SINGLE HOUSES
Hare	0.33	0.21	0.18	0.32	0.15	0.11
G. Squirrel	0.13	0.08	0.03	0.13	0.10	0.05
R. Squirrel	0.02	0.02	0.04	0.03	0.02	0.01
Woodchuck	1.71	0.92	0.79	0.81	0.92	0.11
Chipmunk	0.01	0.01	0.00	0.02	0.01	0.01
Beaver	3.20	3.69	12.49	8.51	9.29	4.82
M. Vole	0	0	0.02	0	0.02	0
D. Mouse	0.01	0.01	0.01	0	0	0.01
Muskrat	0.32	0.37	0.45	0.57	0.13	0.20
Porcupine	0	0	1.38	2.49	1.39	2.49
Dog	3.65	2.11	0	0	2.36	2.11
Wolf	0	0	2.43	4.41	2.43	4.41
Canis sp.	5.02	2.11	3.57	6.48	1.45	4.37
Red Fox	0.33	0.38	0.32	0.58	0.01	0.20
Bear	17.41	20.07	48.63	23.16	31.22	3.09
Raccoon	2.53	2.91	1.06	1.92	1.47	0.99
Mink	0	0	0.09	0	0.09	0
Marten	0.18	0	0.36	0.32	0.18	0.32
Fisher	0	0	0.39	0	0.39	0
Skunk	0.84	0.97	0	0	0.84	0.97
R. Otter	0	0	0.76	1.39	0.76	1.39
Deer	39.39	35.86	26.95	48.86	12.44	13.00
Moose	24.88	28.69	0	0	24.88	28.68
TOTALS					90.55	67.34

AGGREGATE HOUSES: 200 - 90.55 = 109.45
SINGLE HOUSES : 200 - 67.34 = 132.66

KEY: As in Table 8-13

Table 8-21: Spearman's Rho for Mammalian Meat Contributions Using MNIs from the Aggregated Houses

	MCKEOWN	KEFFER	d	d^2
Black Bear	1	3	-2	4
Whitetail Deer	2	1	1	1
Beaver	3	6	-3	9
Canis sp.	4	4	0	0
Wolf	5	21.5	-16.5	272.25
Porcupine	6	21.5	-15.5	240.25
Raccoon	7	7	0	0
Woodchuck	8	8	0	0
River Otter	9	21.5	-12.5	156.25
Muskrat	10	12	-2	4
Fisher	11	21.5	-10.5	110.25
Marten	12	13	-1	1
Red Fox	13	10.5	2.5	6.25
Hare	14	10.5	3.5	12.25
Mink	15	21.5	-6.5	42.25
Grey Squirrel	16	14	2	4
Red Squirrel	17	15	2	4
Chipmunk	18	16	2	4
Meadow Vole	19	21.5	-2.5	6.25
Deer Mouse	20	17	3	9
Mole	22.5	18	4.5	20.25
Domestic Dog	22.5	5	17.5	306.25
Skunk	22.5	9	13.5	182.25
Moose	22.5	2	20.5	420.25
				1815.00

r_s for tied scores = 0.20

Table 8-22: Spearman's Rho for Mammalian Meat Contributions Using MNIs from Single Houses

	KEFFER	MCKEOWN	d	d^2
Deer	1	1	0	0
Moose	2	18.5	-16.5	272.25
Black Bear	3	2	1	1
Canis sp.	4.5	18.5	-14	196
Beaver	4.5	3	1.5	2.25
Raccoon	6	6	0	0
Dog	7	18.5	-11.5	132.25
Skunk	8	18.5	-10.5	110.25
Woodchuck	9	8	1	1
Red Fox	10	9	1	1
Muskrat	11	10	1	1
Hare	12	11.5	.5	.25
Grey Squirrel	13	13	0	0
Red Sqirrel	14	14	0	0
Eastern Chipmunk	15	15	0	0
Deer Mouse	16	18.5	-2.5	6.25
Mole	17	18.5	-1.5	2.25
Porcupine	19.5	5	14.5	210.25
Wolf	19.5	4	15.5	240.25
Marten	19.5	11.5	8	64
River Otter	19.5	7	12.5	156.25
				1396.50

r_s for tied scores = 0.08

Table 8-23: Rank Ordering of the Meat Contributions by Fish Families Using MNIs from the Aggregated Houses

	KEFFER 4 HOUSES			MCKEOWN 3 HOUSES			% DIFFERENCES
	RANK	WEIGHT (kg)	%	RANK	WEIGHT (kg)	%	
Salmonidae	1	31.01	58.91	2	7.52	14.60	44.31
Centrarchidae	2	7.04	13.37	1	12.75	24.71	11.39
Ictaluridae	3	5.60	10.64	4	5.60	10.90	0.26
Esocidae	4	3.20	6.08	6	4.80	9.32	3.24
Percidae	5	1.76	3.34	3	7.48	14.53	11.92
Anguillidae	6	1.20	2.28	6	4.80	9.32	7.04
Sciaenidae	7	1.12	2.13	8	2.24	4.35	2.22
Amiidae	8	0.91	1.73	9	0.91	1.77	0.04
Catostomidae	9	0.80	1.52	6	4.80	9.32	7.80
Percichthyidae	10.5	0	0	10	0.41	0.80	0.80
Cyprinidae	10.5	0	0	11	0.18	0.35	0.35
TOTALS		52.64			51.49		88.64

BRAINERD'S COEFFICIENT: 200 - 88.64 = 111.38

Table 8-24: Spearman's Rho for Meat Contributions of Fish Families Using MNIs from the Aggregated Houses

	MCKEOWN	KEFFER	d	d^2
Centrarchidae	1	2	-1	1
Salmonidae	2	1	1	1
Percidae	3	5	-2	4
Ictaluridae	4	3	1	1
Esocidae	6	4	2	4
Catostomidae	6	9	-3	9
Anguillidae	6	6	0	0
Sciaenidae	8	7	1	1
Amiidae	9	8	1	1
Percichthydidae	10	10.5	-.5	.25
Cyprinidae	11	10.5	.5	.25
				22.50

r_s for tied scores = 0.9

Table 8-25: Brainerd's Coefficient of Similarity for Bird Meat Contributions Using Meat Weights Given in Tables 6-24, 7-8 and 7-12

SPECIES	KEFFER 4 HOUSES WEIGHT %	KEFFER HOUSE 20 WEIGHT %	MCKEOWN 3 HOUSES WEIGHT %	MCKEOWN HOUSE 2 WEIGHT %	% DIFFERENCES AGGREGATE HOUSES	% DIFFERENCES SINGLE HOUSES
Common Loon	0	0	20.45	28.13	20.45	28.13
C. Goose	0	0	32.95	45.31	32.92	45.31
Goldeneye	0	0	18.18	0	18.18	0
Merganser	0	0	13.64	18.75	13.64	18.75
G. Scaup	7.55	0	0	0	7.55	0
Oldsquaw	6.60	0	0	0	6.60	0
Bald Eagle	33.96	0	0	0	33.96	0
R. Grouse	4.72	9.09	5.68	7.81	0.96	1.28
Turkey	42.45	81.82	0	0	42.45	81.82
P. Pigeon	3.77	7.27	9.09	0	5.32	7.27
Screech Owl	0.94	1.82	0	0	0.94	1.82
TOTALS					183.00	184.38

AGGREGATE HOUSES: 200 - 183.00 = 17
SINGLE HOUSES : 200 - 184.38 = 15.62

KEY:
C. Goose = Canada Goose
G. Scaup = Greater Scaup
R. Grouse = Ruffed Grouse
P. Pigeon = Passenger Pigeon

Table 8-26: Spearman's Rho for Bird Meat Contributions using MNIs from the Aggregated Houses

	MCKEOWN	KEFFER	d	d^2
Canada Goose	1	9.5	-8.5	72.25
Common Loon	2	9.5	-7.5	56.25
Common Goldeneye	3	9.5	-6.5	42.25
Common Merganser	4	9.5	-5.5	30.25
Passenger Pigeon	5	6	-1	1
Ruffed Grouse	6	5	1	1
Wild Turkey	9	1	8	64
Bald Eagle	9	2	7	49
Greater Scaup	9	3	6	36
Oldsquaw	9	4	5	25
Screech Owl	9	7	2	4
				381.00

r_s for tied scores = -0.86

Table 8-27: Spearman's Rho for Bird Meat Contributions Using MNIs from Single Houses

	MCKEOWN HOUSE 2	KEFFER HOUSE 20	d	d^2
Canada Goose	1	6	-5	25
Common Loon	2	6	-4	16
Common Merganser	3	6	-3	9
Ruffed Grouse	4	2	2	4
Wild Turkey	6	1	5	25
Passenger Pigeon	6	3	3	9
Screech Owl	6	4	2	4
				92

r_s for tied scores = 0

Table 8-28: Spearman's Rho for Meat Contributions by Mammals, Fish and Birds Using MNIs from the Aggregated Houses

	MCKEOWN	KEFFER	d	d^2
Black Bear	1	3	-2	4
Deer	2	1	1	1
Beaver	3	7	-4	16
Canis sp.	4	4	0	0
Wolf	5	46.5	-41.5	1722.25
Porcupine	6	46.5	-40.5	1640.25
Bass sp.	7	21	-14	196
Sauger/Walleye	8	23	-15	225
Raccoon	9	8	1	1
Pumpkinseed	10	12	-2	4
Sucker	12	28.5	-16.5	272.25
Northern Pike	12	17	-5	25
American Eel	12	24	-12	144
Whitefish	14	6	8	64
Woodchuck	15	9	6	36
River Otter	16	46.5	-30.5	930.25
Channel Catfish	17	15	2	4
Canada Goose	18	46.5	-28.5	812.25
Trout sp.	19	11	8	64
Muskrat	20	22	-2	4
Drum	21	25	-4	16
Marten	22	26	-4	16
Red Fox	23.5	19.5	4	16
Loon	23.5	46.5	-23	529
Goldeneye	25.5	46.5	-21	441
Bullhead	25.5	18	7.5	56.25
Yellow Perch	27	46.5	-19.5	380.25
Merganser	28	46.5	-18.5	342.25
Gar	29	46.5	-17.5	306.25
Hare	30	19.5	10.5	110.25
Bowfin	31	27	4	16
Passenger Pigeon	32	33	-1	1
Mink	33.5	46.5	-13	169
R.Grouse	33.5	32	1.5	2.25
Morone Bass	35.5	46.5	-11	121
Crappies	35.5	46.5	-11	121
G. Squirrel	37	30.5	6.5	42.25
Red Squirrel	38.5	34.5	4	16
Perch sp.	38.5	46.5	-8	64
Chub	40.5	46.5	-6	36
Rock Bass	40.5	46.5	-6	36
Eastern Chipmunk	42	36	6	36
Vole	43	46.5	-3.5	12.25
Deer Mouse	44	37	7	49
Moose	49.5	2	47.5	2256.25
Wild Turkey	49.5	14	35.5	1260.25
Skunk	49.5	13	36.5	1332.25
Bald Eagle	49.5	16	33.5	1122.25
G. Scaup	49.5	28.5	21	441
Oldsquaw	49.5	30.5	19	361
Screech Owl	49.5	34.5	15	225
Mole	49.5	38	11.5	132.25
Domestic Dog	49.5	5	44.5	1980.25
Lake Trout	49.5	10	39.5	1560.25
				19771.00

r_s for tied scores = 0.23

KEY: As in Table 8-2

Table 8-29: Brainerd's Coefficient of Similarity for Meat Contributions by Mammals, Fish and Birds Using MNIs

SPECIES	KEFFER		MCKEOWN		% DIFFERENCES	
	4 HOUSES WEIGHT %	HOUSE 20 WEIGHT %	3 HOUSES WEIGHT %	HOUSE 2 WEIGHT %	AGGREGATE HOUSES	SINGLE HOUSES
MAMMALS						
Hare	0.29	0.20	0.17	0.29	0.12	0.09
G. Squirrel	0.12	0.08	0.07	0.12	0.05	0.04
R. Squirrel	0.02	0.01	0.03	0.03	0.01	0.02
Woodchuck	1.54	0.86	0.73	0.73	0.81	0.13
Chipmunk	0.01	0.01	0.02	0.01	0.01	0
Beaver	2.86	3.46	11.63	7.71	8.77	4.25
M. Vole	0	0	0.01	0	0.01	0
D. Mouse	0	0.01	0	0	0	0.01
Muskrat	0.29	0.35	0.42	0.51	0.13	0.16
Porcupine	0	0	1.28	2.26	1.28	2.26
Wolf	0	0	2.26	4.00	2.26	4.00
Dog	3.27	1.97	0	0	3.27	1.97
Canis sp.	4.50	3.46	3.33	5.88	1.17	2.42
Red Fox	0.29	0.36	0.30	0.53	0.01	0.17
Black Bear	15.60	18.82	45.27	21.00	29.67	2.18
Raccoon	2.26	2.73	0.99	1.74	1.27	0.99
Mink	0	0	0.08	0	0.08	0
Marten	0.16	0	0.33	0.29	0.17	0.29
Fisher	0	0	0.37	0	0.37	0
Skunk	0.75	0.91	0	0	0.75	0.91
Otter	0	0	0.71	1.26	0.71	1.26
W. Deer	35.29	33.61	25.09	44.31	10.20	10.70
Moose	22.29	26.89	0	0	22.29	26.89
FISH						
Gar family	0	0	0.18	0	0.18	0
Suckers	0.13	0.16	0.80	0.47	0.67	0.31
Bowfin	0.15	0.18	0.15	0.27	0	0.09
Lake Trout	1.07	0	0	0	1.07	0
Trout sp.	0.92	1.11	0.47	0	0.45	1.11
Whitefish	3.09	0.93	0.79	1.39	2.30	0.46
N. Pike	0.52	0.63	0.80	1.41	0.28	0.78
Chub	0	0	0.03	0	0.03	0
B. Bullhead	0.46	0.24	0.27	0.12	0.19	0.12
C. Catfish	0.59	0.72	0.67	1.18	0.08	0.46
Am. Eel	0.20	0.24	0.80	1.06	0.12	0.82
Bass sp.	0.29	0.35	1.17	0.52	0.88	0.17
Morone Bass	0	0	0.07	0	0.07	0
Rock Bass	0	0	0.03	0.05	0.03	0.05
Pumpkinseed	0.86	0.35	0.88	0	0.02	0.35
Crappie	0	0	0.07	0	0.07	0
Perch sp.	0	0	0.03	0	0.03	0
Yellow Perch	0	0	0.21	0.09	0.21	0.09
Stizostedion	0.25	0.30	1.00	0.88	0.75	0.58
Drum	0.18	0	0.37	0	0.19	0

Table 8-29 continued

SPECIES	KEFFER 4 HOUSES WEIGHT %	KEFFER HOUSE 20 WEIGHT %	MCKEOWN 3 HOUSES WEIGHT %	MCKEOWN HOUSE 2 WEIGHT %	% DIFFERENCES AGGREGATE HOUSES	% DIFFERENCES SINGLE HOUSES
BIRDS						
C. Loon	0	0	0.30	0.53	0.30	0.53
C. Goose	0	0	0.48	0.85	0.48	0.85
G. Scaup	0.13	0	0	0	0.13	0
Oldsquaw	0.11	0	0	0	0.11	0
C. Goldeneye	0	0	0.27	0	0.27	0
C. Merganser	0	0	0.20	0.35	0.20	0.35
Bald Eagle	0.59	0	0	0	0.59	0
R. Grouse	0.08	0.10	0.08	0.15	0	0.05
W. Turkey	0.74	0.89	0	0	0.74	0.89
P. Pigeon	0.07	0.08	0.13	0	0.06	0.08
S. Owl	0.02	0.02	0	0	0.02	0.02
TOTALS					93.93	66.90

Brainerd's Coefficient for Aggregated Houses: 200 - 93.93 = 106.07
Brainerd's Coefficient for Single Houses : 200 - 66.90 = 133.10

KEY: G. Squirrel = Grey Squirrel
R. Squirrel = Red Squirrel
M. Vole = Meadow Vole
D. Mouse = Deer Mouse
W. Deer = Whitetail Deer
N. Pike = Northern Pike
B. Bullhead = Brown Bullhead
C. Catfish = Channel Catfish
C. Loon = Common Loon
C. Goose = Canada Goose
G. Scaup = Greater Scaup
C. Goldeneye = Common Goldeneye
C. Merganser = Common Merganser
R. Grouse = Ruffed Grouse
W. Turkey = Wild Turkey
P. Pigeon = Passenger Pigeon
S. Owl = Screech Owl

Table 8-30: Spearman's Rho for Meat Contributions of Mammals, Fish and Birds Using MNIs from Single Houses

	MCKEOWN HOUSE 2	KEFFER HOUSE 20	d	d^2
Whitetail Deer	1	1	0	0
Black Bear	2	3	-1	1
Beaver	3	4.5	-1.5	2.25
Wolf	4	37	-33	1089
Canis sp.	5	4.5	.5	.25
Porcupine	6	37	-31	961
Raccoon	7	6	1	1
Northern Pike	8	14	-6	36
Whitefish	9	9	0	0
River Otter	10	37	-27	729
Channel Catfish	11	13	-2	4
American Eel	12	20.5	-8.5	72.25
Sauger/Walleye	13	19	-6	36
Canada Goose	14	37	-23	529
Woodchuck	15	12	3	9
Loon	16.5	37	-20.5	420.25
Red Fox	16.5	15	1.5	2.25
Bass sp.	18	16.5	1.5	2.25
Muskrat	19	18	1	1
Sucker sp.	20	24	-4	16
Merganser	21	37	-16	256
Hare	22.5	22	.5	.25
Marten	22.5	37	-14.5	210.25
Bowfin	24	23	1	1
Ruffed Grouse	25	25	0	0
Brown Bullhead	26.5	20.5	6	36
Grey Squirrel	26.5	26.5	0	0
Yellow Perch	28	37	-9	81
Rock Bass	29	37	-8	64
Red Squirrel	30	28.5	1.5	2.25
E. Chipmunk	31	30	1	1
Deer Mouse	36.5	31	5.5	30.25
Moose	36.5	2	34.5	1190.25
Wild Turkey	36.5	11	25.5	650.25
Skunk	36.5	10	26.5	702.25
Screech Owl	36.5	28.5	8	64
Mole	36.5	32	4.5	20.25
Domestic Dog	36.5	7	29.5	870.25
Trout sp.	36.5	8	28.5	812.25
Pumpkinseed	36.5	16.5	20	400
Passenger Pigeon	36.5	26.5	10	100
				9403.00

r_s for tied scores = 0.17

Table 8-31: **Composition of Iroquoian Meat per 100 grams Edible Portion**

SPECIES	PROTEIN	FAT	CALORIES	SOURCES
(raw unless stated otherwise)				
FISH				
Trouts				
Salmonidae spp.	16.1	11.0		1
Atlantic Salmon	22.5	13.4	217	2
Atlantic Salmon	18.4	12.0	182	6
Atlantic Salmon, smoked	25.4	4.5	142	6
Atlantic Salmon, broiled or baked	26.7	7.8	182	7,8
Lake Trout				
Salvelinus namaycush	16.4	14.9		1
Lake Trout	18.3	10.0	168	2
Lake Trout, broiled or baked	23.3	14.4	216	7
Lake Trout, broiled or baked	26.7	4.4	151	8
Brook Trout	19.2	2.1	101	2
Rainbow Trout	21.5	11.4	209	2
Rainbow Trout	20.5	3.4	118	12
Rainbow Trout, dry heat	26.3	4.3	152	12
Whitefish				
Coregonus clupeaformis	18.0	7.6		1
Whitefish, raw	18.9	8.2	155	2
Whitefish, smoked	20.9	7.3	155	2
Whitefish, smoked	21.1	7.8	154	7
Whitefish, smoked	23.3	1.1	108	8
Cisco				
Coregonus spp.	15.5	12.5		1
Cisco, Lake Herring	17.7	2.3	96	2
Pikes				
Esocidae spp.	19.0	1.2		1
Muskellunge	20.2	2.5	109	2
Northern Pike	18.3	1.1	88	2
Pike, cooked, dry heat	24.4	1.1	113	8
Chub	15.3	8.8	145	2
Suckers, white & mullet	20.6	1.8	104	2
Catfish				
Ictaluridae spp.	17.6	3.2		1
Freshwater Catfish	17.6	3.1	103	2
Catfish				
Ictalurus punctatus	18.2	1.0		5
Freshwater Eel				
Anguillidae spp.	18.0	17.3	246	1
American Eel				
Anguilla rostata	15.6	17.8	233	7
American Eel, raw	15.9	18.3	233	2
American Eel, smoked	18.6	27.8	330	2
Eel, stewed	20.6	13.2	201	6
Basses				
Percichthyidae spp.	18.1	3.0	113	1

Table 8-31 continued

SPECIES	PROTEIN	FAT	CALORIES	SOURCES
Basses				
Serranidae spp.	18.6	1.6		1
Bass, Smallmouth & Largemouth	18.9	2.6	104	2
White Bass	18.0	2.3	98	2
Yellow Perch				
Perca flavescens	19.0	0.9		1
Yellow Perch	19.5	0.9	91	2
Walleye				
Stizostedion vitreum	19.3	1.5		1
Sauger	17.9	0.8	84	2
Freshwater Drum				
Aplodinotus grunniens	17.4	5.5		1
Freshwater Drum	17.3	5.2	121	2
AMPHIBIAN				
Frogs' legs	16.4	0.3	73	2
BIRDS				
Goose, wild, roasted	30.0	20.0	309	7
Goose, wild, roasted	24.4	22.2	303	8
Wild Duck	21.1	15.8	233	2
Duck				
Anas sp.	19.6	29.0	339	4
Duck, wild, flesh only	21.1	1.1	124	7
Grouse, roasted	31.3	5.3	173	6
Grouse, roasted	31.1	5.6	173	8
Squab (pigeon)	18.6	22.1	279	2
Pigeon, roasted	27.8	13.2	230	6
Wild duck eggs	12.0	6.7	103	8
MAMMALS				
Rabbit, wild	21.0	5.0	135	2
Rabbit	21.9	4.0	124	6
Rabbit, stewed	27.3	7.7	179	6
Rabbit/Hare, wild, stewed	28.9	10.0	216	7
Rabbit/Hare, wild, stewed	33.3	3.3	173	8
Hare, stewed	29.9	8.0	192	6
Woodchuck, cooked	28.9	10.0	216	7
Woodchuck, cooked	30.0	8.9	204	8
Beaver, roasted	29.2	13.7	248	2
Beaver, cooked	28.9	13.3	248	7
Beaver, cooked	27.8	5.6	166	8
Muskrat, roasted	27.2	4.1	153	2
Muskrat, roasted	21.1	7.8	162	8
Muskrat, cooked	26.7	3.3	146	7
Porcupine, roasted	21.1	7.8	162	8
Stray Dog	20.5	2.7	112	13
Coyote	20.8	0.9	97	13
Black Bear, stewed	25.6	3.3	137	7
Black Bear, stewed	32.2	13.3	248	8
Raccoon, roasted	29.2	14.5	255	2

Table 8-31 continued

SPECIES	PROTEIN	FAT	CALORIES	SOURCES
Venison, lean meat	21.0	4.0	126	2
Venison, roast	35.0	6.4	198	6
Deer				
O. virginianus	20.0-35.0	4.0-6.4	126-198	4
Deer, fresh, roasted	30.0	5.6	201	7
Deer, roasted	30.0	3.3	158	8
Moose		1.1-1.5		3
Moose, cooked	34.4	3.3	176	7
Moose, roasted	28.9	1.1	134	8

Sources:

1. Sidwell *et al.* 1974; 2. Watt and Merrill 1963; 3. Speth and Spielmann 1983; 4. Waselkov 1987; 5. Sidwell *et al.* 1973; 6. Paul and Southgate 1978; 7. Canada, Ministry of National Health and Welfare 1985; 8. Canada, Ministry of National Health and Welfare 1994; 12. U.S. National Live Stock and Meat Board 1988; 13. Snyder 1991 (for missing reference numbers, see sources for Table 8-33).

Table 8-32: Identified Charred Wild Plant Seeds from the Keffer and McKeown Sites, Listed in Decreasing Frequencies

KEFFER	MCKEOWN
Brambles *Rubus* sp.	Brambles *Rubus* sp.
Cleaver *Galium* sp.	Grasses Gramineae
Lamb's Quarters *Chenopodium* sp.	Chenopod *Chenopodium* sp.
Knotweed *Polygonum* sp.	Strawberry *Fragara* sp.
Elderberry *Sambucus canadensis*	Sumac *Rhus typhina*
Sumac sp. *Rhus* sp.	Knotweed *Polygonum* sp.
Hawthorn *Crataegus* sp.	Nightshade *Solanum nigrum*
Lily-of-the-Valley *Maianthemum canadense*	Panic Grass *Panicum* sp.
Strawberry *Fragara* sp.	Purslane *Portulaca oleracea*
Pin Cherry *Prunus* sp.	Flax *Linum* sp.
Butternut *Juglans cinerea*	Cat-tail *Typha sp.*
Violet *Viola* sp.	Daisy Compositae
Mallow *Malvaceae* sp.	Hickory Nut *Carya* sp.
Thistle *Cirsium* sp.	
Blueberry *Vaccinum* sp.	
Balsam Fir *Abies balsamea*	
Jack-in-the-pulpit *Arisaema triphyllum*	
Ironwood *Ostrya virginiana*	
Vervain *Verbena* sp.	

Sources: D. Wright (1991) for Keffer; Ounjian (1988) for McKeown.

Table 8-33: Composition of Iroquoian Plant Foods per 100 Grams Edible Portion

SPECIES	CARBOHYDRATE	PROTEIN	FAT	CALORIES	SOURCES
(raw unless stated otherwise)					
Zea mays					
Corn, field, whole grain	72.2	8.9	3.9	348	2
Corn on-the-cob	23.7	4.1	2.4	127	6
Corn on-the-cob, boiled	22.8	4.1	2.3	123	6
Corn, immature	19.0	3.2	1.2	86	10
Corn, mature, dry grits	79.6	8.8	1.2	371	10
Corn, boiled, drained kernels	24.7	3.9	tr	108	9
Indian corn, unprocessed	71.0	9.0	3.0	350	8
Indian corn, cooked with wood ash	36.0	4.0	1.0	50	8
Corn flour	76.8	7.8	2.6	368	2
Corn flour	92.0	0.6	0.7	354	6
Phaseolus vulgaris					
Beans, green	7.1	1.9	0.2	32	2
Beans, haricot	45.5	21.4	1.6	271	6
Beans, haricot, boiled	17.1	7.1	0.3	95	6
Curcurbita maxima					
Squash, winter	12.4	1.4	0.3	50	2
Squash, winter	8.8	1.5	0.2	37	10
Squash, winter, boiled, mashed	9.2	1.1	0.3	38	2
Squash, winter, baked	15.4	1.8	0.4	63	2
Pumpkin and Squash seed kernels, dry	15.0	29.0	46.7	553	2
Helianthus annuus					
Sunflower seed kernels, dry	19.9	24.0	47.3	560	2
Sunflower seeds	18.4	22.4	50.0	570	9
Sunflower seeds	18.8	27.5	49.6	580	10
Sunflower seed oil	0	tr	99.9	899	11
Chenopodium album					
Lamb's Quarters	7.3	4.4	0.6	43	8
Lamb's Quarters	7.3	4.2	0.8	43	2
Lamb's Quarters	5.7	3.3	0.6	34	10
Lamb's Quarters, boiled, drained	5.0	3.2	0.7	32	2, 10
Sambucus spp.					
Elderberries	18.0	tr	tr	72	8
Elderberries	16.4	2.6	0.5	72	2

Table 8-33 continued

SPECIES	CARBOHYDRATE	PROTEIN	FAT	CALORIES	SOURCES
Elderberries	18.4	0.6	0.5	73	10
Fragaria spp.					
Strawberries	8.4	0.7	0.5	37	2
Strawberries	7.6	0.6	tr	30	8
Strawberries	6.2	0.6	tr	26	6
Strawberries, wild	-	0.7	0.6	-	10
Vaccinium spp.					
Blueberries	15.3	0.7	0.5	62	2
Blueberries	14.3	tr	0.6	56	8
Blueberries	14.4	1.3	tr	56	9
Blueberries	14.3	0.7	0.4	56	10
Rubus spp.					
Blackberries	13.2	tr	tr	51	8
Blackberries	12.9	1.2	0.9	58	2
Blackberries	6.4	1.3	tr	29	6
Blackberries	12.5	0.7	tr	52	9
Blackberries	12.7	0.7	0.4	52	10
Blackberries, stewed	5.5	1.1	tr	25	6
Raspberries	12.3	1.5	tr	49	8
Raspberries	5.6	0.9	tr	25	6
Raspberries, wild	14.6	1.6	1.1	67	10
Raspberries, black	15.7	1.5	1.4	73	2
Raspberries, red	13.6	1.2	0.5	57	2
Raspberries, stewed	5.9	0.9	tr	26	6
Vaccinium spp.					
Cranberries	3.2	0.4	tr	15	6
Cranberries	6.0	tr	tr	23	8
Cranberries	10.8	0.4	0.7	46	2
Cranberries	13.0	tr	tr	49	9
Cranberries, highbush	9.4	0.1	0.4	39	10
Ribes spp.					
Current, red/white	7.0	1.0	tr	28	8
Current, red/white	12.1	1.4	0.2	50	2
Current, red	4.4	1.1	tr	21	6
Current, red, stewed	3.8	0.9	tr	18	6
Current, white	5.6	1.3	tr	26	6
Current, white, stewed	4.8	1.1	tr	22	6
Currents, dried	63.1	1.7	tr	243	6
Gooseberries	9.7	0.8	0.2	39	2
Gooseberries	5.0	tr	tr	22	8
Gooseberries	9.2	0.6	tr	37	6
Gooseberries, purple berry	14.6	1.0	0.3	58	10
Gooseberries, stewed	2.9	0.9	tr	14	6

Table 8-33 continued

SPECIES	CARBOHYDRATE	PROTEIN	FAT	CALORIES	SOURCES
Physalis spp.					
Groundcherries	11.2	1.9	0.7	53	2, 10
Crataegus spp.					
Hawthorn	20.8	2.0	0.7	87	2
Hawthorn	17.5	1.2	1.4	79	10
Morus spp.					
Mulberries	8.1	1.3	tr	36	6
Mulberries	9.8	1.2	0.6	43	10
Prunus spp.					
Plum	13.6	tr	tr	55	9
Nasturtium officinale					
Watercress	3.0	2.2	0.3	19	2, 10
Malvaceae sp.					
Mallow greens	-	4.4	0.6	37	10
Chives	5.8	1.8	0.3	28	2
Helianthus tuberosus					
Jerusalem Artichoke	17.4	2.6	0.5	77	10
Zizania aquatica					
Wild Rice	75.3	14.1	0.7	353	2
Wild Rice	75.3	11.5	0.8	355	10
Acer saccharum					
Maple syrup	65.0	0	0	250	9
Maple syrup	-	0.1	-	348	10
Quercus alba					
White Oak acorn	52.6	2.8	3.5	219	10
Oak sp. acorn	40.7	6.2	23.9	369	10
Juglans cinerea					
Butternut	8.4	23.7	61.2	629	10
Juglans nigra					
Black Walnut	12.1	25.4	58.9	607	10
Abies balsamea					
Balsam Fir, greens	-	8.8	11.8	-	10

Sources:

2. Watt and Merrill 1963; 6. Paul and Southgate 1978; 8. Canada, Ministry of National Health and Welfare 1994; 9. Canada, National Health and Welfare 1988; 10. Kuhnlein and Turner 1991; 11. Holland *et al.* 1991.

Table 9-1: Rank Ordering of Animals by NISP from Contemporaneous Sites Near the Keffer Site

DRAPER	WHITE	AURORA	BOYD	MCKENZIE	RATCLIFF	RISEBROUGH	SEED-BARKER	MCLEOD
FISH								
1. Catfish	Catfish	no data	Catfish	Suckers	Perch	Y. Perch	Catfish	Catfish
2. Suckers	Suckers			Catfish	Trout	Catfish	Sucker	Y. Perch
3. Walleye/ Sauger	Pike			Bass/Perch	Sucker& Bass& Minnow	Drum	Walleye	Sauger
4. Bowfin	Trout& Y. Perch			Bowfin& Trout&Pike		Pike	Salmon	Bowfin& Am. Eel& W. Sucker& Sm. Bass
5. Y. Perch				Walleye		Bass	Y. Perch& Drum	Muskellunge& Longnose Gar& Redhorse & Lm. Bass
6. Pike/ Muskellunge				Drum			Pike& Crappie& Lm. Bass	
7.							Brook Trout& Rainbow Trout& Whitefish& Pumpkinseed	
TURTLES								
1. Painted	Painted	no data	no data	Painted	Painted& Snapping	Painted	Painted	Painted
2. Blanding's	Blanding's& Snapping			Wood& Map& Blanding's		Snapping	Snapping& Blanding's	Snapping

Table 9-1 continued

DRAPER	WHITE	AURORA	BOYD	MCKENZIE	RATCLIFF	RISEBROUGH	SEED-BARKER	MCLEOD
3. Map							Map& Wood	Blanding's
4.								Map
BIRDS								
1. Turkey	Pigeon	no data	Pigeon& Turkey& Black Duck	Pigeon	Turkey	Turkey	Pigeon	Pigeon
2. Pigeon	Turkey			Swans	Heron	Crow& R. Grouse	Duck sp.	Turkey
3. Grouse	R. Grouse			C. Goose		Crane& Grebe& *Scoter&* Hawk	Turkey	Hawk
4. C. Goose& Teal& Loon	C. Goose& Scoter& Crane			Turkey			Grouse	C. Goose
5. Bufflehead& Hawk Owl& Robin	Pileated Woodpecker				Hawk		C. Goose	Grouse
6.				Ducks			Wood Duck	Pintail& G. Scaup& Bufflehead& Woodpecker

Table 9-1 continued

DRAPER	WHITE	AURORA	BOYD	MCKENZIE	RATCLIFF	RISEBROUGH	SEED-BARKER	MCLEOD
7.							Crane	Merganser& Cooper's Hawk& Blue Jay& Common Loon& Grebe& Meadowlark& Crane& R. tailed Hawk& Black Duck
8.							Scoter& Oldsquaw& Woodpecker& Heron	
9.							Loon& Swan& Hawk& Raven& Crow& Mallard& Goldeneye& Black Duck& Mottled Duck& R. necked Duck	

Table 9-1 continued

DRAPER	WHITE	AURORA	BOYD	MCKENZIE	RATCLIFF	RISEBROUGH	SEED-BARKER	MCLEOD
MAMMALS								
1. Deer	Dog	Deer	Deer	Deer	Deer	Dog	Deer	Dog
2. Dog	Deer	Beaver	Woodchuck	Wapiti	Bear	Beaver	Wolf/Dog	Deer
3. Bear	Beaver	Dog	Dog	Beaver	Wapiti	Deer	Woodchuck	Woodchuck
4. Woodchuck	Hare	Bear	Wapiti	Dog	Beaver	Woodchuck& R. Squirrel	Dog	Muskrat
5. Beaver	Woodchuck& Muskrat	Raccoon	Bear	Woodchuck& Mice	Dog	R. Fox& Bear	Beaver	Beaver
6. Muskrat	Fox		Raccoon	Bear& Raccoon	Woodchuck	Muskrat	Wapiti	Chipmunk
7. Hare& Raccoon& Timber Wolf	Porcupine		Beaver	Muskrat	Porcupine& Marten& Moose		Bear	G. Squirrel
8. Mice	Mice& G. Squirrel		G. Squirrel& Chipmunk& Weasel	Chipmunk& Deer Mouse& R. Squirrel& Fisher& Moose	G. Squirrel& Raccoon& Otter		Deer Mouse	Bear
9. Fisher& Wapiti& R.Squirrel	Vole& R. Fox& R.Squirrel						G. Squirrel	R. Squirrel
10. Otter& R. Fox& G. Fox	Chipmunk						Hare	Hare
11. Mink& Marten& Chipmunk& Rabbit	Bear& Marten& Otter						G. Fox	G. Fox& R. Fox

Table 9-1 continued

DRAPER	WHITE	AURORA	BOYD	MCKENZIE	RATCLIFF	RISEBROUGH	SEED-BARKER	MCLEOD
12. G. Squirrel							R. Squirrel	Raccoon
13.							Raccoon	Marten
14.							R. Fox	Mink& Fisher& Otter& Wapiti
15.							Muskrat	Skunk& Moose
16.							Marten	
17.							Chipmunk	
18.							Fisher	
19.							Meadow Vole	
							Lynx sp.	
21.							Mink	
22.							Bobcat& Otter& Moose& Caribou	

KEY:

Y. Perch = Yellow Perch
Lm. Bass = Largemouth Bass
W. Sucker = White Sucker
Sm. Bass = Smallmouth Bass
C. Goose = Canada Goose
R. Grouse = Ruffed Grouse
G. Scaup = Greater Scaup
R. tailed Hawk = Red-tailed Hawk
R. necked Duck = Ring-necked Duck
R. Squirrel = Red Squirrel
R. Fox = Red Fox
G. Fox = Grey Fox
G. Squirrel = Grey Squirrel

Table 9-2: Rank Ordering of Animals by NISP from Contemporaneous Sites Near the McKeown Site

ROEBUCK	MCIVOR	CLEARY	DRIVER	STEWARD	BECKSTEAD
FISH					
1. Suckers& Redhorse	No Data	Suckers	Am. Eel	Suckers& Redhorse	Suckers
2. Perch sp.& Y. Perch& Walleye		Catfish	Suckers	Am. Eel	Bass
3. Catfish& B. Bullhead		Perch	Walleye/ Sauger	Bass	Am. Eel
4. Trout		Pike	Y. Perch	Y. Perch	Catfish
5. Bass		Trout	Bass& Pike	Catfish	Pike& Walleye
6. Pike& Burbot& Sunfish		Quillback	Catfish	Lake Sturgeon	Lake Sturgeon
7. Minnows		Lake Sturgeon		Walleye/ Sauger	Minnows& Drum
8. Drum& Lake Sturgeon& Longnose Gar& Pumpkinseed				Minnows	
9.				Pike	
10.				Drum	
11.				Cisco/ Whitefish	

Table 9-2 continued

ROEBUCK	MCIVOR	CLEARY	DRIVER	STEWARD	BECKSTEAD
REPTILES					
1. Snapping	Snapping	Snapping	No Data	Snapping	Snapping
2. Painted				Painted& Stinkpot& Blanding's	
3. Wood					
BIRDS					
1. C. Goose	C. Goose	R. Grouse	Grouse sp.	R. Grouse	R. Grouse
2. R. Grouse	Heron	Black Duck& Goldeneye& H. Merganser& Pigeon& Cooper's Hawk& Barred Owl	Duck sp.	Pigeon	Pigeon& Sapsucker
3. Crane	R. Grouse			Blue/Snow Goose	Duck sp.
4. Loon	Black Duck			Crow/Raven	C. Goose
5. Bald Eagle	Bald Eagle& Pintail Duck			C. Goose& C. Loon& Grebe& R. tailed Hawk	
6. Pigeon				Flicker& W. winged Scoter& Crane& Killdeer& Barred Owl& Finch& Perching Bird	

Table 9-2 continued

ROEBUCK	MCIVOR	CLEARY	DRIVER	STEWARD	BECKSTEAD
7. Swan					
8. Raven					
9. Herring Gull					
10. Broadwinged Hawk					
11. Red-shouldered Hawk					
12. Pileated Woodpecker					
13. Great Horned Owl					
14. Pintailed Duck					
MAMMALS					
1. Deer	Deer	Deer	Deer	Beaver	Bear
2. Beaver	Beaver	Beaver	Beaver	Deer	Beaver
3. Fisher	Woodchuck	Bear& Muskrat	Muskrat	Wolf/Dog	Fisher
4. Raccoon	Muskrat	Marten	Hare	Woodchuck	Deer
5. Woodchuck	Bear	Woodchuck	Woodchuck	Meadow Vole	Otter
6. Bear	Marten& Fisher	Fisher& Raccoon	Wolf/Dog	Chipmunk	Marten
7. Muskrat& Dog	Porcupine	R. Squirrel& Hare	Chipmunk& Raccoon	Bear	Wolf/Dog
8. Marten& Mink	Faccoon	Chipmunk& Otter& Porcupine	G. Wolf& Bear& Skunk	Hare	Muskrat
9. Porcupine	R. Squirrel	Dog		Marten	Raccoon

Table 9-2 continued

ROEBUCK	MCIVOR	CLEARY	DRIVER	STEWARD	BECKSTEAD
10. R. Squirrel	Dog	Wolf		Otter	R. Squirrel
11. Hare& Chipmunk	Caribou	Mink		Moose	Meadow Vole
12. Wapiti	Hare	Mice		R. Fox	Porcupine& G. Squirrel
13. G.Squirrel	Otter	Weasel		G. Squirrel	Mink& Woodchuck
14.	Mink			Mink	Rabbit
15.	Chipmunk			Shrew& Weasel& Wolverine	Bobcat& Deer Mouse& Jumping Mouse
16.	Lynx				
17.	Skunk& Moose				

KEY: Y. Perch = Yellow Perch
B. Bullhead = Brown Bullhead
C. Goose = Canada Goose
R. Grouse = Ruffed Grouse
H. Merganser = Hooded Merganser
C. Loon = Common Loon
R. tailed Hawk = Red-tailed Hawk
W. winged = White-winged Scoter
R. Squirrel = Red Squirrel
G. Wolf = Grey Wolf

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