An Analysis of the Faunal Remains from the Schwerdt Site, a Late Prehistoric Encampment in Allegan County, Michigan

Michael J. Higgins
Western Michigan University

AN ANALYSIS OF THE FAUNAL REMAINS FROM THE SCHWERDT SITE, A LATE PREHISTORIC ENCAMPMENT IN ALLEGAN COUNTY, MICHIGAN

by

Michael J. Higgins

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Michael J. Higgins, M.A.

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Analysis of faunal remains from the Schwerdt site, a fifteenth century encampment on the Kalamazoo River, reveals a temporary late spring occupation with an exploitive strategy aimed primarily at the spawning sturgeon. The position of Schwerdt in a larger subsistence/settlement system is examined through comparisons with other contemporaneous sites in the southeastern Lake Michigan region. Changes in subsistence strategies here are viewed as cultural adaptations to an environment on the northern periphery of effective maize agriculture.

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CHAPTER 1

INTRODUCTION

The Problem

In recent years, archaeological research at Western Michigan University has been concerned with, among other things, the nature of late prehistoric/Upper Mississippian occupations within the Kalamazoo River Basin, and within the southern Lake Michigan region in general. There are two immediate problems to be addressed in relation to this topic. The first of these has to do with discerning the antecedents and affinities of this particular cultural manifestation in the area. This could generally be accomplished through a systematic analysis of ceramic styles occurring within the region during this period of time, noting similarities and differences through time and space (See McAllister 1980). The second problem concerns the nature of the overall subsistence economy of late prehistoric peoples occupying this region and how this relates to settlement patterns. An examination of floral and faunal remains from sites dating to this time would hopefully lead to a clearer understanding of Upper Mississippian subsistence/settlement patterning in the area. This paper addresses this latter problem through an analysis of the faunal remains from one such site, the Schwerdt site (20 AE 127), Allegan County, Michigan.

In their examination of late prehistoric settlement patterns in the Upper Great Lakes, Fitting and Cleland (1969) have proposed for the southern portion of this region what they have termed the "Miami and Potawatomi Pattern", named after the historic Indian tribes which occupied this area. This pattern is characterized by a seasonal cycle of large semi-permanent agricultural villages in the summer and dispersal into large hunting camps in the winter. In presenting this pattern, the authors also noted the lack of sites which fit such a model. At that time, the only site which seemed to support it was Moccasin Bluff in Berrien County, Michigan which Fitting and Cleland (Ibid: 297) have suggested represents a summer agricultural village.

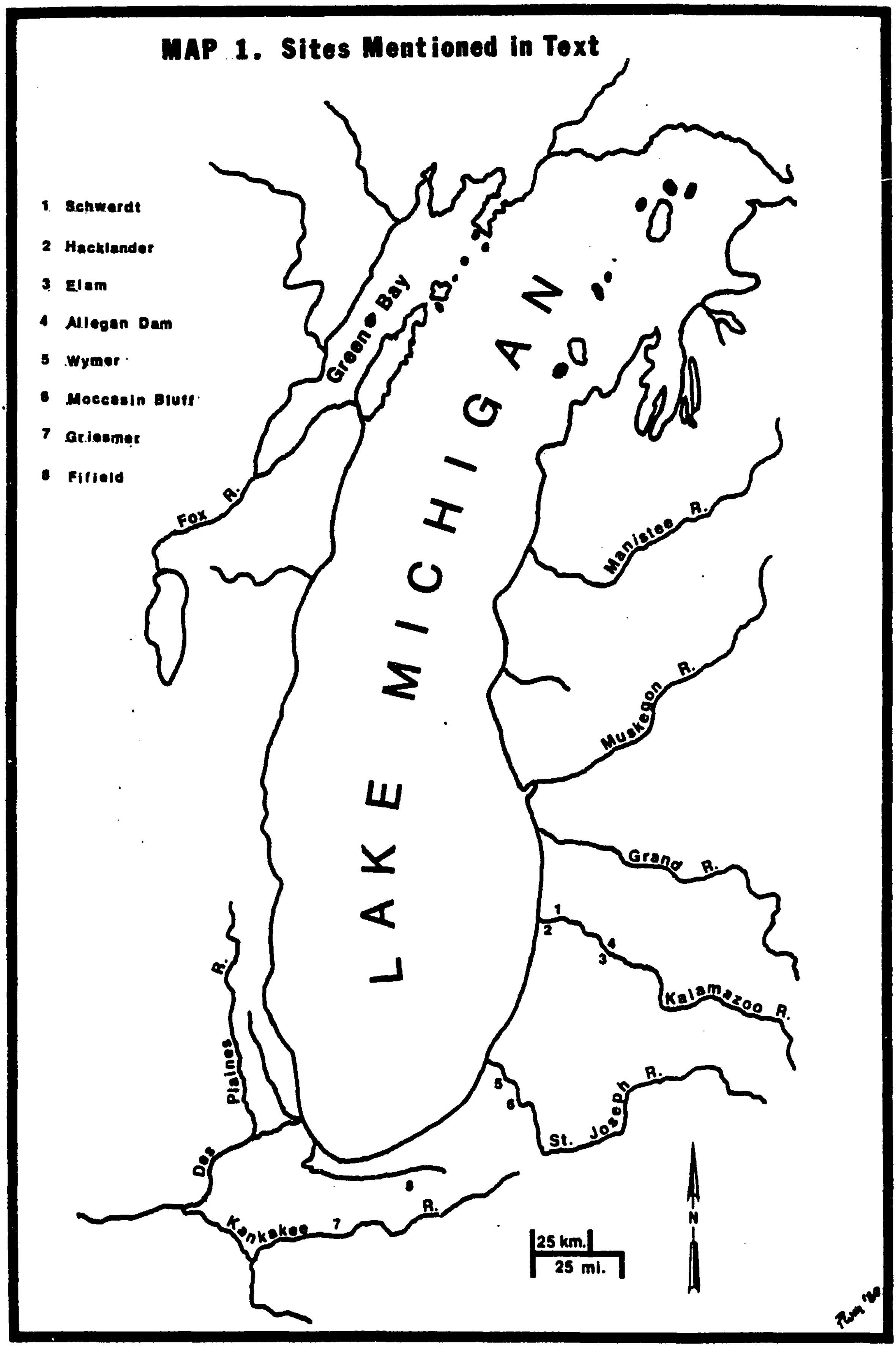
More recently, additional data from northwestern Indiana (Faulkner 1972) and southwestern Michigan (Barr 1979; Cremin 1977, 1980; Spero 1979) indicate that some modifications to this Miami and Potawatomi Pattern seem in order. In a preliminary report on the Schwerdt site, Cremin (1977) noted that the pattern perceived there did not seem to fit either that of a large agricultural summer village or a winter encampment. Schwerdt was interpreted as representing a short-term spring-summer occupation and Cremin (Ibid.) suggested that the Miami and Potawatomi Pattern is more complex than the summer-winter cycle originally proposed. Analysis of the faunal remains from the Elam site, also located on the Kalamazoo River, has supported this contention for an additional movement in the late spring-early summer for the purpose of exploiting the abundant aquatic resources of this area (Barr 1979).

With this in mind, the major goal of this thesis is to test the hypothesis that Schwerdt represents a short-term, late spring occupation, and that the subsistence economy at the site represents a specialized procurement strategy involving the exploitation of aquatic and riparian resources. This, and data from comparable sites in the area, will provide a basis from which models of late prehistoric settlement patterning in the southern Lake Michigan region may be discussed in greater detail.

Description of the Site

The Schwerdt site (20 AE 127) is located in the Lower Kalamazoo River Valley in Allegan County, Michigan (see Map 1). The site occupies a high sand bank on the north side of the river at a pronounced bend, and is approximately 11 km upstream from the mouth of the Kalamazoo. Schwerdt was located in 1976 by a Western Michigan University archaeological survey crew when an examination of the narrow tract of woods lying between a cultivated field and the river revealed a buried cultural midden in the eroding bank. Site size has been estimated at about 1.3 ha, based upon surface scatter and testing (Cremin 1980).

Cultural material recovered from the site indicates contemporaneity with known Upper Mississippian sites in the area. Analysis of the ceramics by Paul McAllister has revealed strong ties to Berrien Phase ceramics from the Moccasin Bluff site (Bettarel and Smith 1973). In addition, several vessels have been assigned to the Huber ceramic tradition which extended around southern Lake Michigan into northwestern Indiana and northeastern Illinois (McAllister 1980). This material is very compatible with the radiocarbon dates of 505 ±



MAP 1. Sites Mentioned in Text

70 years: A.D. 1445 (UGA-1725) and 500 ± 120 years: A.D. 1450 (UGA-1726) derived from charcoal samples taken from features excavated during the 1977 season. The tightness of these dates, together with the homogeneity of the cultural material recovered, strongly suggest a single component site, with perhaps some seasonal revisitation over an unknown number of years.

Out of a total of 46 features delineated at Schwerdt, there were 40 pits, 4 postmolds, and 2 rock concentrations. Based upon overall morphology and contents, 35 of the 40 pit features have been interpreted as representing a single functional class--that of a roasting facility (Cremin 1980). All of these features are basin-shaped and, although highly variable in size, exhibit a consistent homogeneity of contents throughout the site. The uppermost soil zone is generally a dark organic fill containing varying quantities of camp trash. The vast majority of the site's faunal remains was recovered from this zone within the pit features. Underlying this is a soil unit composed of oxidized and/or fused sand, usually devoid of any cultural material. The basal zone consists of a jet-black sand containing large quantities of carbonized plant residues, including wood charcoal and incompletely burned logs (Ibid.).

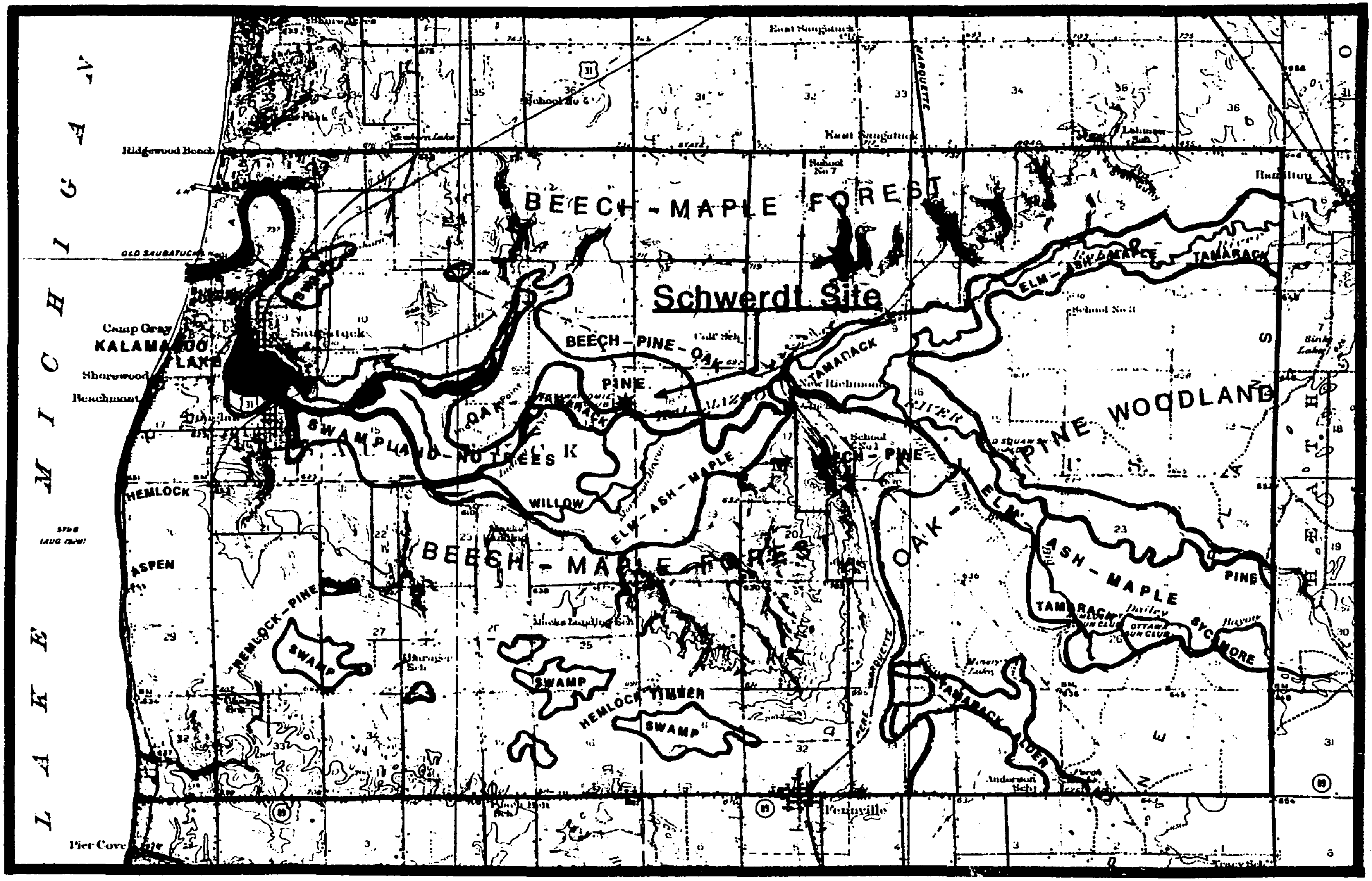
The morphology and content of this particular class of features at Schwerdt compares very favorably to similar facilities reported for the Moccasin Bluff site (Bettarel and Smith 1973) and at the Upper Mississippian Rader and Griesmer sites (Faulkner 1964; 1972). Furthermore, the presence of the remains of aquatic tubers in these features at the latter two sites, and at Schwerdt, argues for similar functions of these features at all three sites (Cremin 1980).

The immediate site environs have been described in detail elsewhere (Cremin 1979), so only a brief summary will be presented here. The Lower Kalamazoo River Valley has been characterized

> . . . as a mosaic of plant communities, with beech-maple and oak-pine woodlands dominating on the uplands, depressions which lack outlets supporting bog communities in which remnant northern conifers are prevalent, extensive swamp associations flanking stream channels on the valley floor and with stands of hemlock common along Lake Michigan. (Cremin 1980:2).

Perhaps the most significant of these plant communities in relation to the Schwerdt site are the vast marsh and swamp associations bordering the Kalamazoo River immediately below and downstream from the site. Potential resources associated with this zone would include numerous plants providing edible parts such as aquatic tubers. Faunistically, the area would have been a haven for muskrat, racoon, and several species of frogs and turtles, with migratory waterfowl present in early spring and autumn. The adjacent river environment itself would have supported perhaps an even richer assortment of potential resources. Numerous species of anadromous fish would have been seasonally abundant, and the river no doubt supported respectable populations of beaver and turtles.

The upland community around Schwerdt included such mast-producing trees as oaks, hickories, and beech, as well as sap-producing maples. Animal species associated with this type of environment consisted of white-tailed deer, rabbit, squirrel, black bear, and wild turkey—to name a few.



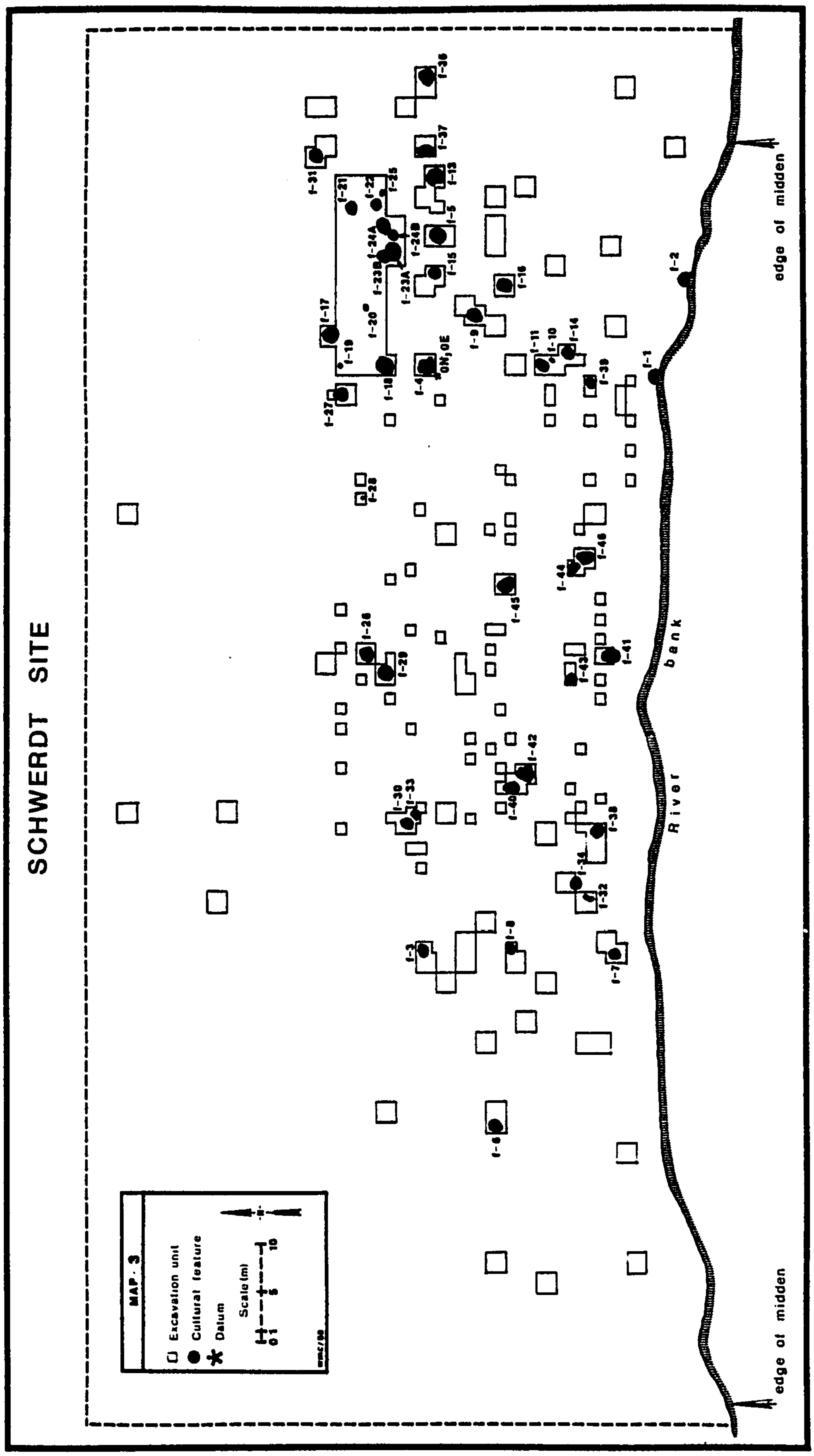
MAP 2. Environment of the Lower Kalamazoo Valley

This brief environmental sketch of the area surrounding the Schwerdt site indicates a rich assortment of potential resources, many of which are, however, highly seasonal in nature. Generally speaking, the lowland marsh/riverine environment, with its aquatic plants and anadromous fish, would be best exploited in the spring or early summer; while the upland environment, with its less abundant (or pronounced) nut and acorn resources, and the seasonal congregations of white-tailed deer would best be exploited in the autumn and winter months. There are, of course, exceptions to the above statements (such as sugar maple sap in the spring). However, when the combined resources of each environment are taken as a whole, optimal seasons for exploitation can be established.

Excavations

Initial testing of the Schwerdt site took place in spring, 1977 in conjunction with WMU's annual archaeological field school under the direction of Dr. William Cremin. Further excavations were conducted in the spring of 1979. Both random and judgement sampling were employed and, in all, 483 m^2, or about 3.7% of the estimated site area has been tested (See Map 3).

Soil from the excavation units was processed through 1/4" mesh screen. When features were encountered, a sample of the fill was taken for flotation, with the remainder processed through either 1/4" or 1/8" mesh, the latter being used most extensively in the 1979 season. Flotation was employed extensively during both seasons for data recovery of both features and the midden following the method described by Struever (1968).


SCHWERDT SITE
MAP 3
Excavation unit
Cultural feature
Datum
Scale(m)
0 1 5 10
edge of midden
River bank
edge of midden

CHAPTER 2

THEORETICAL AND ANALYTICAL CONSIDERATIONS

If the perspective of any archaeological endeavor is to be toward interpretation and problem solving, what can and should a faunal analysis encompass? That faunal remains should be kept and examined needs no longer to be debated (see Daly 1969). What seems to be at issue now is to what extent should a researcher carry his or her analysis. Olsen (1971:1) has stated that, "Interpretation, rather than identification, should be stressed as the final goal of bone examinations." In noting a trend toward primarily descriptive faunal reports--often undertaken by non-archaeologists--Bruce Smith (1976) has stated that the researcher should be concerned with the following problems:

1. What was the relative importance of various species of animals in the diet of prehistoric human populations?
2. Was exploitation of animal populations primarily a seasonal activity, and, if so, during what season of the year was each species hunted?
3. What procurement strategies were employed to obtain exploited species?
4. To what degree was human predation of animal populations selective?
5. What was the overall seasonal pattern and strategy of human exploitation of the faunal section of the biotic community?

Smith goes on to say that the majority of faunal reports begin and end with the first of these problems, relating to dietary significance of species. The other questions--if they are addressed at all--are given only token consideration. While this is a definite improvement over the "laundry list" type of faunal reports popular only 15 to 20 years ago, it is still inadequate for the state of archaeology today. Therefore, this analysis of the faunal remains from the Schwerdt site was undertaken with all of the above questions in mind.

Any analysis of faunal remains involves some implicit assumptions by the researcher in regard to the material being handled (Smith: 1976). The first major assumption is that the remains are representative of animals actually killed and utilized by prehistoric occupants of the site. Also involved is the assumption that the remains which are recovered are representative of what was deposited at the time of occupation. Factors which could affect the validity of these statements include differential preservation of skeletal elements (either natural or through cultural activities such as food preparation), the loss of bones through the activities of scavengers, the addition of bone from natural causes, and the loss of bone through non-uniform disposal of remains. In any case, the degree to which these factors have affected the faunal assemblage of a site is difficult, if not impossible, to assess, but the researcher should be aware of the possibility that his or her sample may be biased in ways which cannot be controlled for.

A final assumption is fortunately something which can be controlled. This is, that the faunal remains recovered are representative of those bones which have survived to the present. This can be controlled for by assuring that an adequate sample is collected, both in terms of quantities and spatial coverage. Important here is the utilization of adequate data recovery techniques which will insure that no class of remains will be overlooked (e.g. the use of flotation for the recovery of small scale organic remains).

The first step in a faunal analysis is identification. Bone from each provenience unit is sorted and identified as to species or class, utilizing one or more of the available bone identification manuals (Olsen 1964, 1968; Gilbert 1973), along with a good comparative osteological collection. Each bone is examined to determine the particular element and side, and note is also made at this time of any unusual characteristics such as butchering marks or unfused epiphyses. Some of the bone may be so fragmentary and/or poorly preserved as to render identification even to the class level impossible. This material is categorized as indeterminate bone and is simply counted and weighed.

Determination of dietary significance requires some sort of conversion from bones to meat, since it was meat that was consumed and not bones. This can be accomplished through any one of a number of methods, the Minimum Number of Individuals (MNI) method being the most commonly used and widely accepted. Stated simply, one determines the minimum number of individuals for each species by counting the most frequently occurring element and noting differences in age and size. Thus if 13 right humeri and 11 left humeri were present, the MNI would be 13. If, however, two of the left humeri were from immature individuals and none of the right were, then the MNI would be 15 (13 + 2). Once the MNI has been established for each species, available meat yields can be established by taking percentages of the particular animal's live weight in the manner proposed by White (1953).

As an alternative to the MNI method, Ziegler (1973:28) has proposed converting skeletal weight to edible meat weight through multiplying the recovered bone weight by a conversion factor. Using this method, the edible meat figure would supposedly correspond with the amount of bone recovered. As Chaplin (1971:69) has pointed out, the relationship between bone weight and meat weight is not a simple matter to determine and the establishment of conversion ratios which would be acceptable to all seems unlikely. In similar manner, Lyman's (1979) proposal to count only that meat which would be available from the particular bone elements recovered places too much emphasis upon trying to determine actual usable meat amounts, when it is the relative ecomonic importance of various animal species which should be under consideration. Thus, in the MNI method, the usable meat figures are not meant to represent actual amounts of meat consumed at the site, but should be looked upon as ratios for comparisons among species. The MNI method is used in this report.

A brief mention of recovery techniques seems in order here. As stated before, both 1/4" and 1/8" mesh screens were utilized along with flotation. Table 1 presents a comparison between material

Table 1

Comparison of Recovery Techniques
Schwerdt Site, Allegan County, Michigan

Species/Class	SCREEN ct.	wt.	% by wt.	FLOTATION ct	wt.	% by wt.	TOTALS ct.	wt.
FISH	2972	1376.76	81.6	2428	310.09	18.4	5400	1686.85
Lake Sturgeon, Acipenser fulvescens	2777	1346.51	82.4	1693	287.21	17.6	4400	1633.72
Freshwater Drum, Aplodinotus grunniens			0.0	1	0.02	100.0	1	0.02
Bass, Micropterus sp.	9	1.78	41.1	8	2.55	58.9	17	4.33
Rock Bass, Ambloplites rupestris	1	0.20	100.0			0.0	1	0.20
Crappie, Pomoxis sp.	2	0.19	100.0			0.0	2	0.19
Bluegill, Sunfish; Lepomis sp.			0.0	3	0.10	100.0	3	0.10
Bowfin, Amia calva	3	1.10	72.4	2	0.42	27.6	5	1.52
Channel Catfish, Ictalurus punctatus	1	6.45	100.0			0.0	1	6.45
Redhorse, Moxostoma sp.			0.0	1	0.30	100.0	1	0.30
Sucker Family, Catostomidae			0.0	1	0.87	100.0	1	0.87
Indeterminate Fish	179	20.53	52.4	719	18.62	47.6	898	39.15
MAMMALS	240	1245.37	95.5	35	58.50	4.5	275	1303.87
Black Bear, Ursus americanus	40	613.65	100.0			0.0	40	613.57
White-tailed Deer, Odoeoileus virginianus	29	424.61	90.4	3	45.16	9.6	36	469.77
Beaver, Castor canadensis	16	58.85	99.9	1	0.02	0.1	17	58.87
Racoon, Procyon lotor	1	2.71	100.0			0.0	1	2.71
Muskrat, Ondatra zibethicus	6	5.06	77.3	5	1.49	22.7	11	6.55

Table 1, Continued

Species/Class	SCREEN ct.	SCREEN wt.	SCREEN % by wt.	FLOTATION ct.	FLOTATION wt.	FLOTATION % by wt.	TOTALS ct.	TOTALS wt.
Small Rodent, cf. Cricetidae			0.0	5	0.03	100.0	5	0.03
Indeterminate Mammal	148	140.49	92.3	21	11.80	7.3	169	152.29
TURTLES	269	175.23	87.1	193	25.89	12.9	462	201.12
Snapping Turtle, Chelydra serpentina	63	94.04	89.9	8	10.52	10.1	71	104.56
Box Turtle, Terrapene sp.	9	8.42	100.0			0.0	9	8.42
Blanding's Turtle, Emydoidea blandingi	28	23.02	100.0			0.0	28	23.02
Painted Turtle, Chrysemys picta	2	0.11	39.3	2	0.17	60.7	4	0.28
Indeterminate Turtle	167	49.64	76.6	183	15.20	23.4	350	64.84
BIRD	5	2.52	100.0			0.0	5	2.52
cf. Wild Turkey, Meleagris gallapavo	1	0.57	100.0			0.0	1	0.57
Indeterminate Bird	4	1.95	100.0			0.0	4	1.95
MUSSELS	39	398.28	87.2	3	58.57	12.8	42	456.85
Three-Ridge, Amblema costata	6	85.59	100.0			0.0	6	85.59
Spike, Elliptio dilatatus	1	12.74	100.0			0.0	1	12.74
Indeterminate Mussel	32	299.95	83.7	3	58.57	16.3	35	358.52
GASTROPODS	8	2.33	94.0	5	0.15	6.0	13	2.48
TOTAL IDENT. BONE	3533	3200.49	87.6	2664	453.20	12.4	6197	3653.69
INDETERMINATE BONE	3528	668.81	59.0	14,183	464.20	41.0	17,711	1133.01
TOTALS	7061	3869.30	80.8	16,847	917.40	19.2	23,908	4786.70

recovered in the screens and that recovered from flotation. Flotation is shown to be the better method for the recovery of small fish remains (719 versus 179 for indeterminate fish elements). That the screened material is as numerous as it is for this class of remains reflects the extensive employment of 1/8" mesh in processing features in 1979. For the 1977 season, when 1/8" mesh was used only sparingly, a total of only 14 indeterminate fish elements were recovered from the screens compared to 294 from flotation (Higgins 1979, Table 1). It is clear that without flotation a significant number of small bone elements would have been lost.

All bone recovered from the 1977 flotations was analyzed. However, in 1979, due to the vast quantities of material being recovered from flotation, it was decided to take a 50% sample, by volume, of <u>all</u> material in each flotation sample by using a riffle sampler. The material which went through the riffle was then sorted into its respective classes (bone, ceramics, chert, flora, etc.) with the remainder simply boxed away and not analyzed. This 50% sample still provided a more than adequate and, hopefully (since it was randomly done), representative sample from each feature unit floated.

CHAPTER 3

THE FAUNA

Excavations at the Schwerdt site recovered about 24,000 fragments of bone weighing approximately 4.8 kg. An average soil pH of 6.3 (George Spero, personal communication) provided for good preservation of faunal material, and, in all, 76.3% of the bone by weight was identifiable to at least the class level. Besides the bone listed in Table 2, a large fragment of a cow innominate (saw-cut) and two very recent fish cleithrum were also recovered but, due to their obvious intrusive nature, were not included in any of the calculations. Table 2 presents a summary of the Schwerdt faunal assemblage, giving the relative economic significance of each species as indicated by ratios of usable meat to minimum numbers of individuals. Twenty three different species, totaling 72 individuals, are represented here. A description of all faunal species/classes follows.

Fish

Fish remains were, by far, the most frequently encountered item in the Schwerdt faunal assemblage, comprising over 46% of all identifiable bone by weight. Also, fish, as a class, surpass all others in terms of numbers of individuals with 33. For the purposes of this study, discussion of fish remains will be broken down into two categories, lake sturgeon and other fish, based upon their respective economic significance within the faunal assemblage.

Table 2

Faunal Remains: 1977, 1979
Schwerdt Site, Allegan County, Michigan

Species/Class	TOTAL ct.	wt.	% by wt. ident bone	% by wt. all bone	MNI	Live wt./ ind. (kg)	Usable meat/ ind. (kg)	Usable meat/ spec. (kg)	%
FISH	5400	1686.85	46.2	35.2	33			238.39	44.55
Lake Sturgeon, <u>Acipenser fulvescens</u>	4470	1633.72	44.7	34.1	21	13.6	10.9	228.9	42.8
Freshwater Drum, <u>Aplodinotus grunniens</u>	1	0.02	-	-	1	0.9	0.7	0.7	0.13
Bass, <u>Micropterus sp.</u>	17	4.33	0.1	0.1	4	0.9	0.7	2.8	0.5
Rock Bass, <u>Ambloplites rupestris</u>	1	0.20	-	-	1	0.2	0.16	0.16	0.03
Crappie, <u>Pomoxis sp.</u>	2	0.19	-	-	1	0.2	0.16	0.16	0.03
Bluegill, Sunfish; <u>Lepomis sp.</u>	3	0.10	-	-	2	0.2	0.16	0.32	0.06
Bowfin, <u>Amia calva</u>	5	1.52	-	-	1	0.9	0.7	0.7	0.03
Channel Catfish, <u>Ictalurus punctatus</u>	1	6.45	0.2	0.1	1	3.6	2.9	2.9	0.5
Redhorse, <u>Moxostoma sp.</u>	1	0.30	-	-	1	2.2	1.75	1.75	0.3
Sucker Family, <u>Catostomidae</u>	1	0.87	-	-	-	-			
Indeterminate Fish	898	39.15	1.1	0.8	-				
MAMMALS	275	1303.87	35.7	27.2	11			289.44	54.1
Black Bear, <u>Ursus americanus</u>	40	613.57	16.8	12.8	2	135.9	95.1	190.2	35.5
White-tailed Deer, <u>Odoeoileus virginianus</u>	36	469.77	12.8	9.8	1	90.6	45.3	45.3	8.5
Beaver, <u>Castor canadensis</u>	17	58.87	1.6	1.2	3	20.4	14.3	42.9	8.0
Racoon, <u>Procyon lotor</u>	1	2.71	0.1	-	1	11.3	7.9	7.9	1.5
Muskrat, <u>Ondatra zibethicus</u>	11	6.55	0.2	0.1	3	1.4	1.0	3.0	0.6

Table 2, Continued

Species/Class	TOTAL ct.	wt.	% by wt. ident bone	% by wt. all bone	MNI	Live wt./ ind. (kg)	Usable meat/ ind. (kg)	Usable meat/ spec. (kg)	%
Small Rodent, cf. *Cricetidae*	5	0.03		–	1	.2	.14	.14	0.03
Indeterminate Mammal	169	152.29	4.2	3.2	–				
TURTLES	462	201.12	5.5	4.2	5			2.5	0.5
Snapping Turtle, *Chelydra serpentina*	71	104.56	2.9	2.2	1	9.0	1.8	1.8	.3
Box Turtle, *Terrapene sp.*	9	8.42	0.2	0.2	1	0.9	0.2	0.2	0.04
Blanding's Turtle, *Emydoidea blandingi*	28	23.02	0.6	0.5	2	0.9	0.2	0.4	0.07
Painted Turtle, *Chrysemys picta*	4	0.28	–	–	1	.5	0.1	0.1	0.02
Indeterminate Turtle	350	64.84	1.8	1.3					
BIRD	5	2.52	–	–	1			3.8	0.7
cf. Wild Turkey, *Meleagris gallapavo*	1	0.57	–	–	1	5.4	3.8	3.8	0.7
Indeterminate Bird	4	1.95	–	–	–	–			
MUSSELS	42	456.85	12.5	9.5	23			0.94	0.2
Three-Ridge, *Amblema costata*	6	85.59	2.3	1.8	5	0.2	0.04	0.2	0.04
Spike, *Elliptio dilatatus*	1	12.74	0.3	0.3	1	0.2	0.04	0.04	0.01
Indeterminate Mussel	35	358.52	9.8	7.5	17	0.2	0.04	0.7	0.13
GASTROPODS	13	2.48	0.1	–	13				
TOTAL IDENT. BONE	6197	3653.69	99.9	76.3					
INDETERMINATE BONE	17,711	1133.01	–	23.7					
TOTALS	23,908	4786.70	–	100.0	72			535.07	100.02

Lake Sturgeon

The lake sturgeon (Acipenser fulvescens) is a large, torpedo-shaped archaic fish characterized by its covering of large external bony plates and its shark-like tail fin. An inhabitant of shallow waters, it is a bottom-feeding fish—living almost entirely upon small animals which it takes from the bottom with its ventrally-located protuberant mouth (Harkness and Dymond 1961:22). Formerly, the geographic range of the lake sturgeon encompassed three large drainage systems—the Mississippi, the Great Lakes, and Hudson Bay; probably reaching its highest densities in the latter two.

Known to reach enormous size (up to six or seven feet), the sturgeon is a slow growing fish, not reaching sexual maturity until about age 20 years. Generally speaking, its size at this age would be approximately 50 inches (127 cm) long[1] with a weight of about 30 pounds (13.6 kg) (Harkness and Dymond, 1961:33). This figure has been used in this study as the average live weight for sturgeon.

The lake sturgeon is an anadromous fish, ascending rivers and streams in the late spring to spawn. Harkness and Dymond (Ibid.:36) state that the migration up the rivers begins soon after these are free of ice; but that actual spawning does not take place until the water temperature approaches 60 degrees F. Thus, actual spawning times may be highly variable from river to river, sooner in the south

[1]50 inches is the figure given by Harkness and Dymond (p.29) for Lake Huron sturgeon at 20 years of age. It is felt that Lake Huron sturgeon would most closely approximate those of Lake Michigan.

than in the north. Sturgeon are said to spawn in shallow rapids at places from which they are barred from progressing further upstream.

With respect to the Schwerdt site, fragments of the sturgeon's bony plates were, by far, the most ubiquitous and abundant element found—sturgeon comprising 44.7% of all identified bone by weight. Of the 38 features from which faunal remains were recovered, 28 contained sturgeon remains; and those that didn't contained very little other bone. Table 2 indicates that, in terms of diet, sturgeon contributed more than any other single species represented at the site, with nearly 43% of the total usable meat calculated. It is clear from the above observations that the lake sturgeon was the single most important species exploited by the Schwerdt inhabitants.

As indicated by its previously described habits, the optimal time for harvesting sturgeon would be during the spring spawning season, when they would be abundant in the rivers. Although there are no data available on the abundance of sturgeon in the Kalamazoo River, special reference has been made to them spawning in the shallow waters of Lake Michigan at Saugatuck, located at the mouth of the Kalamazoo (Harkness and Dymond, 1961:40). An early historic account mentions "vast numbers of sturgeon, pike, and other toothsome denizens of the lake" swarming up the Kalamazoo River (Johnson 1880:40). Sturgeon have also been observed in the river recently during the spring, despite the considerable industrial pollution present today. So, although it is impossible to assess the prehistoric sturgeon population of the Kalamazoo, indications are that they were seasonally dense.

In regard to methods of actually taking sturgeon, direct evidence is wholly lacking from the site. The ethnographic literature mentions sturgeon being captured with fish weirs, nets, and spears, with the latter being the most commonly cited method. At the Juntunen site in northern Michigan, spearing is indicated by the presence of bone harpoons (McPherron 1967:195). Bettarel and Smith (1973:122) speculate that the numerous small triangular points found at the Moccasin Bluff site may have been used for spearing sturgeon as well as for hunting other game. The tool assemblage from Schwerdt (particularly in the biface category) is remarkably scant in this regard (John Meszaros, pers. comm.), and no direct evidence for bone harpoons or nets (in the form of net sinkers) was recovered from the site. Occasional mention is made in the historical literature of the use of wooden spears for taking fish (see Turner 1911:571 for specific mention of taking sturgeon in this manner from the Kalamazoo River in the nineteenth century), and this remains a possibility which is worthy of consideration. However, it is also possible that nets were used in the procurement of sturgeon from the river, but no evidence of such remains. This will be discussed in more detail below.

Other Fish

Fish remains other than sturgeon were numerous at the Schwerdt site. It is interesting to note that, of the 28 features which contained sturgeon bone, 23 of these also produced remains of other fish species. The other fish represented at the site account for 12 individuals representing 8 different species. It is notable that all of these are, like the lake sturgeon, spring spawners. The redhorse, a member of the Sucker family, would be the first to spawn, followed by sturgeon and then the various members of the Sunfish family (bass, rock bass, bluegill, and crappie). Within that same period of time catfish and bowfin would spawn as well (Scott 1967; Hubbs and Lagler 1958). The freshwater drum does not spawn until mid-summer but this species, like many of the other species for that matter, would be available in the river nearly all year round.

The size composition of these species suggests some sort of non-selective method of procurement. While some of the larger fish such as catfish and sucker could be taken by spearing, it seems highly unlikely that the smaller Sunfish (crappie, rock bass, and bluegill) could be easily captured in this manner. The presence of these small species in the faunal assemblage seems to argue for the use of nets, albeit, again, there is no direct evidence for such from the site. Although these three species represent a minimum of only four individuals, non-diagnostic small fish remains were most numerous at Schwerdt. Out of a total of 217 fish vertebrae recovered during the 1977 excavations, a total of 179, or 82.5 percent, of these fell within the 2 to 4 mm diameter range, indicating smaller fish (Higgins 1979, Fig. 1).

If, indeed, nets were used by the Schwerdt inhabitants for the procurement of fish (and indirect evidence points to their use), in what manner and to what degree were they employed? In terms of overall fish procurement, two possibilities come to mind: (1) That the netting of small fish was accomplished using small hand-held nets (leaving no physical evidence for such use behind) and that this activity was merely incidental to the spearing of sturgeon, or (2) that nets were employed exclusively in the procurement of fish, with sturgeon being the primary target for exploitation and the other species being caught incidentally at the same time. Neither one of these statements can be proved with the data at hand, but, whatever the procurement method, the significance which fish (particularly sturgeon) had in the subsistence economy at Schwerdt cannot be over-estimated!

Mammals

Although mammals as a class account for slightly over 54% of the total usable meat inventory at Schwerdt, they are represented by a mere 275 pieces of bone scattered over the site. Needless to say, mammal remains were not a frequently encountered item. Six species are represented by the eleven individual mammals determined to be present on the site, and their economic significance to the overall subsistence of the Schwerdt inhabitants varies from considerable to negligible.

Black bear

The black bear (Ursus americanus) was among the largest mammals to inhabit the Great Lakes region in historic times, ranging in size from 200 to 500 pounds. Once common throughout much of North America, its present range is limited to the more remote areas of the continent. The black bear is an omnivorous animal, eating everything from berries and insects to fish and carrion. Because of its adaptable eating habits, the bear is most likely to inhabit an area which offers a diversity of environments and food resources. Burt (1957:57) lists the black bear's habitat as heavily wooded areas and swamps.

With one understandable exception, during the mating season in June, bears are pretty much solitary animals. While it does not hibernate in the true meaning of the word, the bear does go through an extended period of inactivity, or sleep, during the winter months. It is during the latter part of this period, late January or early February, that the female gives birth to her young (Schwartz and Schwartz 1959:270).

This period of inactivity, lasting from November through April, would be the optimal time for hunting bear, as they could be more easily located and killed. It is also during this same time that the bear's hide is thickest with fur and the animal's fat content (highly prized by historic Indians) is at its highest.

In his extensive study of bear ceremonialism, A. Irving Hallowell has noted the marked tendency for the bear to be hunted at this time of the year:

> Bear hunters in both the New World and the Old show a common tendency toward the adjustment of their hunting practices to the hibernatory habit of the animal. The favorite time to hunt the beast is toward the end of winter, or in early spring, while snow is still on the ground. The den of the animal can then be located by the discoloration of the snow around its breaking hole or by vapor arising from it. Sometimes the animal is tracked the previous fall, and its refuge marked, as bears do not usually den until after the

> first fall of snow. Or the hunters may know the places where the bears of their habitat take refuge year after year. The animal is thus rudely disturbed in its winter sleep before it has a chance to emerge from its retreat. (1926:31-33).

Hallowell goes on to say that the most common method of killing a bear is with a spear or an axe.

The bear apparently held a position of respect among a great many historic Indian tribes, there being a widespread practice of established post-mortem ceremonialism following a successful bear hunt. Hallowell (Ibid.: 61-72, 135-140) states that historic accounts most frequently mention the bear's head as being the primary recipient of reverence in such ceremonies. The placing of the head in an elevated position and the ceremonial blowing of tobacco into its nostrils are two practices most often cited. The remainder of the skeleton was commonly disposed of in a predetermined manner. Hallowell states:

> It is said that the bones of the bear and often of other game animals must be kept out of the way of dogs. Should a dog gnaw or even touch them the "spirit" or "owner" of the animals will be offended and misfortune or poor luck in hunting will result. (Ibid.:136)

This historic account is indeed interesting, particularly in light of the relative absence of post-cranial bear elements from prehistoric archaeological sites. This absence has been previously noted in the literature (e.g. Parmalee 1959; Parmalee et. al. 1972: 39; Smith 1975:118-119) and may indicate that the above practice was carried out in prehistoric times as well.

In regard to the Schwerdt site, bear remains are represented exclusively by cranial elements. The remains of black bear skulls were found near the top of two features, numbers 13 and 14. Each skull was placed in an inverted position, apparently without the mandibles, at the top of a large pit amidst redeposited refuse fill. The skull from feature 13 was intact save for missing anterior dentition, while that from feature 14 was found in a fragmentary, although mostly complete, state. The base of the complete skull exhibits some modification in the form of a perforation through the sphenoid area, the function of which is open to speculation (perhaps for brain removal or the placement of the head upon a pole). The only other remains of black bear recovered were isolated teeth and mandible fragments scattered over the site.

This "bears" a striking similarity to the Bell site, a proto-historic Fox village in eastern Wisconsin (Parmalee 1963) where a black bear skull was recovered from a storage-refuse pit. This was also placed in an inverted position, only on top of the mandible (Ibid.:66). This skull and a second from another pit had a portion of the cranium (parietal-temporal) broken away, which Parmalee (Ibid.:67) suggests was for removal of the brains. However, given Hallowell's comments on the frequency of killing bear with a blow on the head from an axe, these fractures could just as easily be the result of this practice.

While black bear seems to have been a posthumous participant in an extra-subsistence level of cultural activity at the Schwerdt site, it was also a considerable part of the diet of these inhabitants, accounting for 35.5% of the total usable meat. In addition, the hides and fat were no doubt a valuable commodity. It is possible that only the skulls (representing the bears' heads) were brought to the site and that bear was not consumed at Schwerdt at all. However, given the the aforementioned inability of the researcher to assess the extent of such cultural practices as differential disposal of remains, one must assume that these bones are representative of animals slain on or near the site.

White-tailed deer

A total of only 36 fragments of deer bone representing but one individual was recovered from the Schwerdt site; deer accounting for only 8.5% of the total usable meat. In the eastern Woodlands area, white-tailed deer was most often a major source of protein in prehistoric times, and the presence of only one individual at Schwerdt strongly suggests procurement strategies directed at other resources.

Of the 36 bone fragments recovered, ten of these were antler. The presence of burrs on the two main beam fragments indicate that the antlers had been naturally shed. This, together with the archaeological context in which all the antler was found (clustered in two features), suggests curation as raw material for probable use as tools.

Beaver

The beaver is the largest rodent in North America, an adult reaching a length of over four feet. The webbed hind feet and the broad flat tail are two easily distinguishable characteristics of the beaver's semi-aquatic way of life. The original distribution of the beaver included nearly all of North America, coast to coast from northern Mexico to the northern limit of trees in Canada. Heavy trapping in the eighteenth and nineteenth centuries greatly reduced this range, eliminating much of the southern portion; but due to reintroductions and conservation measures, this species is making a strong comeback.

Beavers live in and along streams, rivers, marshes, and small lakes bordered by stands of small timber, preferably aspen, poplar, birch, maple, or willow (Burt 1957:109). These animals are known for their construction of large dams and lodges. Dams are usually built only in areas where it is necessary to impede water--a lodge must be near permanently deep water so the beaver can leave without exposing itself above the surface (Schwartz and Schwartz, 1959:165). At other times, lodges may be built on small islands, or beavers may construct their homes within streambanks without the characteristic mound of tree limbs and mud. Beaver colonies may contain anywhere from one to twelve individuals, with about five being the average (Bradt 1938). A colony characteristically includes an adult male and female, the present-year's kits, and yearlings from the previous year's brood (Ibid.:158).

The diet of the beaver includes small trees (approx. 2 inches in diameter), with aspens, maples, and willows being preferred above others. Bradt (1938:153) has noted the tendency toward reliance on aquatic plants, including water lily roots, during the summer months when tree cutting is at a minimum. This observation is especially notable given the afore-mentioned vast aquatic-riparian environment of the Schwerdt site.

From ethnohistoric accounts, winter seemed to be the optimal season for taking beaver, as this is when the pelt is at its thickest (Kinietz 1940:22-23). However, the fur trading industry may have had considerable influence in regard to beaver procurement and seasonality at that time, and mention is also made of taking beaver in the summer (Ibid.). The method mentioned by Kinietz for the procurement of beaver by the Huron and the Ottawa was to stretch a net at the submerged lodge opening and smash a hole into the lodge. When the beaver left to repair its home, it would be caught in the net (Ibid.:23, 237). It is interesting to note that this was almost the exact method which Bradt (1938:140) used in the 1930s for catching beaver with live traps.

With regard to the Schwerdt site, beaver is represented by 17 bone fragments denoting three individuals. Beaver accounts for eight percent of the total usable meat at the site and its presence within the faunal assemblage is in accord with opportunities afforded by the immediate site environs.

Muskrat

The muskrat is a rodent about the size of a small house cat. It is characterized by its short limbs, vertically flattened tail and its dark to reddish-brown color. The distribution of the muskrat is throughout most of North America and it is rather common given the proper habitat.

Muskrats live in marshes, streams, rivers and lakes, preferring still or slowly moving water with vegetation. It may construct its house out of aquatic vegetation in shallower water or, like the beaver, may live in a streambank (Schwartz and Schwartz 1959:220). Although primarily a nocturnal animal, muskrats may commonly come out in the daytime during the late spring and early summer (Ibid.:221).

In regard to the procurement of muskrat, the optimal season, again regarding the pelt, would be winter. However, muskrat could be taken at nearly any time of the year. The ethnohistoric literature is lacking in detail for actual methods of taking the animal, but they would have most likely included some form of traps or nets. The muskrat's frequent diurnal appearances during the late spring-early summer may have provided an opportune time for easy exploitation with net or spear.

Muskrat remains at the Schwerdt site amount to eleven bone fragments representing three individuals. Because of this animal's small size, muskrat accounts for only 0.6% of the total usable meat at the site. Thus, although perhaps not a significant part of the Schwerdt inhabitants' diet, the presence of muskrat in the faunal assemblage is consistent with the environment and with other members of the assemblage.

Racoon

Racoon (Procyon lotor) is represented at the Schwerdt site only by one mandible fragment, and its relative contribution to the meat diet amounts to only 1.5% of the total.

The racoon prefers wooded areas along streams, lakes, marshes, or similar watered environments (Burt 1957:59). Its den is usually located in a hollow tree but may be found in a variety of situations. The area around the Schwerdt site would have provided excellent racoon habitat and the animal could have been hunted through the use of traps or snares, or by locating the animal in its den (Smith 1975:45).

The only other mammal species represented at the Schwerdt site was a mouse or a rat (family Cricetidae), identified by the presence of a few foot bones recovered by flotation from Feature 5. It is entirely possible that these remains are intrusive, but even if they are not, the contribution to the total diet of the Schwerdt inhabitants by this animal is so negligible as to make any further discussion fruitless.

In summary, the most striking observation concerning the mammalian fauna from the Schwerdt site is the predominance of aquatic and riparian species, specifically beaver, muskrat, and racoon. Seven of the 11 individual mammals present at the site can be said to inhabit a water-associated environment, and all species could be expected to frequent such an environment on a regular basis.

Turtles

Four species of turtles, accounting for five individuals, are represented at Schwerdt. While turtle remains account for 5.5% of all identified bone, the relative contribution to the total meat diet by this group amounts to only 0.5%.

With the exception of perhaps the box turtle, all species are compatible with the immediate environment of the site. Of the painted turtle, Lagler (1943:295-296) states that it is "very common in the quieter waters of most larger rivers in the state." Pope (1939:186) lists this species' habitat as preferring quiet, warm, shallow water which supports an abundance of vegetation. The snapping turtle is said to be more abundant in bodies of water with soft muddy banks or bottom (Carr 1952:64), while the habitat preference of the Blanding's turtle is similar to that of the painted (Ibid.:134). The box turtle, although essentially a terrestrial species, is often found in close proximity to some water source.

In terms of exploitation, the optimal time for procuring turtles would be the nesting season, which for all of the above species would be the month of June. It is at this time of the year that the female leaves the water for the purpose of laying her eggs, usually only a relatively short distance from the water. These animals would be easy prey on land. Another optimal time for exploitation, at least with respect to the snapping turtle, would be the winter months, when they can be found hibernating in congregations. At other times of the year turtles could be trapped or netted.

Bird

The only bird identified at the site was wild turkey, indicated by the presence of one proximal femur fragment. This species is generally found in heavily wooded areas and should be associated with the upland environment of Schwerdt. It should also be mentioned here that waterfowl were notably absent from the assemblage, probably being a reflection of seasonality more than an avoidance of exploitation.

Mussels

Identification of freshwater mussel remains was difficult (and impossible in most cases) due to their poorly preserved nature. The fact that 5 out of 6 individuals identified were Amblema costata may merely reflect a bias of preservation and identification, and should not be interpreted as preferential exploitation. This species is characteristically thick-shelled, thus providing for a greater chance of survival; and the shell has deep, diagnostic ridges which make identification easier. Those specimens which could not be identified as to genus and/or species could usually be assigned as being either a right or left valve, providing that the hinge was well enough preserved. In this way, minimum numbers could be determined even though species designation often could not be.

Both of the species identified (Amblema costata and Elliptio dilatatus) are among the most common in the area, inhabiting both large and small streams. The habitat preference for both as listed by Parmalee (1967) is a sand and gravel bottom.

The small number (23 individuals) of freshwater mussels recovered from the Schwerdt site indicates only a minimal effort at exploiting this resource.

Gastropods

In general, land snails should not be considered a food item collected by prehistoric peoples, but rather as a marker or indicator of past environments or climates. Of the 13 specimens recovered from the Schwerdt site, five were found in the plowzone of test units, with two of the remaining eight being too fragmentary for identification. This left a total of only six snail shells (all terrestrial) to work with: a sample much too small to make any meaningful or conclusive statements regarding former environments. For this reason, no attempt was made at identification to the species level.

CHAPTER 4

INTERPRETATION

As previously stated, it is the ultimate goal of any faunal analysis to be interpretive, for it is interpretation which gives animal bones meaning in a human cultural sense. Quickly reviewing those problems which Smith (1976) has stressed as being of major concern in interpretation, the five areas to be dealt with are:

1. Relative dietary significance of species
2. Seasonality
3. Procurement methods
4. Selectivity
5. Overall seasonal patterns and strategies.

Each of these areas will be discussed in terms of the faunal assemblage as a whole. While the dietary percentages for each species were listed in the previous chapter, the discussion which follows will focus on what these numbers mean in relation to each other. It is hoped that an examination of the first four of the above problems will lead to an understanding of the fifth problem, involving procurement patterns and strategies at the Schwerdt site.

Diet

In terms of diet, the lake sturgeon was the single most important species represented on the site with nearly 43 percent of the total usable meat. In comparing classes, fish and mammals together account for 98.6 percent of all meat calculated, with mammals contributing over 54 percent of this. It must be remembered, however, that the major species in terms of dietary significance for this class, the black bear, may have functioned primarily in an extra-subsistence level of cultural activity. With respect to minimum numbers of individuals and overall ubiquity and abundance on the site, fish, by far, was the most exploited group.

Seasonality

Seasonality is generally determined by employing data from three different sources (Smith, 1976).

1. By examining detailed wildlife studies done on modern animal populations, one can note seasonal variations in habitat and food preferences, foraging patterns, density in group sizes and composition, as well as noting seasons of mating and birth. One or more of these factors may point to a certain time of the year when a particular species would be most susceptible to exploitation.

2. An examination of ethnohistorical and present-day hunting practices can often indicate an optimal season for exploitation of a species--particularly when used in conjunction with data from wildlife studies as mentioned above.

3. The final source of determining seasonality is through direct archaeological evidence. With regard to faunal analysis this usually means examining the remains for any osteological markers of the season at time of death. This could involve epiphyses closure, tooth eruption, the presence or absence of antlers on a deer skull, or the rings on fish scales, among others. Determination of sexes and ages

can oftentimes also be gleaned from osteological evidence.

Seasonal indicators strongly suggest a late spring occupation of the Schwerdt site. The strongest such indicator is the lake sturgeon. As noted previously, the sturgeon is an anadromous fish, ascending rivers and streams only in the spring to spawn. Actual spawning takes place anywhere from mid-May to mid-June, depending upon the water temperature (Harkness and Dymond 1961:36-37). The ethnohistorical and historical literature most often mentions spring as the optimal season for taking sturgeon (Kinietz 1940; Johnson 1880). Also, the other species of fish are spring spawners as well, and this too would be the optimal time of the year for exploitation of these species.

In regard to seasonality of the mammalian species, the best season for black bear (from ethnohistorical accounts) is during the winter months, because of the thickness of the fur and fat. However, the bear must also be evaluated from its potential significance in an extra-subsistence level of activity as well as from a subsistence point of view, and may have been taken wherever and whenever encountered. The bear was no doubt a frequent visitor to the vast wetland environment below Schwerdt.

The relative lack of deer on the site suggests an occupation at a time other than the optimal fall/winter season. Also, the presence of shed antler further argues for a spring occupation.

The previously mentioned habits of the beaver and the muskrat would indicate that they would be available in the marsh/riverine environment of the site during the late spring. The beaver's tendency toward the use of water-lily tubers and other aquatic plants during the late spring and summer, and the muskrat's frequent diurnal appearances during this same time of the year point to both availability and relative ease of procurement.

Also mentioned previously was the fact that all of the species of turtles present on the site have their nesting season in the month of June, at which time they could have been easily taken on land.

In summary, practically all indications are that the Schwerdt site was occupied during the late spring. The recovery of fragments of the tuber of the American Lotus (Nelumbo lutea) from 14 of the pit features at the site (Cremin 1980:8) lends further support to this interpretation, as this is the optimal time of the year for the exploitation of this resource (Ibid: 11).

Methods of Procurement

Procurement methods were discussed along with each individual species, so only a summary will be presented here. As there was no direct archaeological evidence of any methods of procurement at Schwerdt, the following are based on indirect evidence and inferences from the ethnohistorical literature.

Fish represented at the Schwerdt site could have been taken in at least two different manners. While the ethnohistorical literature most often cites spearing as the method of taking sturgeon, the small size of other fish species suggest the use of nets. Therefore, either small nets were used incidental to the spearing of sturgeon, or nets were used exclusively in the procurement of fish, with sturgeon no doubt being the primary target species. A further argument for the use of nets may be the presence of the turtles. While these species could have been easily taken when encountered on land during their nesting activities, they could also have been caught in nets being employed primarily for fishing.

With regard to the mammalian species, procurement methods are inferred from ethnohistorical accounts and the habits of the particular animal. As stated previously, the bear was often killed with a spear or an axe; beaver and muskrat were taken with nets placed over submerged lodge openings; and racoon through the use of traps or snares, or by locating the animal in its den. Again, it must be emphasized that these are only possible methods which may have been employed in the procurement of these animals. The lack of any direct evidence precludes making any definite statements in this regard.

Selectivity

Smith (1975) has measured selectivity by obtaining estimated biomasses of species within a given environment and comparing these with projected meat yields. Thus, assuming all species could be taken with the same ease, and assuming that prehistoric hunters were taking them according to their respective frequencies of occurrence within the environment, the relative percentages of their biomasses should be nearly equal to their relative percentages of meat in the diet. Factors which would cause differences in these two groups of percentages include biotic potential, amount of edible meat per individual, ease of capture, and seasonal changes in the density levels of prey species (Smith 1975). Unfortunately, this method could not be employed with the Schwerdt fauna because adequate data for estimating the biomass of the lake sturgeon (the most important species at the site) do not exist. Thus, discussions of selectivity for the Schwerdt material will regrettably be unquantitative in nature (for an application of the previously described method, the reader should consult Munson, Parmalee, and Yarnell 1971:426-427).

One of the most striking observations regarding the Schwerdt faunal assemblage is the predominance of aquatic and riparian species. Of the 23 species represented at the site, only black bear, white-tailed deer, and wild turkey can be considered essentially upland species; with the remainder all associated with riverine/aquatic habitats. Also, as previously noted, the white-tailed deer is often found to have been the most important dietary species at sites in the Eastern Woodlands area. The presence of only one individual at Schwerdt strongly suggests a seasonal procurement strategy aimed at other resources, for the environment of the site must have supplied at least an adequate habitat for this species.

The key factor which surely must have influenced selectivity here was the seasonal abundance of sturgeon in the river. The presence of these large, aquatic "protein packages" provided the inhabitants of Schwerdt with maximum yield through minimum effort or risk of failure.

Procurement Patterns and Strategies at Schwerdt

The overwhelming evidence of diet, seasonality, and selectivity point to the Schwerdt site as a sturgeon fishery. The site was occupied in the late spring (and possibly early summer) on a short-term basis for the designated purpose of exploiting the spawning sturgeon. The remainder of the faunal assemblage suggests incidental exploitation of this same wetlands/riverine type of environment.

This narrow-spectrum type of economy, aimed at one primary prey species, provided the inhabitants of the site with high yields of meat with very little risk of failure. A temporary, intensively occupied site such as Schwerdt is indicative of procurement strategies involving seasonal scheduling and movements, and therefore must represent only one part of a larger subsistence/settlement system. The role that Schwerdt had in this overall system will be discussed in the following chapter.

CHAPTER 5

INTRA-SITE AND INTERSITE COMPARISONS

Intra-site Comparisons

Since 93.7% of all bone (by weight) came from the features, discussion of faunal distributions will focus exclusively upon these. Looking at the species distribution by feature in Appendix B, the only observation which can be made is the tendency for the more faunistically abundant and diverse features to be located on the eastern half of the site (refer to Map 3). Table 3 indicates that the heaviest densities of faunal material (bone weight per liter of fill) are found in features 13, 14, 31, 36, 41, and 44—all located in the eastern half of the site. This should not be interpreted as an indication of different activity areas since the same sorts of material are found over the entire site. More probably, it is merely a reflection of the heavier use (or re-use) of the eastern portion. Also, some pit features in this area were found to overlap each other, indicating seasonal re-occupation.

Faunal densities per liter of fill for each of the pit features listed in Table 3 were obtained by adding together the weight of all faunal material recovered from each feature--both from the screens and from flotation—and dividing this by the estimated feature volume. In computing total weight for the 1979 material, adjustments had to be made due to the procedure of having taken a 50% volume sample of the unsorted material recovered from flotation. The weight

Table 3

Volumetric-Bone Data
of the Pit Features
At the Schwerdt Site

Feature	Est. volume* (liters)	Total wt. of bone (g)	Bone wt. /liter of fill (g)	No. of liters floated	Bone wt. from flot. (g)	Bone wt. per liter flot. (g)
1	-	40.34	-	-	-	-
2	-	0.00	0.00	-	-	-
5	1110	252.38	0.23	435	166.50	0.38
6	820	3.14	0.0004	253	3.14	0.01
7	540	10.15	0.02	230	10.15	0.04
8	330	20.09	0.06	84	15.47	0.18
9	400	14.64	0.04	16	8.67	0.54
11	500	10.47	0.02	20	4.11	0.21
13	1110	735.66	0.66	36	17.44	0.48
14	260	468.02	1.80	36	40.53	1.13
15	360	125.59	0.35	24	49.88	2.08
16	570	62.25	0.11	24	2.21	0.09
17	540	33.19	0.06	18	2.68	0.15
18	830	5.32	0.006	20	0.52	0.03
21	440	35.50	0.08	16	4.28	0.27
22	190	0.32	0.002	16	0.32	0.02
23A	690	1.01	0.001	16	1.01	0.06
23B	680	96.03	0.14	32	8.09	0.25
24A	860	154.39	0.18	16	8.24	0.52
24B	260	30.05	0.12	8	1.55	0.19

Table 3, Continued

Feature	Est. volume* (liters)	Total wt. of bone (g)	Bone wt. /liter of fill (g)	No. of liters floated	Bone wt. from flot. (g)	Bone wt. per liter flot. (g)
26	810	19.21**	0.02	41	2.73**	0.07
27	520	31.24**	0.06	32	11.03**	0.34
29	950	87.63**	0.09	24	47.05**	1.96
30	450	89.57**	0.20	32	2.32**	0.07
31	460	25.39**	0.60	20	7.20**	0.36
34	1100	19.92**	0.02	32	4.61**	0.14
36	520	1472.45**	2.83	112	266.37**	2.38
38	770	76.21**	0.10	20	12.11**	0.61
39	390	0.66**	0.002	20	0.60**	0.03
41	830	496.21**	0.60	47	394.96**	8.40
42	380	14.06**	0.04	16	0.03**	0.002
43	500	4.96**	0.01	40	1.61**	0.04
44	550	388.13**	0.71	32	186.43**	5.83
45	1160	7.17**	0.006	20	0.23**	0.01
46	920	20.53**	0.02	28	23.22**	0.83
TOTALS 35	20,900	4851.88**		1816	1305.29**	
MEAN	630	138.63	0.23	55	39.55	0.72

* Estimated from pit dimensions utilizing formulae developed by W. M. Cremin.

** Figures include adjustments in weights for the 1979 flotation samples in which only a 50% volume sample was quantified and analyzed.

of this material was divided by the weight of all floated material, thereby acquiring the percentage which was quantified and analyzed. This figure subtracted from 100% gave the percentage of bone not examined, which was converted to a weight figure and added to the weight of bone actually analyzed. By doing this for each feature excavated in 1979, densities of material recovered for both seasons of excavation are now comparable.

While computing faunal densities per liter of fill for the pit features, some rather large disparities were observed compared to faunal densities per liter of fill floated (see Table 3). While slightly higher densities would be expected for the flotation material--as this is a maximizing recovery technique--in actuality some are lower, some are higher, and some are grossly higher than the densities of faunal material actually recovered. Using the most extreme example, the density of bone actually recovered from feature 41 is 0.6 g/l, while that from flotation is 8.4 g/l. Using this latter figure--had the entire contents of feature 41 been floated--a total of 6972 g of material would have been recovered. The material actually recovered (from 1/8" screen and flotation) amounts to only 496 g. This means that if the flotation sample is regarded as being representative of the entire feature's contents, a grand total of almost 6500 g of faunal material was lost through 1/8" screen! Obviously, this could not have been the case.

The source of this disparity lies in the procedures used in obtaining and processing flotation samples. If such a sample is to be regarded as being representative of the entire feature, then each soil zone (if zones exist) within the feature must be sampled with equal percentages and in a standardized method. Aside from calculating volumes and percentages in the field, perhaps the best method for achieving such results would be to take flotation samples in a column fashion, whenever possible, from the center of a feature. This would provide equal (although perhaps unknown) percentage samples for each zone in the feature; and would alleviate the problems involved when taking larger samples from zones obviously containing material and smaller samples from zones exhibiting little material.

At the processing level, the 1979 Schwerdt material was processed through a riffle sampler, removing a 50% volume sample. However, since the fill was not screened prior to being floated, some large bone fragments were recovered which would not go through the sampler. The fact that these bones were put in with the sample to be analyzed is no doubt another source of bias. This problem could be easily alleviated by merely screening the fill before floating it. This may also eliminate the need for a riffle sampler since there would be considerably less material recovered in the flotation process.

Inter-site Comparisons

How does the pattern perceived at Schwerdt, as a temporary, late spring sturgeon fishery, compare with those from other contemporaneous sites within the southeastern Lake Michigan region? An answer to this question lies in an examination of specific faunal assemblages/analyses. Delineating patterns and observing site distributions will hopefully lead to a clearer understanding of late prehistoric settlement patterning and overall subsistence strategies within this area.

Beginning with the Kalamazoo River Basin, there are four sites (including Schwerdt) which contain material datable to this time period and from which faunal remains were recovered. These additional three sites are Elam, Allegan Dam, and Hacklander (the latter site is predominately Late Woodland but will provide an important comparison/contrast with the others).

The Elam site is located approximately 27.5 km upstream from Schwerdt. A radiocarbon date of 685 ± 85: A.D. 1265 (UGa 2631) was obtained from a pit feature bearing late prehistoric ceramics. Although an Archaic and Early Woodland component are present on the site, all faunal materials are associated with this thirteenth century occupation (Barr 1979:28).

Barr's (Ibid.) analysis of the faunal data indicates that mammals dominate the Elam assemblage, both in terms of minimum numbers and diet (80% of the total usable meat compared to 16% for fish). Fish, turtles, mussels, beaver, and muskrat account for 80% of the individuals at Elam, and Barr (Ibid: 36) correctly argues for a warm-weather occupation aimed at exploiting aquatic and riparian resources. However, the absence of small fish remains and the relative lack of mussels, together with the more diverse mammalian assemblage (which includes one elk), suggest that the riverine environment of Elam was not as intensively exploited as it was at Schwerdt. Furthermore, it is hypothesized that Elam represents a slightly longer occupation, perhaps from late spring through the end of summer (Ibid.:39). The Elam faunal assemblage, therefore, represents a more balanced hunting and fishing economy than is indicated at Schwerdt. Despite these differences, the seasonal patterns of Schwerdt and Elam are in basic agreement.

The Allegan Dam site is located almost directly across the river from Elam. Radiocarbon dates for the site are 640 and 740 ± 100: A.D. 1310 and A.D. 1210 (Crane and Griffin 1972) and 735 ± 60: A.D. 1215 (UGa-2629). The faunal remains from the site were analyzed by Terrance Martin and included in the site report written by George Spero (1979). Overall, faunal remains were scant and highly fragmentary—due in part to the highly acidic soil. The presence of sturgeon on the site suggests at least a warm-weather occupation (Ibid.:79). However, perhaps even more so than at Elam, there is a greater proportion of mammal remains (82% by weight of all identified bone versus 18% for fish, turtles, and mussels), representing a mixed hunting and fishing economy, with the former being the most important.

The Hacklander site is located about 7 km from the mouth of the Kalamazoo River and 4 km downstream from Schwerdt. The cultural material from this site consists of a mixture of several different Late Woodland components. A detailed analysis of the faunal remains has been conducted by Terrance Martin (1976, 1978). As it was impossible to separate faunal material into cultural components, the pattern presented for Hacklander represents a generalized Late Woodland subsistence strategy for the Lower Kalamazoo River Valley.

This will, however, provide an important comparison/contrast with Schwerdt.

Probably the most significant observation in terms of this discussion is the relative frequency of occurrence of mammals and aquatic species (fish, turtles, and mussels). Martin (1978:14) compared bone weight densities by arbitrary levels for each of the three random sampling areas excavated. He found that at no time in the site's history did aquatic fauna play a more important role than mammals. From the site overall, 74.7% by weight of all identified bone was mammal, compared to 25.2% for fish, turtles, and mussels.

The presence of sturgeon on the site indicates at least a spring occupation (a fall/winter occupation is suggested for one particular area of the site), and Martin concludes that--although spring spawning fish are present in the assemblage--intensive exploitation of this resource is not indicated (Ibid.:26).

Two patterns emerge from this comparison of these four sites in the Lower Kalamazoo River Valley. The first is that seasonal indicators from all suggest short-term, warm weather occupations. The second pattern is the tendency for an increase in the intensity of aquatic and riparian species exploitation through time. The Late Woodland pattern, as indicated for Hacklander and, in essence, Allegan Dam, is characterized by a mixed hunting and fishing economy, with primary emphasis being on the former. Elam represents a transitional phase vis-a-vis procurement strategies, with an increase in the exploitation of aquatic resources, but still maintaining an overall mixed economy. Schwerdt, the most recent of these sites, can be viewed as representing a shift in both procurement strategies and methods toward an intensification of aquatic/riparian resource exploitation. While the procurement strategy here was aimed primarily at the spawning sturgeon, the use of nets (as evidenced by the presence of small fish remains) is just one indication of the degree to which the remainder of this riverine environment was being incidentally exploited.

Outside of the Kalamazoo River Valley, sites relating to the late prehistoric period include the Moccasin Bluff and Wymer sites, on the Lower St. Joseph River, and the Griesmer, Fifield, and Rader sites in northwestern Indiana.

The Moccasin Bluff faunal material was analyzed and reported on by Charles Cleland (1966; Bettarel & Smith, 1973). The presence of 53 individual deer and 30 sturgeon reflects a well balanced assemblage indicative of a year-round permanent or semi-permanent occupation. This is substantiated by the presence of deer skulls from which the antlers were both removed and naturally dropped, indicating that this species was hunted during both spring and fall (Cleland 1966:217). Also, a relatively large amount of maize was recovered from the site, strongly suggesting an agricultural emphasis on the part of the late prehistoric residents.

The Wymer site is located approximately 10 km downstream from Moccasin Bluff. Preliminary testing by Western Michigan University in 1979 and and prior excavations by Andrews University suggest similarities to Moccasin Bluff. The sparce faunal material collected to date includes sturgeon and deer, with one deer skull having antlers attached (Barr 1979; Garland and Mangold 1980). This admittedly small faunal sample, combined with the presence of structural features, points to a permanent or at the very least a semi-permanent occupation similar to that inferred for Moccasin Bluff.

Of the three sites in northwestern Indiana to be discussed, Rader and Griesmer are located in the Kankakee Marsh area of the Kankakee River. The Fifield site is located on Damon Run Creek, a small tributary of the Little Calumet River. The overwhelming predominance of fish, turtles, and mussels in the faunal assemblages from Rader and Griesmer, together with the presence of aquatic tubers, point to warm-weather occupations (Faulkner 1964:95; 1972:113) and to site functions very similar to Schwerdt. Indeed, the marsh environment of both sites is very reminiscent of that of Schwerdt. All three of these sites evidence intensive utilization of this marsh/riverine environment, with different specific procurement strategies indicated, probably due to variations in resource availability and/or abundance.

In contrast, the Fifield site faunal assemblage contains very little in the way of aquatic species. The species composition is consistent with the upland nature of the site, being dominated by such animals as deer, elk, bear, bison, and wild turkey. Faulkner (1972:147-148) argues for a semi-permanent agricultural village status for Fifield, basing this interpretation primarily upon its large size (1.7 ha) and upon not-so-strong faunal indicators. It seems more correct that the Fifield site should be interpreted as an intensively occupied (or reoccupied) winter hunting encampment. This interpretation is supported by the faunal composition and the very location of the site, within an unquestionable upland environment.

What emerges from this discussion are three very distinctive site types. The first, represented by Moccasin Bluff and probably Wymer, is the semi-permanent agricultural village. These villages are characterized by occupations either year-round or in winter/early spring and early fall. The second site type, best represented by Schwerdt, Elam, Griesmer, and Rader (and to perhaps a lesser degree by Allegan Dam), is the warm-weather, special purpose site, oriented toward aquatic and riparian resource exploitation. The third and final site type, represented at this time only by the Fifield site, is the temporary winter camp, where the faunal remains indicate a primary emphasis upon hunting.

The Late Prehistoric Pattern

Re-examining the Miami and Potawatomi pattern as previously mentioned in the beginning of this paper, a cycle involving large permanent villages during the summer and large temporary camps in the winter has been proposed (Fitting and Cleland 1969). However, the site types as described above do not neatly fit this pattern. In noting a similar situation for northeastern Illinois/northwestern Indiana, Faulkner (1972:180) has proposed a subsistence/settlement pattern which includes a dispersal from the permanent agricultural village into small temporary fishing and hunting camps in the late spring. This dispersal supposedly took place following the spring planting of crops and was scheduled to coincide with the maximum availability of aquatic and riparian resources. Thus, the seasonal cycle as proposed here would find the occupants of this area living in agricultural villages in the early spring while planting was taking place. Following this, the populations broke up into smaller units to exploit the late spring native flora and fauna. Late summer and autumn found everyone reassembled into the agricultural villages for harvesting purposes; and then dispersing to temporary winter hunting camps. Cremin (1980) proposes a similar pattern for the southwestern Michigan area.

The relative scarcity of sites identified as winter hunting encampments within this entire southeastern Lake Michigan region is particularly disturbing. As an alternative to the large winter camps proposed by Fitting and Cleland (1969), a dispersal of the population into many smaller groups may be argued for. Cremin (1980) has suggested that at least some of the small upland lithic scatters, identified through survey in the Kalamazoo River Valley may represent such sites. However, light debris densities, as might be anticipated given the degree of occupation, makes it impossible to positively assign them to the late prehistoric period.

As a further alternative, it is suggested that large agricultural village sites such as Moccasin Bluff and Wymer represent a more year-round occupation than is currently proposed. The faunal assemblage from Moccasin Bluff indicates both summer and winter occupations and Cleland (1966:217) has interpreted this as indicating a year-round settlement. Instead of virtual abandonment of these large sites during the winter, one could propose small hunting excursions supplementing the stored cultigens at these sites. The small lithic scatters described above may represent such hunting stations.

Whatever the exact pattern, it is clear that Schwerdt represents one of the late spring dispersal sites. Following the thinking of Fitting and Cleland (1969) and Faulkner (1972) it is probably safe to assume that the Schwerdt inhabitants were agriculturalists, albeit evidence for such is wholly lacking from the site. If this is true, where is the agricultural village to which Schwerdt was ancillary? Extensive survey of the Kalamazoo River Drainage by Drs. William Cremin and Elizabeth Garland has failed to identify even one site which could be such a village. While it is possible that such a site was missed by survey teams or has been destroyed/concealed by modern-day settlements, it is thought to be more probable that such a site may be located in another drainage (Cremin 1980). The St. Joseph River Valley to the south, for example, has been mentioned as a probable candidate for the location of the Schwerdt people's village (Ibid.). This drainage has the broad alluvial floodplain suitable for aboriginal farming which the Kalamazoo lacks, and sites located here, such as Moccasin Bluff, have been identified as agricultural villages. This may be partially substantiated from early historic accounts placing the St. Joseph River based Potawatomi in the Kalamazoo drainage during the spring for purposes of fishing and hunting (Johnson 1880:40).

CHAPTER 6

SUMMARY AND CONCLUSIONS

Analysis of the faunal remains from the Schwerdt site reveal a temporary late spring occupation directed primarily at exploiting the spawning sturgeon, and indirectly at several other resources of the valley floor. When viewed as part of a larger subsistence/settlement system, Schwerdt represents a short-term seasonal movement of people. This cyclical movement can be viewed as a strategy particularly well suited to the northern periphery of effective maize agriculture, where native flora and fauna still played an essential role in the overall subsistence of these people (Cremin 1980).

A comparison of warm-weather seasonal sites in this region suggests a gradual shift through time from longer occupations exhibiting mixed hunting and fishing economies to shorter occupations exhibiting more narrowly focused economies aimed at exploiting aquatic and riparian resources. One possible explanation for this may lie in an increase in the importance of agriculture through time. If agriculture was becoming a more significant part of the subsistence system in this area, it would require an increasingly greater amount of these people's time. Other subsistence activities, including procurement strategies and seasonal scheduling, would have had to be adjusted accordingly; thus, the trend toward the shorter term, intensive, and more narrowly focused seasonal occupation of special purpose sites.

Determining the exact nature of large village sites such as Moccasin Bluff and Wymer is fundamental to a more complete understanding of Late Prehistoric subsistence/settlement patterns in this area. Indeed, the Wymer site, with the application of appropriate research hypotheses and recovery procedures, may provide significant kinds of data which can be used toward reaching this goal.

APPENDIX A

Detailed Recovery Notes of Faunal Remains

Lake Sturgeon (Acipenser fulvescens):

Pectoral spines	12 right, 19 left, 5 fragments
Frontal bones	21
Cleithrum	4 right, 2 left
Dermal plate fragments	4407

Freshwater Drum (Aplodinotus grunniens):

Dentary	1 fragment

Large or Small-mouth Bass (Micropterus sp.):

Dentary	1 right, 4 left
Premaxilla	2 right
Maxilla	2 right
Quadrate	2 left
Ceratohyal	2 right, 1 left
Frontal bone	1 left
Hyomandibular	1 left
Operculum	1 right

Rock Bass (Ambloplites rupestris):

Dentary	1 left

Crappie (Pomoxis sp.):

Dentary	1 left
Premaxilla	1 left

Bluegill, Sunfish (Lepomis sp.):

Premaxilla	2 left
Dentary	1 left

Bowfin (Amia calva):

Dentary	1 right, 1 left
Premaxilla	1 fragment
Vertebra	1

Channel Catfish (Ictalurus punctatus):

Dentary	1 right

APPENDIX A Continued

Redhorse (Moxostomia sp.):

Pharyngial arch	1 right

Sucker (Family Catostomidae):

Rib	1 side indet.

Indeterminate fish (Class Pisces):

Vertebrae	558
Scales	68
Spines, misc.	268

Black Bear (Ursus americanus):

Canine (mand.)	1 side undet.
Canine	1 indet.
1st max. molar	1 left
2nd max. molar	1 left
1st mand. molar	2 side undet.
2nd mand. molar	1 right
3rd mand. molar	1 side undet.
Crania	1 complete, 1 fragmentary
Mandible	2 fragments

White-tailed Deer (Odocoileus virginianus):

Maxillary teeth	7
Auditory bullae	1 right, 1 left
Radius	1 right (distal)
Cervical vertebra	1
Metatarsal	1 right, 1 indet. fragment
Metacarpal	1 left, 1 indet. fragment
Tarsal	1 right
Humerus	1 right (distal)
Tibia	1 left
Astragalus	1 left
Metapodial	1 fragment
Vertebrae	2
Antler	2 main beams, 8 fragments

APPENDIX A Continued

Beaver (<u>Castor canadensis</u>):

Innominate	3 right, 3 left
Humerus	1 right
Tibia	1 right
Molars	4
Incisor	1

Racoon (<u>Procyon lotor</u>):

Mandible	1 left

Muskrat (<u>Ondatra zibethicus</u>):

Mandible	3 right, 2 left
Innominate	1 right
Femur	2 right
Molars	3

Small Rodent (cf. Family <u>Cricetidae</u>):

Incisor	1 fragment
Phalanges	4

Indeterminate mammal (Class <u>Mammalia</u>):

Misc. bone fragments	169

Snapping turtle (<u>Chelydra serpentina</u>):

Carapace and plastron frags.	63
Scapula	1 side indet.
Vertebrae	6

Box Turtle (<u>Terrapene carolina</u>)

Carapace and plastron frags.	9

Blanding's Turtle (<u>Emydoidea blandingi</u>):

Nuchal bones	2
Carapace fragments	26

APPENDIX A Continued

Painted Turtle (Chrysemys sp.):

Scapula	1 side indet.
Innominate	1 fragment
Humerus	1 right
Femur	1 right

Indeterminate turtle (Order Testudines):

Carapace and plastron frags.	350

cf. Wild Turkey (Meleagris gallapavo):

Femur	1 left

Indeterminate bird (Class Aves):

Longbone fragments	4

Mussel, Three-Ridge (Amblema costata):

Valves	1 right, 5 left

Mussel, Spike (Elliptio dilatatus):

Valve	1 left

Indeterminate mussel (Class Pelecypoda):

Valves	17 right, 13 left, 4 indet.

Gastropods (Class Gastropoda):

Shells	13

Appendix B

Faunal Feature Association

	Feature #1		Feature #3		Feature #5		Feature #6	
	ct.	wt.(g)	ct.	wt.(g)	ct.	wt.(g)	ct.	wt.(g)
FISH	23	32.68			663	110.35		
Lake Sturgeon	23	32.68			444	107.26		
Freshwater Drum								
Bass								
Rock Bass								
Crappie								
Bluegill, Sunfish								
Bowfin								
Channel Catfish								
Redhorse								
Sucker Family								
Indeter. Fish					219	3.09		
MAMMALS	1	5.61	1	0.86	19	8.26		
Black Bear								
White-tailed Deer								
Beaver	1	5.61			1	0.02		
Racoon								
Muskrat					1	0.32		
Small Rodent					5	0.03		
Indeter. Mammal			1	0.86	12	7.89		
TURTLES					145	9.55		
Snapping Turtle								
Box Turtle								
Blanding's Turtle								
Painted Turtle								
Indeter. Turtle					145	9.55		
BIRD								
CF. Wild Turkey								
INDETER. BIRD								
MUSSELS	-	0.01	1	9.81	3	20.62		
Three-Ridge								
Spike								
Indeter. Mussel	-	0.01	1	9.81	3	20.62		
GASTROPODS					1	0.12		
INDETER. BONE	60	2.04			4955	103.48	124	3.14
TOTALS	84	40.34	2	10.67	5786	252.38	124	3.14

Appendix B, Continued

	Feature #7		Feature #8		Feature #9		Feature #11	
	ct.	wt.(g)	ct.	wt.(g)	ct.	wt.(g)	ct.	wt.(g)
FISH	7	0.69	125	10.74	42	7.21	50	6.81
Lake Sturgeon	7	0.69	123	10.70	42	7.21	45	6.75
Freshwater Drum								
Bass								
Rock Bass								
Crappie								
Bluegill, Sunfish								
Bowfin								
Channel Catfish								
Redhorse								
Sucker Family								
Indeter. Fish			2	0.04			5	0.06
MAMMALS					1	1.30	1	0.23
Black Bear								
White-tailed Deer								
Beaver								
Racoon								
Muskrat								
Small Rodent								
Indeter. Mammal					1	1.30	1	0.23
TURTLES								
Snapping Turtle								
Box Turtle								
Blanding's Turtle								
Painted Turtle								
Indeter. Turtle								
BIRD								
CF. Wild Turkey								
INDETER. BIRD								
MUSSELS			-	0.56				
Three-Ridge								
Spike								
Indeter. Mussel			-	0.56				
GASTROPODS			1	0.54				
INDETER. BONE	142	9.46	297	8.25	161	6.13	154	3.43
TOTALS	149	10.15	423	20.09	204	14.64	205	10.47

Appendix B, Continued

	Feature #13		Feature #14		Feature #15		Feature #16	
	ct.	wt.(g)	ct.	wt.(g)	ct.	wt.(g)	ct.	wt.(g)
FISH	362	157.60	393	120.16	493	69.05	11	1.87
Lake Sturgeon	349	155.55	479	119.69	462	67.40	7	1.83
Freshwater Drum							1	0.02
Bass								
Rock Bass								
Crappie								
Bluegill, Sunfish								
Bowfin								
Channel Catfish								
Redhorse								
Sucker Family								
Indeter. Fish	13	2.05	14	0.47	31	1.65	3	0.02
MAMMALS	27	485.72	45	182.11	4	3.20	19	23.55
Black Bear	1	415.70	31	170.08				
White-tailed Deer	11	39.49			1	1.80		
Beaver	7	24.04						
Racoon								
Muskrat			2	0.26				
Small Rodent								
Indeter. Mammal	8	6.08	12	11.77	3	1.40	19	23.55
TURTLES	23	12.90	165	113.10	4	1.97	4	0.32
Snapping Turtle			60	91.86	2	1.75		
Box Turtle	9	8.42						
Blanding's Turtle								
Painted Turtle			2	0.11				
Indeter. Turtle	14	4.48	103	21.13	2	0.22	4	0.32
BIRD								
CF. Wild Turkey								
INDETER. BIRD								
MUSSELS	3	34.02	-	0.64	1	10.68	2	34.27
Three-Ridge							1	26.27
Spike	1	12.74						
Indeter. Mussel	2	21.28	-	0.64	1	10.68	1	8.00
GASTROPODS	6	1.10						
INDETER. BONE	702	44.73	1312	52.01	1219	40.69	76	2.24
TOTALS	1123	735.66	2016	468.02	1721	125.59	112	62.25

Appendix B, Continued

	Feature #17		Feature #18		Feature #20		Feature #21	
	ct.	wt.(g)	ct.	wt.(g)	ct.	wt.(g)	ct.	wt.(g)
FISH	85	28.08					66	30.67
Lake Sturgeon	83	28.03					66	30.67
Freshwater Drum								
Bass								
Rock Bass								
Crappie								
Bluegill, Sunfish								
Bowfin								
Channel Catfish								
Redhorse								
Sucker Family								
Indeter. Fish	3	0.05						
MAMMALS							1	0.27
Black Bear								
White-tailed Deer								
Beaver								
Racoon								
Muskrat								
Small Rodent								
Indeter. Mammal							1	0.27
TURTLES	-	0.14					3	0.59
Snapping Turtle								
Box Turtle								
Blanding's Turtle								
Painted Turtle								
Indeter. Turtle	-	0.14					3	0.59
BIRD								
CF. Wild Turkey								
INDETER. BIRD								
MUSSELS								
Three-Ridge								
Spike								
Indeter. Mussel							-	1.09
GASTROPODS	-	2.01	1	4.80				
INDETER. BONE	202	2.96	37	0.52	2	0.02	104	2.88
TOTALS	288	33.19	38	5.32	2	0.02	174	35.50

Appendix B, Continued

	Feature #22		Feature #23A		Feature #23B		Feature #24A	
	ct.	wt.(g)	ct.	wt.(g)	ct.	wt.(g)	ct.	wt.(g)
FISH	2	0.04	1	0.01	214	33.14	190	38.11
Lake Sturgeon					205	33.08	183	37.92
Freshwater Drum								
Bass								
Rock Bass								
Crappie								
Bluegill, Sunfish								
Bowfin								
Channel Catfish								
Redhorse								
Sucker Family								
Indeter. Fish	2	0.04	1	0.01	9	0.06	7	0.19
MAMMALS					2	21.79	4	25.84
Black Bear								
White-tailed Deer					1	10.90	1	20.42
Beaver					1	10.89	3	5.42
Racoon								
Muskrat								
Small Rodent								
Indeter. Mammal								
TURTLES					7	1.36	7	3.37
Snapping Turtle								
Box Turtle								
Blanding's Turtle								
Painted Turtle								
Indeter. Turtle					7	1.36	7	3.37
BIRD								
CF. Wild Turkey								
INDETER. BIRD								
MUSSELS					2	35.66	4	78.03
Three-Ridge					1	10.10	1	10.88
Spike								
Indeter. Mussel					1	25.56	3	67.15
GASTROPODS								
INDETER. BONE	20	0.28	36	1.00	145	4.08	211	9.04
TOTALS	22	0.32	37	1.01	370	96.03	416	154.39

Appendix B, Continued

	Feature #24B		Feature #25		Feature #26		Feature #27	
	ct.	wt.(g)	ct.	wt.(g)	ct.	wt.(g)	ct.	wt.(g)
FISH	18	5.77			45	7.19	41	9.88
Lake Sturgeon	18	5.77			43	7.17	40	9.87
Freshwater Drum								
Bass								
Rock Bass								
Crappie								
Bluegill, Sunfish								
Bowfin								
Channel Catfish								
Redhorse								
Sucker Family								
Indeter. Fish					2	0.02	1	0.01
MAMMALS								
Black Bear								
White-tailed Deer								
Beaver								
Racoon								
Muskrat								
Small Rodent								
Indeter. Mammal								
TURTLES	27	22.20						
Snapping Turtle								
Box Turtle								
Blanding's Turtle	27	22.20						
Painted Turtle								
Indeter. Turtle								
BIRD								
CF. Wild Turkey								
INDETER. BIRD								
MUSSELS								
Three-Ridge								
Spike								
Indeter. Mussel								
GASTROPODS								
INDETER. BONE	79	2.08	2	0.46	219	11.00	265	16.35
TOTALS	124	30.05	2	0.46	264	18.19	306	26.23

Appendix B, Continued

	Feature #29		Feature #30		Feature #31		Feature #34	
	ct.	wt.(g)	ct.	wt.(g)	ct.	wt.(g)	ct.	wt.(g)
FISH	170	37.73	19	15.96	8	0.70	9	2.90
Lake Sturgeon	168	37.67	13	9.06	7	0.69	7	2.89
Freshwater Drum								
Bass			1	0.35				
Rock Bass								
Crappie								
Bluegill, Sunfish								
Bowfin								
Channel Catfish			1	6.45				
Redhorse								
Sucker Family								
Indeter. Fish	2	0.06	4	0.10	1	0.01	2	0.01
MAMMALS			2	9.71	7	15.69		
Black Bear								
White-tailed Deer			1	4.18	3	14.73		
Beaver			1	5.53				
Racoon								
Muskrat								
Small Rodent								
Indeter. Mammal					4	0.96		
TURTLES			14	12.26				
Snapping Turtle								
Box Turtle								
Blanding's Turtle								
Painted Turtle								
Indeter. Turtle			14	12.26				
BIRD			4	1.95				
CF. Wild Turkey								
Indeter. Bird			4	1.95				
MUSSELS	-	0.50	3	13.31			1	14.60
Three-Ridge							1	14.60
Spike								
Indeter. Mussel	-	0.50	3	13.31				
GASTROPODS								
INDETER. BONE	523	28.34	140	35.39	60	5.78	28	0.49
TOTALS	693	66.57	182	88.58	75	22.17	38	17.99

Appendix B,. Continued

	Feature #36		Feature #38		Feature #39		Feature #40	
	ct.	wt.(g)	ct.	wt.(g)	ct.	wt.(g)	ct.	wt.(g)
FISH	1101	544.59	23	9.51	3	0.07	2	0.56
Lake Sturgeon	854	527.18	19	9.49	2	0.06	2	0.56
Freshwater Drum								
Bass	7	1.83						
Rock Bass								
Crappie	2	0.19						
Bluegill, Sunfish								
Bowfin								
Channel Catfish								
Redhorse								
Sucker Family								
Indeter. Fish	238	15.39	4	0.02	1	0.01		
MAMMALS	15	305.23	2	24.81				
Black Bear								
White-tailed Deer	8	300.18	1	21.84				
Beaver			1	2.97				
Racoon								
Muskrat								
Small Rodent								
Indeter. Mammal	5	5.05						
TURTLES	5	0.46						
Snapping Turtle								
Box Turtle								
Blanding's Turtle								
Painted Turtle								
Indeter. Turtle	5	0.46						
BIRD								
CF. Wild Turkey								
INDETER. BIRD								
MUSSELS	5	60.42	3	24.67				
Three-Ridge	1	16.74						
Spike								
Indeter. Mussel	4	43.68	3	24.67				
GASTROPODS								
INDETER. BONE	1905	451.86	83	12.38	38	0.36	24	0.11
TOTALS	3029	1362.56	111	71.37	41	0.43	26	0.67

Appendix B, Continued

	Feature #41		Feature #42		Feature #43		Feature #44	
	ct.	wt.(g)	ct.	wt.(g)	ct.	wt.(g)	ct.	wt.(g)
FISH	449	77.68			8	1.36	388	218.57
Lake Sturgeon	110	57.06			7	1.33	382	218.48
Freshwater Drum								
Bass	9	2.15						
Rock Bass	1	0.20						
Crappie								
Bluegill, Sunfish	3	0.10						
Bowfin	5	1.52						
Channel Catfish								
Redhorse	1	0.30						
Sucker Family	1	0.87						
Indeter. Fish	319	15.48			1	0.03	6	0.09
MAMMALS	6	48.90					1	1.00
Black Bear								
White-tailed Deer	2	43.91						
Beaver	1	2.95						
Racoon								
Muskrat	3	2.04					1	1.00
Small Rodent								
Indeter. Mammal								
TURTLES	46	16.14						
Snapping Turtle	6	5.90						
Box Turtle								
Blanding's Turtle	1	0.82						
Painted Turtle	2	0.17						
Indeter. Turtle	37	9.25						
BIRD								
CF. Wild Turkey								
INDETER. BIRD								
MUSSELS	6	73.01	2	13.90				
Three-Ridge			1	7.00				
Spike								
Indeter. Mussel	6	73.01	1	6.90				
GASTROPODS								
INDETER. BONE	2217	133.32	4	0.15	42	2.68	1585	92.29
TOTALS	2724	349.05	6	14.05	50	4.04	1974	311.86

Appendix B, Continued

	Feature #45 ct.	Feature #45 wt.(g)	Feature #46 ct.	Feature #46 wt.(g)	TOTALS ct.	TOTALS wt.(g)
FISH			69	9.23	5181	1588.91
Lake Sturgeon			61	9.18	4251	1535.92
Freshwater Drum					1	0.02
Bass					17	4.33
Rock Bass					1	0.20
Crappie					2	0.19
Bluegill, Sunfish					3	0.10
Bowfin					5	1.52
Channel Catfish					1	6.45
Redhorse					1	0.30
Sucker Family					1	0.87
Indeter. Fish			8	0.05	898	39.01
MAMMALS					156	1163.67
Black Bear					32	585.78
White-tailed Deer					29	457.45
Beaver					16	57.43
Racoon					0	0.00
Muskrat					7	3.62
Small Rodent					5	0.03
Indeter. Mammal			1		67	59.36
TURTLES			1	0.18	451	194.54
Snapping Turtle					68	99.51
Box Turtle					9	8.42
Blanding's Turtle					28	23.02
Painted Turtle					4	0.28
Indeter. Turtle			1	0.18	342	63.31
BIRD					4	1.95
cf. Wild Turkey					0	0.00
Indeter. Bird					4	1.95
MUSSELS	1	6.91			37	432.71
Three-Ridge					6	85.59
Spike					1	12.74
Indeter. Mussel	1	6.91			30	334.38
GASTROPODS					8	3.77
INDETER. BONE	18	0.16	356	1.16	17,547	1090.74
TOTALS	19	7.07	426	10.57	23,292	4484.86

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