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FAUNAL ANALYSIS AND SHIFTING NICHE EXPLOITATION
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SAGINAW VALLEY OF MICHIGAN

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FAUNAL ANALYSIS AND SHIFTING NICHE EXPLOITATION STRATEGIES AT THE SCHULTZ SITE 20SA2 IN THE SAGINAW VALLEY OF MICHIGAN

By

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ABSTRACT

FAUNAL ANALYSIS AND SHIFTING NICHE EXPLOITATION STRATEGIES AT THE SCHULTZ SITE 20SA2 IN THE SAGINAW VALLEY OF MICHIGAN

By

Erica Lyn Bonkosky Shipman

Faunal assemblages can reveal changing paleoenvironmental conditions, the seasonality of site occupancy, and, indirectly, climatic fluctuations. The Schultz Site (20SA2), located in the Saginaw Valley of Michigan, with stratified occupational units spanning the period 2,600 B.P. through 800 B.P., presents a detailed geoarchaeological sequence that was analyzed in the context of changing aquatic environments and associated changes in faunal exploitation. Four important conclusions can be summarized from this analysis of the Schultz Site fauna. First, the refined recovery facilitated by the flotation technique does not significantly decrease the rate of identification at this site. Second, the Schultz Site environment varied seasonally and temporally over the course of several hundred years, affecting the habitability of the site and the intensity of occupation and its utilization through time. Third, this fluctuation resulted in multiple season usage of the site through time and a changing subsistence strategy that included clear resource targeting of aquatic habitats at particular times. Finally, the analysis of these faunal samples confirms, supports, and broadens earlier analyses.

To my father for introducing me to Lucy and friends so many years ago.

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CHAPTER 1: THE SCHULTZ SITE

Introduction

The analysis of faunal remains has become an essential and at times primary component of contemporary archaeological research. Animal remains can provide direct insights into the food resources available to and procured and selected by past populations. Faunal assemblages can, furthermore, reveal changing paleoenvironmental conditions, the seasonality of site occupancy, and, indirectly, climatic fluctuations.

The occurrence of animal remains at an archaeological site allows assessment of the relative abundance of the elements of a specific fauna or suite of faunas. Notable absences in collections of faunal assemblages, where particular animals would be expected, may be indicative of either human selection, or of environmental variations in a local region. Often, the correlation of faunal and cultural remains can provide insights into the patterns of decision-making and economy of the people using the area. Frequencies of faunal remains can also be indicative of the relative intensity, or variation in intensity, of habitation or use of a particular site, and the targeting of individual or groups of species.

This thesis focuses on the faunal assemblages of the Schultz Site (20SA2), located in the Saginaw Valley of Michigan (Figure 1), at the confluence of the Tittabawassee and Saginaw rivers (Fitting ed. 1972). The Schultz Site, with stratified occupational units

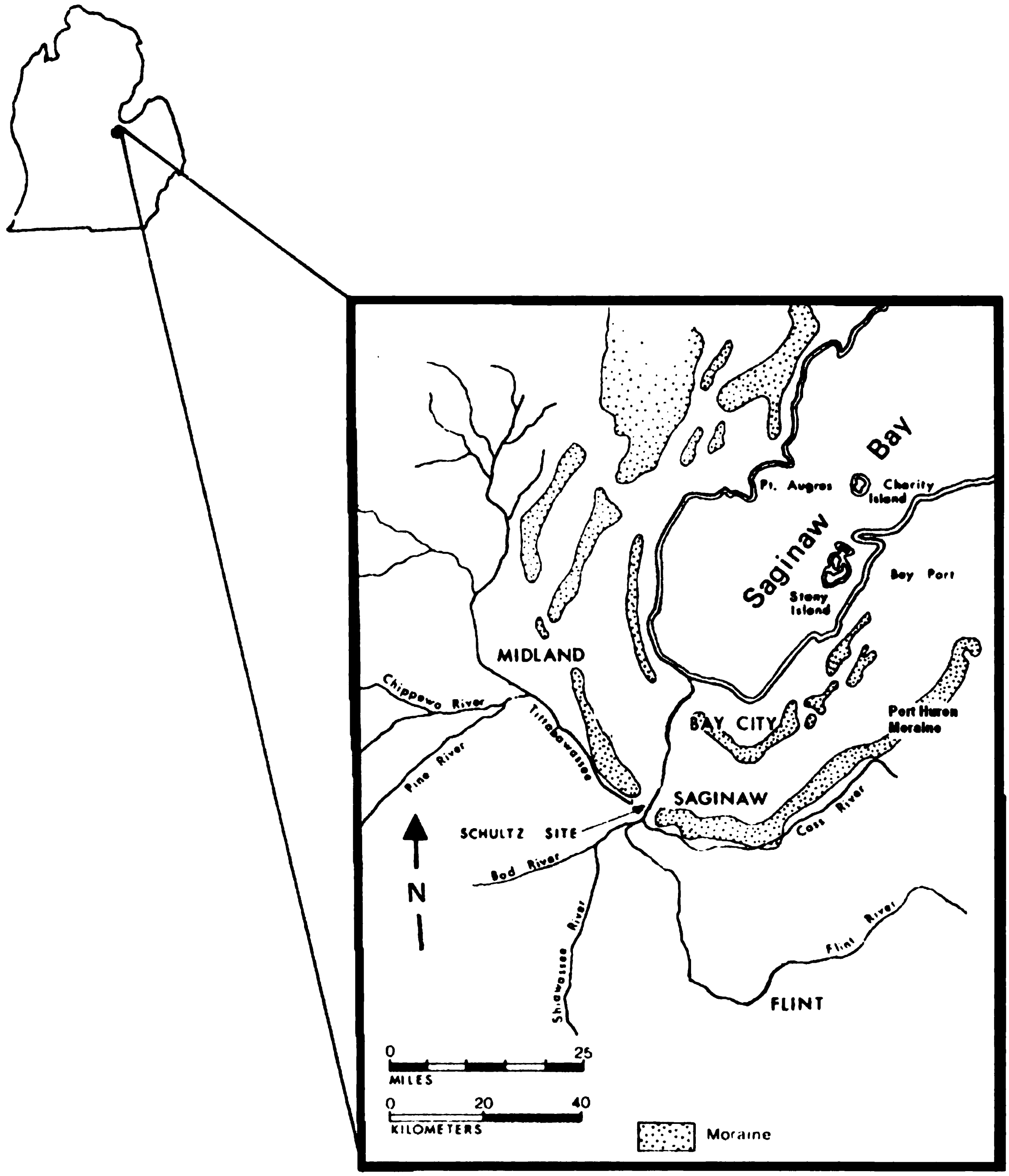

Figure 1: Location of the Schultz Site in the Saginaw Valley of Michigan (From Lovis et al. 1994)

spanning the period 2,600 B.P. through 800 B.P., presents a detailed geoarchaeological sequence that can be analyzed in the context of changing aquatic environments and associated changes in faunal exploitation (Lovis et al. 2001).

Fluctuations of the base plane in the lower Lake Huron/Michigan basin resulted in local aggradation and degradation of levees that may relate to local shifts in channel position (Speth 1972: 67-68, 74). Such changes had a marked impact on local aquatic and river-edge environments utilized by human populations during the span of site occupation.

The focus of this thesis is to link the identification of vertebrate faunal remains to changes in the environment and human exploitation patterns throughout the Schultz Site occupation. Paleoenvironmental and geological data are used to interpret past environments, animal habitats and distributions, and to address the implications of the faunal assemblage for determining seasonality of site occupation. Results from this faunal analysis will be compared with earlier research by Cleland (1966), Luxenberg (1972), and Lovis et al. (2001). Finally, a comparison of sampling strategies will be made with reference to earlier work.

1991 Michigan State University Excavation

The Schultz Site faunal assemblages have been studied in a series of analyses and excavations since the 1960s, by C. E. Cleland in the mid-1960s (Cleland 1966), B. Luxenberg in the early 1970s (Luxenberg 1972), and L. Palsgaard in the early 1980s

(Ozker 1982). The Schultz Site (20SA2; Figure 2), was most recently excavated in 1991 by a Michigan State University (MSU) team led by W.A. Lovis (Lovis et al. 1994). Because of its location and relatively undisturbed condition, 20SA2 provides an excellent reference for changing economic, environmental, and technological conditions in the region over an extended time span.

One goal of the 1991 excavation was to collect comprehensive environmental data and apply that data to interpretation of spatial and temporal changes at the site and in the region (Lovis et al. 2001: 3). A second goal was to address changing subsistence patterns as a result of environmental fluctuations as the people changed from a hunting and gathering to a horticultural society (Lovis et al. 2001: 4). The third primary goal was to further evaluate the differences in identification rate between samples recovered by screening methods and those recovered through flotation (Lovis et al. 2001: 4).

Field Recovery Methods

Methods used during the 1991 excavation of the Schultz Site (20SA2), which are briefly summarized here, are detailed in the preliminary report submitted in 1994 (Lovis et al. 1994) as well as in a more recent article (Lovis et al. 2001). The collection strategy consisted of four components. First, a machine trench (designated T 91-1) was excavated through the center of the site, paralleling a trench from earlier excavations. The purpose of this parallel trench was the correlation and verification of previously defined stratigraphic units. Next, five separate one square meter units (N25, N35, N45, N55, N65) were excavated and screened using ¼" (5mm) mesh at 10 meter increments along the T 91-1 trench. Three additional, smaller trenches (T 91-2, T 91-3, T 91-4) were machine excavated, perpendicular to T 91-1, for further stratigraphic and temporal control (Figure 2). Finally, five flotation columns were collected; two in Trench 91-1(Lovis et al. 1994) and one from each of the other trenches.

A summary of the stratigraphic units, cultural horizons, geologic units, and ages of the levels sampled during the 1991 excavation is shown in Figure 3. The level immediately below the uppermost stratum (or plow zone) dates to circa 800 B.P., well prior to any contact with Europeans. As a whole, human occupation of the Schultz Site extends back in time at least another 1,700 years, to ca. 2,500 B.P., covering the cultural horizons of the Late Woodland Period back to the Late Archaic/Early Woodland transition (Lovis et al. 1994).

Geological and depositional units were defined by their contacts with differentiated sedimentary layers above and below, or by unconformities in the layers. The stratigraphic units were determined in the field and are based on several observable characteristics of the strata (Boggs 1995). The characteristics can be physical, such as sediment color, grain size, and chemical composition; biological, i.e. animal remains or cultural i.e. artifacts found within the stratigraphic units. The stratigraphic units may be as broad as the geologic units or some smaller portion thereof.

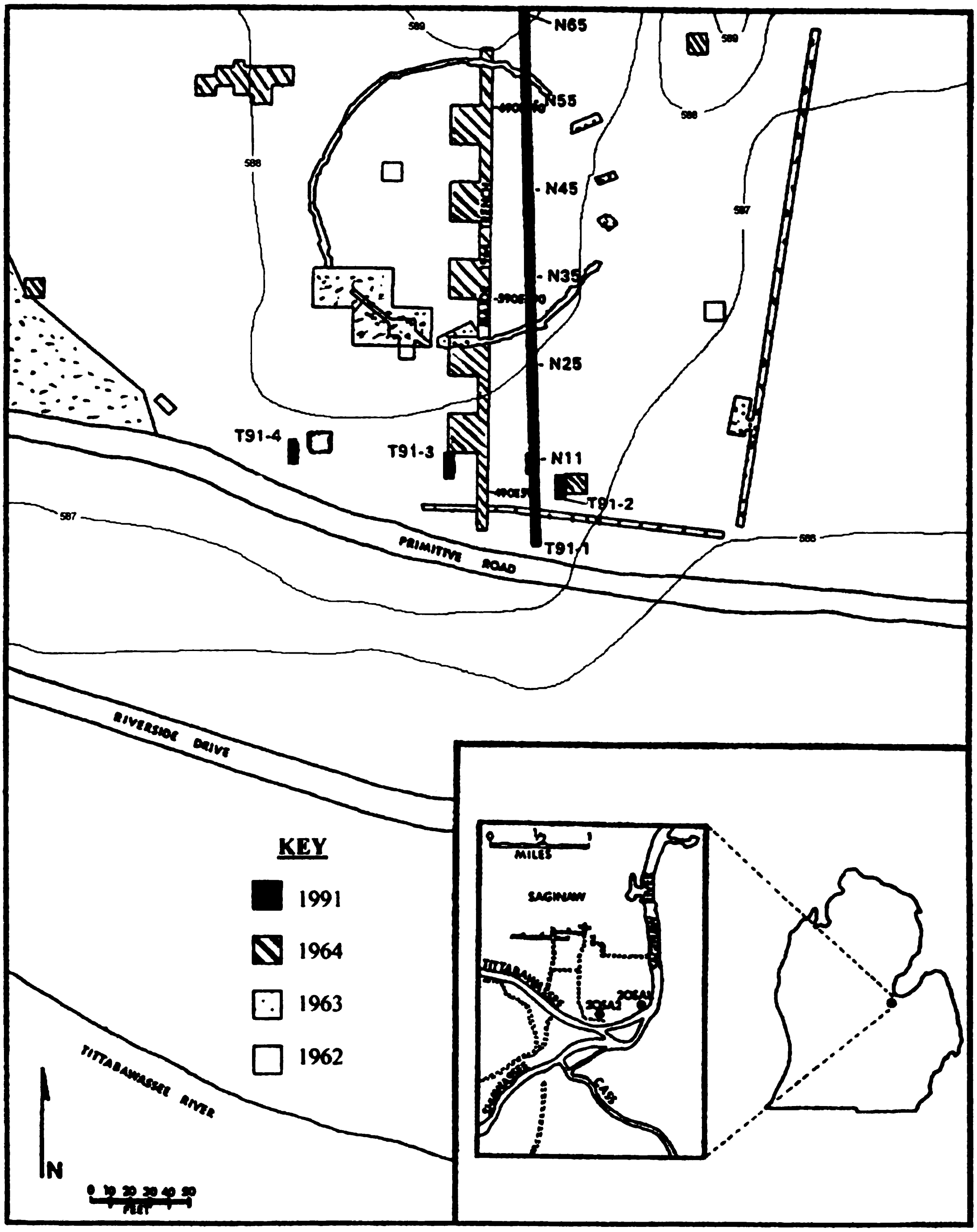

Figure 2: Excavations at the Schultz Site (From Lovis et al. 1994)

Stratigraphic units at archaeological sites may also be correlated with cultural units. Cultural units can be characterized by the artifacts found within each layer and the manner in which the artifacts vary in their concentration through time. Some of the carbon-based artifacts and animal remains may be datable by chronometric assay, allowing correlations between stratigraphic units, cultural horizons, and calendrical ages (Figure 3).

Prior Research

Environmental factors that can be interpreted include ancient drainage connections, water quality (e.g., turbidity, flow rate, and relative oxygen level), substrate type, seasonality, and climate change (Olsen 1971, Shackley 1981). Analysis of the Schultz Site by Cleland (1966) and Luxenberg (1972) indicated variations in the environment, sediment deposition rates, and human exploitation of the site through the represented time span. Correlation of different flotation samples from the 1991 excavation with the geologic units (Figure 3) will facilitate environmental reconstruction.

Research by Eschman and Karrow's (1985) pointed to an "outlet controlled" model for the geological development of the Great Lakes region, and by extension, the vicinity around the Schultz Site. Beginning approximately 10,000 years ago, with the retreat of the Huron lobe of the Wisconsinan ice sheets, the Saginaw Bay region was shaped by several episodes of fluctuating depositional events (Eschman and Karrow 1985). As the

Calendrical Age	Stratigraphic Unit	Cultural Horizon	Geologic Unit		General Depth*
	11	Plow Zone	Plow Zone		surface
820 B.P.	10	Saginaw Thin Late Woodland	Upper Dark Silts	Erosional Disconformity	surface -35
1150 B.P.	9	Late Middle Woodland (Ruben)/ Early Late Woodland (Saginaw Thin) Transition	Intermediate Dark Silts		35-60
1690 B.P.	8c	Green Point Middle Woodland	Middle Dark Silts		60-65
	8b	Green Point Middle Woodland	Brown Silts		65-75
1700 B.P.	8a	Green Point/ Tittabawassee Middle Woodland Transition		Erosional Disconformity	75-85
1840-1690 B.P.	7	Shiawassee Early Woodland/Tittabawassee Middle Woodland Transition			85-115
2380-1840 B.P	6	Shiawassee Early Woodland			115-120
2530-2380 B.P.	5a	Schultz/Shiawassee Early Woodland Transition			150-120
2500-2540 B.P.	4	Schultz Early Woodland	Lower Dark Silts		150-170
2500 B.P.	3	Late Archaic/Early Woodland			>170
	2		Gray Silts	Erosional Disconformity	
	1b		Bedded Sands		

* Note: General Depth is measured in cm below surface. General Depth is an average of all columns sampled. Actual depth of each unit varies by column.

Figure 3: Schultz Site Unit Correlations

glacial lobes of ice retreated, proglacial lakes developed in the moraine-rimmed lowland basins.

Early Holocene lacustrine deposits underlie the cultural strata at the Schultz Site and the faunal materials (Lovis et al. 1994: 7). By 3000 B.P., isostatic rebound, outlet incisions, and shifting outlets had decreased lake levels in the Lake Huron basin (Lovis et al. 1994: 7-8). As lake level stabilized, new drainage patterns developed between the Saginaw River and Lake Huron (Lovis et al. 1994: 8).

Contrary to Eschman and Karrow (1985), a more detailed basin-wide variation model has been proposed for the Great Lakes region by Larsen (1985). This model suggests that variation in precipitation and/or temperature and evaporation rates periodically raised lake level in the Huron/Michigan basin (Larson and Schaetzal 2001). Based upon fluvial dynamics, streams grading to higher base lake levels would have led to flooding in the adjacent riverine areas. At other times, streams grading to lower base lake levels would have led to further down-cutting events, creating a depositional sequence such as that found at the Schultz Site 20SA2 (Lovis et al. 1994: 9)(Figure 3). Overall, it is likely that a combination of the two models affected the changing lake levels at the Schultz Site (Larson and Schaetzal 2001).

Modern Local Environment

The Schultz Site 20SA2 (Figure 1) is nestled inland from Saginaw Bay between the confluence of the Tittabawassee and Saginaw rivers, just down-stream of the Cass and Shiawassee rivers. Politically located within the city of Saginaw, Michigan, the site is contained by a local levee (Ozker 1982: 7) and is situated within an extensive moraine-bounded drainage basin, (Speth 1972: 67)(Figure 1). The waters of four rivers---the Tittabawassee, Shiawassee, Flint, and Cass---converge to form the Saginaw River before flowing into Saginaw Bay. The area is low-lying and notable for its minimal gradient. Sandy dunes mark the shorelines of past lake stages. The Schultz Site is near the confluence of this dendritic river system, towards the northwest corner of the Shiawassee Flats.

The Shiawassee Flats are often overlain by water, creating a large wetland and swamp environment around the Schultz Site. The resulting wetlands, past and present, support a diverse population of aquatic and semi-aquatic animals (Ozker 1982).

Properly defined, the Schultz Site is bounded by the Tittabawassee River to the northwest and the Shiawassee River on the southwest (Fitting 1972: 5). The Shiawassee, Flint, and Cass Rivers drain the land to the south and east of the site (Figure 1), reaching maximum discharge much earlier in the spring than the Tittabawassee River draining the land to the north and west (Fitting 1972: 43). Often, the confluence of flood periods caused the area to be underwater, creating ponds between moraine ridges as the Saginaw River slowly emptied into Saginaw Bay (Fitting 1972: 44).

Cultural Context

The post-glacial fluctuations of lake levels in the Great Lakes region can be related to changes in habitation patterns within the region (Table 1). People were clearly in Michigan at least as early as the Paleo-Indian period of ca. 12,000 to 10,000 B.P. (Shott and Wright 1999: 61). There are archaeological data from nearby sites within the Saginaw Valley showing occupation as early as 10,400 B.P. (Shott and Wright 1999: 63). Fluctuations in lake level would have caused the Paleo-Indian peoples to move about frequently (Shott 1986).

Within Michigan and the Great Lakes area, the Saginaw Valley provides the best-dated Archaic sequence in the region (Lovis and Robertson 1989). Lovis and Robertson (1989) propose an Archaic chronology of the Saginaw Valley in which a resident population of humans is assumed, although much of the data, including sites and artifacts from the Early and Middle Archaic Periods, are likely unrecoverable and underwater at present (Lovis 1999: 83-124). Termed the Dehmel Road Phase, the late Middle Archaic between 6,200 and 4,500 B.P. is characterized by a series of large, side-notched points. The Archaic archaeological remains suggest "diffuse" economic activities that include a diverse range of subsistence resources (Lovis 1999: 110).

Table 1: Archaeological Cultural Chronology of Research Area

Saginaw Thin Late Woodland	820 B.P.
Late Middle Woodland (Ruben)/ Early Late Woodland (Saginaw Thin)	1550 B.P.
Green Point Middle Woodland	1690 B.P.
Green Point/ Tittabawassee Middle Woodland Transition	1700 B.P.
Shiawassee Early Woodland/Tittabawassee Middle Woodland Transition	1840-1690 B-P
Shiawassee Early Woodland	2380-1840 B.P.
Schultz/Shiawassee Early Woodland Transition	2530-2380 B.P.
Schultz Early Woodland	2540-2500 B.P.
Late Archaic/Early Woodland	2500 B.P.

Note: Nomenclature and dates mostly follow Fitting (1972).

The use of cherts, greywacke, and argillite to produce stem-styled points, are dated to between 4,500 and 3,500 B.P., in the Late Archaic. The next 1,000 years leads into the Early Woodland ceramic-producing culture around 2,500 B.P. Several local stylistic variations of projectile points are evidenced throughout the region in the late Archaic period. Most notable, at ca. 2,500 B.P., are the Meadowood points. These points, however, do not correspond directly with the Early Woodland ceramics associated with the Schultz complex (Lovis and Robertson 1989).

Wilkinson (1971: 7-10) defines the term "Woodland" in the context of chronologies emerging from the region.

> The term "Woodland" refers to the prehistoric groups in the Eastern United States whose culture was characterized by relatively simple grit-tempered pottery and a subsistence level based primarily upon hunting and gathering, although agriculture became increasingly important during the later periods. Woodland populations are further characterized by regional variations in this basic pattern, and are differentiated from the earlier, pre-pottery Archaic groups and the later, strongly agricultural groups of the Mississippi Valley. This generalized Woodland culture is commonly broken down into three divisions; Early, Middle and Late....as there are marked cultural differences between them.

Late Archaic, Early Woodland, and Middle Woodland periods are present at the Schultz Site 20SA2 (Figure 3). From ca. 2,500 to 2,200 B.P., the Early Woodland populations used burial mounds, built earthworks, developed a basic, rough pottery form, and incorporated cultigens in their subsistence strategies (Halsey 1999: 125-146).

Around 2,200 B.P. and continuing for approximately 600 years, pottery styles increased in variability, as did the cultivation of agricultural products. In addition, mortuary and ceremonial activities increased in frequency as well as in degree of elaboration (Kinglsey 1999: 159). This marks the Middle Woodland period (Wilkinson 1971:9), one of the peak cultural periods at the Schultz Site.

The Schultz Site occupation was slightly later than other areas, due to high water levels. However, once the lake levels receded, due to its highly favorable location and unique environment, the Schultz Site was even more heavily occupied than neighboring regions (Kinglsey 1999).

Following the Middle Woodland peak of development, an increase in sedentary cultural activity in the Saginaw Valley marks the end of the Middle Woodland period and the beginning of the Late Woodland period, ca 1600 B.P. (Kingsley 1999: 172). Archaeological data shows that by 1000 B.P., few Late Woodland sites remained in the Saginaw Valley. Lovis et al. (1994) suggest this decrease may be due to a logistical shift to smaller scale, transient hunting-and-fishing activities in the Saginaw Valley. They further suggest that the transition may be due to the development of intensive horticulture in the region indicative of increased seasonal exploitation of resources, shifting settlement patterns, and general movement to upland areas for maize cultivation (Lovis et al. 1994: 22).

One of the primary goals of the 1991 excavation was to collect comprehensive environmental data and apply that data to interpretation of spatial and temporal changes at the site and in the region (Lovis et al. 2001: 3). Prior research indicated variability in the environment both across the Saginaw Valley as well as through time, although current research supports a basin-wide variation model as the cause (Larsen 1985). As the environment changed as a result of changing temperature, precipitation, and evaporation rates in the area, so did habitation patterns. Frequent fluctuations in lake level would have spurred frequent movement as indicated in the Paleo-Indian Period both of which reduced over time. Movements became seasonally based, as lake and climatic fluctuations stabilized and the horticultural practices developed in the Saginaw Valley.

CHAPTER 2: FAUNAL ANALYSIS THROUGH TAPHONOMY, SEASONALITY, AND IDENTIFICATION

Faunal analysis is often undertaken as a means of examining the relative importance of major classes of fauna. Review of the death assemblage as a whole, both temporally and spatially, can illustrate changing patterns of exploitation. However, several factors can greatly influence the recoverability of species. These factors may include taphonomy and related faunal preservation, seasonality, and the identification rates of the remains.

Taphonomy and Faunal Preservation

Data obtained from faunal analyses are important in paleoecological and paleoenvironmental studies. The taphonomy of animal remains from archaeological sites often reflects cultural activity, or selective cultural pressures, in addition to natural phenomena (Gifford 1981).

If a death by natural causes is assumed, rather than a culturally derived one, several factors can affect the remains prior to burial (Schiffer 1976). Initially, scavenging may disarticulate the skeleton, removing skin and muscle tissue that could have enhanced preservation by protecting the bones and keeping them intact. The exposed bones are then exposed to further weathering or erosional actions on a daily and seasonal scale (Micozzi 1991:5).

Diagenesis may be much more extensive in climatically diverse regions that experience periods of heat and freezing temperatures. Freezing and thawing of the ground around the remains cause the ground to swell and contract and can cause periods of burial and re-exposure through time. Action by burrowing animals in and around the remains can also disrupt the bones, causing some to be buried more quickly than others, and consequently allowing some of the bones to be better preserved than others when rapidly buried and undisturbed (Micozzi 1991: 72).

According to Gifford (1981), soil conditions can also be an important factor in preservation. In regions of highly acidic soils, the chance for long-term preservation is reduced, as the acid in the soil begins to leach away the calcium in the bones. In the Great Lakes region, coniferous forests are numerous and widespread. Conifers are notorious for their removal of nutrients from the surrounding forest floor, leaving the slight soil cover very acidic. In coniferous regions, the high soil acidity is coupled with poor soil quality and soil depth, reducing the probability of burial and recovery because soil formation is hindered (Smith 1996). The longer the bones are exposed to the surface elements, the fewer there will be to recover. Once deposited in the soil, the bones are degraded by the acidic soil, so the longer the bones have been within a coniferous region, the fewer there will be remaining and susceptible to recovery in the future (Smith 1996).

Preservation near water margins is, however, much more likely (Gifford, 1981). Shoreline regions with deep soils and rapid burial processes at work are likely to be better places for long-term survival of bone. Unlike many other areas in the Great lakes Region, the Saginaw Valley near Lake Huron, where several river drainages merge, is therefore potentially a good place for preservation of skeletal remains.

Bone survivability can also be affected by many intrinsic factors (Micozzi 1991: 55). The age of the deceased animal affects suture patterns and fusion between bones. The bones of younger animals are more susceptible if the epiphyses are still unfused. Mature adult animals will have more robust bones that are likely to survive longer. These older animal bones are also likely larger, and tend to preserve better because there is more material to preserve.

Strong, thick limb bones often preserve well. Small bones, such as phalanges, disarticulate easily and are likely to break down more quickly. The health of the animal at death can also be an important factor in its preservation (Micozzi 1991: 55-7). If an animal is in poor nutritional health, or starved, the minerals and nutrients in the bones will be reduced, as will the muscle mass surrounding them, leading to a quicker breakdown of the tissue and the bones.

Some animals characteristically have dense bones, e.g. mammals and turtles, while others, such as birds and fishes (Casteel 1976: 88), have relatively hollow or brittle bones, and are not as likely to preserve (Smith 1996: 44-45). Dentition, which is high in hard crystalline dentine and enamel, has the highest degree of survivability in faunal remains (Hillson 1986).

Cultural activities affecting taphonomy include prey selection by hunters and gatherers, burning associated with cooking, and waste disposal (Smith 1996: 46). Cultural selection by seasonality and animal type can skew assemblages of faunal remains, leading to a misrepresentation of the local paleoenvironment if bones have been transported (Needs-Howarth 1999: 28). Evidence of transportation may be evident in assemblages of environmentally unrelated fauna.

Culturally related bone transportation is usually due to the butchering associated with killing large animals away from the campsite, and transporting selected valuable pieces over long distances (Smith 1996: 46). The butchering can also lead to fragmenting of certain elements when extracting marrow or brains for eating. Assemblages of elements associated with high nutrient value are therefore likely in some situations (Cleland 1966: 128).

Bones that have a white-blue coloration are indicative of intense burning over an extended period of time (Smith 1996: 45). This is likely a clear indicator of cultural action. Flash forest fires move quickly and pass on, whereas fire pit burning may occur repeatedly in one place over long periods. The white-blue coloring of the bones occurs as the bones are hardened by the fire, and increases the likelihood of preservation as the fragments are flame-hardened and preserved. However, they are often fragmentary, and relatively useless for later identification purposes.

The impact of taphonomy on the faunal remains from the Schultz Site are likely more cultural in nature, rather than a result of natural phenomenon. As the site is located in a near-shore environment, a moderate preservation would be expected. A large number of mammal remains were recovered in the same sedimentary units as fish remains, indicating transportation of killed animals. Furthermore, the majority of the mammal bones were highly fragmented, and many of the bones recovered were calcined. Therefore, it is likely that remains reflect cultural activities or selective cultural pressures.

Seasonality

Tracing seasonal migration, behavior, and behavior patterns of target species can provide additional information on the season of resource exploitation at archaeological sites. Key seasonal indicators vary by taxonomic class.

Reptiles and amphibians normally hibernate in the winter months, following the first frost, until the spring thaw. Therefore, the presence or lack of herpetological specimens in an assemblage can provide seasonal information as well.
The reptile remains from this sample reveals that there may have been a spring to summer occupation or utilization of the Schultz Site, during the Early Woodland Transition period (2380-2500 B.P.).

Many species of fish engage in seasonal behavior. Most fish spawn in the spring, so deep-water fish species may normally be found in the shallows in the springtime. A large number of one type of fish remains may be indicative of spring spawning season targeting. However, the deep-water lake trout is one species that spawns in the fall. The presence of lake trout therefore likely indicates a fall collection method, when they may be easily caught in shallower water.

Black bears average four months of dormancy each year (Cleland 1966: 163). They will awaken or leave their den to defecate or eat during winter warm spells and when disturbed. Following the dormancy period, the black bear goes through one seasonal spring molt (Baker 1983: 438). If black bears are targeted as prey for their pelts, it would be less likely for them to be hunted during the molting period.

Black bear, have been suggested to have been hunted only during the late fall or early winter months when they were both the fattest and least dangerous to hunt, although opportunistic or culturally driven hunting cannot be discounted (Egan 1993: 74).

The Early Woodland periods at the Schultz Site lack diagnostic animal remains for determination of seasonality. The first clear evidence for seasonality of occupation occurs in Stratigraphic Unit 5A, dating to around 2,530-2,380 B.P. in the Early Woodland Period, with reptile and lake trout specimens (Table 2). Since reptiles are indicative of a warm weather occupation and lake trout can be indicative of a fall occupation, the Early Woodland period may show evidence of a dual season occupation. However, the low number of specimens precludes a definitive determination.

Table 2: Summary Statistics (NISP) for Faunal Remains by Unit from the Schultz Site Flotation Material

Taxon ID	Common Name	Stratigraphic Unit										% of Total Specimens
		2	3	4	5A	6	7	8a	8b	8c	Total	
Aves indeterminate		0	1	0	1	0	2	8	13	8	33	
Total Bird		**0**	**1**	**0**	**1**	**0**	**2**	**8**	**13**	**8**	**33**	**0.06%**
Heteromyidae indeterminate		0	0	0	0	0	0	0	1	0	1	
Rodentia indeterminate		1	0	0	0	0	1	1	2	2	7	
Ondatra zibethicus	muskrat	0	0	0	2	0	25	46	27	13	113	
cf. *Ondatra zibethicus*	cf. muskrat	0	0	0	0	1	1	2	2	0	6	
Castor canadensis	beaver	0	0	0	0	2	2	1	4	0	9	
Odocoileus virginianus	white-tailed deer	0	0	0	1	0	2	15	8	1	27	
cf. *Odocoileus virginianus*	cf. white-tailed deer	0	0	0	1	0	1	13	4	0	19	
Ursus americanus	black bear	0	0	0	0	0	0	3	0	0	3	
cf. *Ursus americanus*	cf. black bear	0	0	0	0	0	0	3	0	0	3	
Carnivora indeterminate		0	0	0	0	0	0	0	2	0	2	
Subtotal		**1**	**0**	**0**	**4**	**3**	**32**	**84**	**50**	**16**	**190**	
Mammal indeterminate		0	0	1	55	55	106	706	699	264	1886	
Total Mammal		**1**	**0**	**1**	**59**	**58**	**138**	**790**	**749**	**280**	**2076**	**3.81%**
Acipenser fulvescens	lake sturgeon	0	0	0	2	7	5	186	98	146	444	
Lepisosteus osseus	longnose gar	0	0	1	8	6	20	103	177	137	452	
Salvelinus namaycush	lake trout	0	0	0	1	0	1	5	1	0	8	
Esox lucius	northern pike	0	0	0	1	0	0	4	3	0	8	
Cyprinidae indeterminate		0	0	0	1	0	0	0	0	0	1	
Catostomidae indeterminate		0	0	0	1	0	1	7	7	1	17	
Catostomus sp.	sucker sp.	0	0	0	0	0	0	2	10	6	18	
Catostomus commersonnii	longnose sucker	0	0	0	0	0	0	0	1	1	2	
Moxostoma sp.	redhorse sp.	0	0	0	0	0	0	2	0	0	2	
Ictaluridae indeterminate		0	0	0	0	0	2	1	25	8	36	
cf. *Ictalurus melas*	cf. black bullhead	0	0	0	0	0	0	1	0	0	1	
Ictalurus nebulosus	brown bullhead	0	0	0	0	0	0	0	7	0	7	

Table 2 (cont'd):

Taxon ID	Common Name	Stratigraphic Unit										% of Total Specimens
		2	3	4	5A	6	7	8a	8b	8c	Total	
Ictalurus punctatus	channel catfish	0	0	0	0	0	0	1	1	0	2	
cf. *Ictalurus punctatus*	cf. channel catfish	0	0	0	0	0	0	3	1	0	4	
Ictiobus sp.		0	0	0	0	0	0	1	0	0	1	
Lota lota	burbot	0	0	0	1	0	0	0	0	0	1	
Centrarchidae indeterminate		0	0	0	0	0	1	13	11	5	30	
Micropterus salmoides	largemouth bass	0	0	0	0	0	0	1	0	0	1	
Micropterus sp.	bass sp.	0	0	0	0	0	2	3	2	0	7	
Pomoxis sp.	crappie sp.	0	0	0	0	1	0	1	0	0	2	
Roccus chrysops	rock bass	0	0	0	0	0	0	1	0	0	1	
Percidae indeterminate		0	0	0	0	0	0	0	1	0	1	
Perca flavescens	yellow perch	0	0	0	0	0	1	3	0	0	4	
Stizostedion vitreum	yellow walleye	0	0	1	0	5	25	25	71	24	151	
cf. *Stizostedion vitreum*	cf. yellow walleye	0	0	0	0	0	0	4	1	4	9	
Aplodinotus grunniens	freshwater drum	0	0	0	0	1	1	4	42	26	74	
Subtotal		**0**	**0**	**2**	**15**	**20**	**59**	**371**	**459**	**358**	**1284**	
Osteichthyes sp.		24	74	270	513	1060	1461	12861	20950	13526	50739	
Total Fish		**24**	**74**	**272**	**528**	**1080**	**1520**	**13232**	**21409**	**13884**	**52023**	**95.55%**
Apalone spinifera	spiny turtle	0	0	0	0	0	0	0	1	0	1	
Chelydra serpentina	snapping turtle	0	0	0	0	0	1	10	5	0	16	
cf. *Chelydra serpentina*	cf. snapping turtle	0	0	0	0	0	0	1	0	0	1	
Chrysemys picta	painted turtle	0	0	0	0	0	0	3	3	1	7	
Emydoidea blandingii	Blanding's turtle	0	0	0	0	0	0	6	1	0	7	
cf. *Emydoidea blandingii*	cf. Blanding's turtle	0	0	0	0	0	0	2	0	0	2	
Chleonia sp.		0	0	0	0	0	3	29	16	6	54	
cf. Chelonia sp.	cf. turtle sp.	0	0	0	1	0	0	0	0	0	1	
Colubridae indeterminate		0	0	0	2	0	0	0	4	0	6	
Thamnophis sp.	garter/ribbon snake	0	0	0	1	0	0	0	5	4	10	
cf. Thamnophis sp.	cf. garter/ribbon snake	0	0	0	0	0	0	0	0	1	1	
Total Reptile		**0**	**0**	**0**	**4**	**0**	**4**	**51**	**35**	**12**	**106**	**0.19%**

Table 2 (cont'd):

Taxon ID	**Common Name**	**Stratigraphic Unit**										**% of Total Specimens**
		2	**3**	**4**	**5A**	**6**	**7**	**8a**	**8b**	**8c**	**Total**	
Class indeterminate		0	0	0	1	2	4	11	72	119	209	**0.38%**
Total - All Taxa		**25**	**75**	**273**	**593**	**1140**	**1668**	**14092**	**22278**	**14303**	**54447**	

	Startigraphic Unit									
	2	**3**	**4**	**5**	**6**	**7**	**8a**	**8b**	**8c**	
% of Total Specimens	0.05%	0.14%	0.50%	1.09%	2.09%	3.06%	25.88%	40.92%	26.27%	**54447**

Two turtle bones were recovered from Stratigraphic Unit 4, four reptile specimens, turtle and snake, were recovered from Unit 5A, and four turtle specimens were recovered from Unit 7 (Table 2). During the Middle Woodland Periods spanning Stratigraphic Units 8a-8c, 98 reptile specimens were recovered (Figure 4)(Table 2). Of the 109 reptile remains reviewed in this thesis sample, 98 of them date to the Middle Woodland period (Table 2). This large percentage seems indicative of a spring to summer occupation or utilization of the Schultz Site region during the Middle Woodland period.

Lake trout were recovered in Stratigraphic Units 5A, 7, 8a, and 8b (Figures 5-7)(Table 2). Although only one specimen is positively identified for Units 5A (Figure 5), 7 (Figure 6), and 8b (Figure 6), there are five specimens from Unit 8a (Figure 6 & 7). These remains could suggest a fall occupation or utilization for the Schultz Site region during the Early Woodland and Middle Woodland periods, particularly around 300 A.D (Figure 3).

Positively identified black bear remains were recovered only from Stratigraphic Unit 8a, column 91-2, in the flotation samples (Figures 8 & 9), and possible black bear remains were recovered in Unit 4, column 91-2, of the screened material. Therefore, the black bear remains may indicate a late fall or winter occupation during the Middle Woodland period, and possibly during the Early Woodland Period.

In the sample studied, deer are rare during Early Woodland period. However, during the Early-Middle Woodland period they are much more numerous. A fragment of deer skull

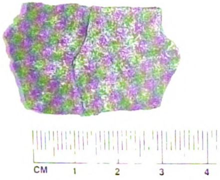

FIGURE 4:
Eastern Spiny Softshell Turtle *(Apalone spinifera)*
Carapace (fragment)

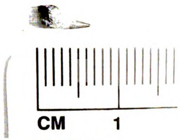

FIGURE 5:
Lake Trout *(Salvelinus namaycush)*
Dentary Tooth
Unit 5

Unit 7 **Unit 8a** **Unit 8b**

Figure 6:
Lake Trout *(Salvelinus namaycush)*
Dentary Fragments

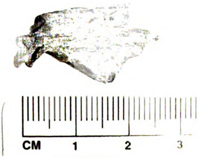

FIGURE 7:
Lake Trout *(Salvelinus namaycush)*
Left Articular (fragment)
Unit 8a

FIGURE 8:
Worked Bear *(Ursus americanus)*
Tooth

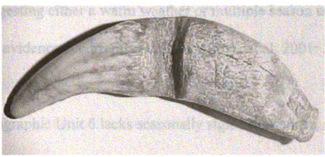

FIGURE 9:
Worked Bear *(Ursus americanus)*
Tooth Close-Up

FIGURE 10:
Worked Deer *(Odocoileus virginianus)*
Skull and Antler Fragment

and attached antler was recovered from Stratigraphic Unit 8a, also indicating a fall occupation for the Middle Woodland occupation of the site (Figure 10).

Cleland (1966) and Fitting (1972: 268) suggested a winter occupation of the Early Woodland Schultz Site. Ozker (1982) contradicted Cleland and Fitting, suggesting a dual season occupation in both early summer and autumn. The Column 11 identified specimens were similar to the remains identified in the remaining five columns and screened material, suggesting either a warm weather or multiple season utilization of the site, but no conclusive evidence is currently available (Lovis et al. 2001: 21-22).

The sample from Stratigraphic Unit 6 lacks seasonally significant bones, although snapping turtle was recovered in the Column 11 sample (Lovis et al. 1994). Lake trout and reptile remains recovered from Stratigraphic Unit 7 spanning 1840-1700 B.P. of the Shiawassee Early Woodland/Tittabawassee Middle Woodland Transitional period also suggest a dual warm weather and fall occupation.

Remains from Unit 8a, of the Middle Woodland Period, include both seasonally warm weather fauna including 51 turtle bones, as well as fall fauna including the aforementioned deer antler (Figure 10), black bear bones, and five lake trout bones (Figures 5-7)(Table 2). Stratigraphic Unit 8a, dating to approximately 1,700 B.P., may therefore reflect a year-round or minimally a multiple-season occupational period of the Schultz Site.

Remains from Unit 8b, of the Middle Woodland Period, also represent a multi-seasonal assemblage, including 26 turtles, nine snakes, and one lake trout (Table 2). The remains recovered from Unit 8c include 12 reptile bones, indicative of a warmer season (Table 2). Therefore, it is possible that the Schultz Site was being occupied primarily during the spring and summer months during this interval.

Fitting (1972: 269) proposed that during the Middle Woodland Period, the Schultz Site was occupied during both the summer and the fall on the basis of artifactual, faunal, floral, and cultural densities. Column N11 faunal and floral data support a late summer-early fall encampment during the Middle Woodland Period (Lovis et al. 2001: 22). The fauna reviewed in this thesis suggest a multiple season occupation during the Middle Woodland Period. These more recent findings corroborate Cleland's (1966: 143) argument for a spring/summer/fall occupation of the Schultz Site during the Middle Woodland Period.

Like the N11 faunal sample, the bird remains reviewed in this faunal sample were relatively unimportant, as no elements could be meaningfully identified to a more specific identification taxon than class (Lovis et al. 1994: 21). Avian bone is present only in Stratigraphic Units 3, 5A, 7, 8a, 8b, and 8c (Table 2). There was only one avian bone recovered from each of Units 3 and 5A and two avian bones recovered from Unit 7. The majority of the avian remains were recovered from the Middle Woodland Units. There were eight bones from both Unit 8a and Unit 8c, and 13 bones recovered from Unit 8b.

Methodology

Column N11, from Trench 91-1 has previously been analyzed and described in Lovis et al. 1994 and 2001 (Figure 2). Identification of the remaining material from the aforementioned screened and the other four flotation samples followed the zooarchaeological methods established by Beverley A. Smith in preparation of those reports (Lovis et al., 1994, 2001).

Identifications include documentation of the specimen's provenience, taxon identification, skeletal element, side and portion of the element, and other observations such as age, cultural and/or natural modification and other notes as appropriate (Lovis et al. 1994).

This research was facilitated by Dr. Beverley A. Smith, University of Michigan-Flint, who directed the analysis and verified the identifications. The extensive comparative skeletal collections at the Michigan State University Museum were the key resource used to identify the faunal material as precisely as possible. Literature on comparative osteology was also used (Gilbert 1990, Gilbert et al. 1985, Olsen 1971, Rackham 1994). Snake vertebrae were identified by Dr. J.A. Holman of the Michigan State University Museum.

Previous analysis of the Schultz Site by Cleland (1966), Luxenberg (1972) and Lovis et al. (1994) suggested notable differences in both the intensity of occupation and the faunal utilization through time, although the faunal density is fairly high throughout (Lovis et al. 1994). The relative density of the fauna recovered from each unit is an indicator of the intensity of occupation (Lovis et al. 1994). The earlier work suggested a lower density occupation during the Early Woodland, Transitional, and Late Woodland periods, with maximum occupational density occurring during the Middle Woodland period (Cleland 1966, Luxenberg 1972).

The 1991 Michigan State University excavation faunal sample size was over 100,000 specimens, mostly bone fragments, none of which were articulated or associated. Over 55,000 fragments were reviewed for the 1994 report from Column N11, leaving approximately 54,000 fragments for review in this thesis. The N11 fragments previously reviewed had an identification rate of 6.5% (Lovis et al. 1994).

Flotation Sample

The faunal flotation sample from column N11 totaled 55,145 specimens, whereas columns 26N, 34.5N, 91-2, 91-3 cumulatively totaled 54,447 specimens (Tables 3-6). All vertebrate classes, with the exception of amphibians, are represented in this sample (Figure 12). As with the N11 sample (91.2%), fish (Osteichthyes) dominate the sample (columns 26N, 34.5N, 91-2, 91-3) and comprise 96.3 percent of the overall total in all stratum levels.

Table 3: Column 26N Summary Statistics (NISP) for Faunal Remains by Unit from the Schultz Site Flotation Material

Taxon ID	Common Name	Stratigraphic Unit										
		2	**3**	**4**	**5A**	**6**	**7**	**8a**	**8b**	**8c**	**Total**	**% of Total Specimens**
Aves indeterminate		0	0	0	1	0	1	0	0	0	2	
Total Bird		**2**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**2**	**0.06%**
Rodentia indeterminate		0	0	0	0	0	1	1	0	0	2	
Ondatra zibethicus	muskrat	0	0	0	2	0	4	1	0	0	7	
Castor canadensis	beaver	0	0	0	0	0	1	0	0	0	1	
Odocoileus virginianus	white-tailed deer	0	0	0	1	0	2	0	0	0	3	
cf. *Odocoileus virginianus*	cf. white-tailed deer	0	0	0	1	0	0	0	0	0	1	
Subtotal		**0**	**0**	**0**	**4**	**0**	**8**	**2**	**0**	**0**	**14**	
Mammal indeterminate		0	0	1	53	0	97	57	0	0	208	
Total Mammal		**0**	**0**	**1**	**57**	**0**	**105**	**59**	**0**	**0**	**222**	**6.70%**
Acipenser fulrescens	lake sturgeon	0	0	0	2	0	2	5	0	0	9	
Lepisosteus osseus	longnose gar	0	0	1	8	0	9	2	0	0	20	
Salvelinus namaycush	lake trout	0	0	0	0	0	1	0	0	0	1	
Esox lucius	northern pike	0	0	0	1	0	0	0	0	0	1	
Cyprinidae indeterminate		0	0	0	1	0	0	0	0	0	1	
Catostomidae indeterminate		0	0	0	1	0	1	0	0	0	2	
Ictaluridae indeterminate		0	0	0	0	0	2	3	0	0	5	
Lota lota	burbot	0	0	0	1	0	0	0	0	0	1	
Centrarchidae indeterminate		0	0	0	0	0	1	0	0	0	1	
Micropterus salmoides	largemouth bass	0	0	0	0	0	0	1	0	0	1	
Micropterus sp.	bass sp.	0	0	0	0	0	1	2	0	0	3	
Perca flavescens	yellow perch	0	0	0	0	0	1	1	0	0	2	
Stizostedion vitreum	yellow walleye	0	0	1	0	0	24	6	0	0	31	
Aplodinotus grunniens	freshwater drum	0	0	0	0	0	1	0	0	0	1	
Subtotal		**0**	**0**	**2**	**14**	**0**	**43**	**20**	**0**	**0**	**79**	
Osteichthyes sp.		0	68	263	497	0	1227	937	0	0	2992	
Total Fish		**0**	**68**	**265**	**511**	**0**	**1270**	**957**	**0**	**0**	**3071**	**92.72%**

Table 3 (cont'd):

Taxon ID	**Common Name**	**Stratigraphic Unit**										
		2	**3**	**4**	**5A**	**6**	**7**	**8a**	**8b**	**8c**	**Total**	**% of Total Specimens**
Chrysemys picta	painted turtle	0	0	0	0	0	0	1	0	0	1	
Chleonia sp.		0	0	0	0	0	2	1	0	0	3	
cf. Chelonia sp.	cf. turtle sp.	0	0	0	1	0	0	0	0	0	1	
Colubridae indeterminate		0	0	0	2	0	0	0	0	0	2	
Total Reptile		**0**	**0**	**0**	**3**	**0**	**2**	**2**	**0**	**0**	**7**	**0.21%**
Class indeterminate		0	0	0	1	0	4	5	0	0	10	**0.30%**
Total - All Taxa		**2**	**68**	**266**	**573**	**0**	**1382**	**1023**	**0**	**0**	**3312**	

	Startigraphic Unit								
	2	**3**	**4**	**5**	**6**	**7**	**8a**	**8b**	**8c**
% of Total Specimens	0.06%	2.05%	8.03%	17.30%	0.00%	41.73%	30.89%	0.00%	0.00%

Table 4: Column 34.5N Summary Statistics (NISP) for Faunal Remains by Unit from the Schultz Site Flotation Material

Taxon ID	Common Name	Stratigraphic Unit										
		2	3	4	5A	6	7	8a	8b	8c	Total	% of Total Specimens
Aves indeterminate		0	1	0	0	0	0	0	0	0	1	
Total Bird		**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0.35%**
Rodentia indeterminate		1	0	0	0	0	0	0	0	0	1	
Ondatra zibethicus	muskrat	0	0	0	0	0	21	0	0	0	21	
cf. *Ondatra zibethicus*	cf. muskrat	0	0	0	0	0	1	0	0	0	1	
Castor canadensis	beaver	0	0	0	0	0	1	2	0	0	3	
cf. *Odocoileus virginianus*	cf. white-tailed deer	0	0	0	0	0	1	0	0	0	1	
Subtotal		**1**	**0**	**0**	**0**	**0**	**24**	**2**	**0**	**0**	**27**	
Mammal indeterminate		0	0	0	2	0	6	8	0	0	16	
Total Mammal		**1**	**0**	**0**	**2**	**0**	**30**	**10**	**0**	**0**	**43**	**15.09%**
Acipenser fulvescens	lake sturgeon	0	0	0	0	0	1	0	0	0	1	
Lepisosteus osseus	longnose gar	0	0	0	0	0	7	0	0	0	7	
Salvelinus namaycush	lake trout	0	0	0	1	0	0	0	0	0	1	
Micropterus sp.	bass sp.	0	0	0	0	0	1	0	0	0	1	
Stizostedion vitreum	yellow walleye	0	0	0	0	0	1	0	0	0	1	
Subtotal		**0**	**0**	**0**	**1**	**0**	**10**	**0**	**0**	**0**	**11**	
Osteichthyes sp.		24	10	7	16	0	81	90	0	0	228	
Total Fish		**24**	**10**	**7**	**17**	**0**	**91**	**90**	**0**	**0**	**239**	**83.86%**
Chleonia sp.		0	0	0	0	0	0	1	0	0	1	
Thamnophis sp.	garter/ribbon snake	0	0	0	1	0	0	0	0	0	1	
Total Reptile		**0**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**2**	**0.70%**
Class indeterminate		0	0	0	0	0	0	0	0	0	0	**0.00%**
Total - All Taxa		**25**	**11**	**7**	**20**	**0**	**121**	**101**	**0**	**0**	**285**	

	Startigraphic Unit								
	2	**3**	**4**	**5A**	**6**	**7**	**8a**	**8b**	**8c**
% of Total Specimens	8.77%	3.86%	2.46%	7.02%	0.00%	42.46%	35.44%	0.00%	0.00%

Table 5: Column T 91-2 Summary Statistics (NISP) for Faunal Remains by Unit from the Schultz Site Flotation Material

Taxon ID	**Common Name**	**Stratigraphic Unit**										
		2	**3**	**4**	**5A**	**6**	**7**	**8a**	**8b**	**8c**	**Total**	**% of Total Specimens**
Aves indeterminate		0	0	0	0	0	0	7	11	4	22	
Total Bird		**0**	**0**	**0**	**0**	**0**	**0**	**7**	**11**	**4**	**22**	**0.07%**
Ondatra zibethicus	muskrat	0	0	0	0	0	0	42	20	2	64	
cf. *Ondatra zibethicus*	cf. muskrat	0	0	0	0	0	0	2	1	0	3	
Castor canadensis	beaver	0	0	0	0	0	0	1	1	0	2	
Odocoileus virginianus	white-tailed deer	0	0	0	0	0	0	13	5	1	19	
cf. *Odocoileus virginianus*	cf. white-tailed deer	0	0	0	0	0	0	13	1	0	14	
Ursus americanus	black bear	0	0	0	0	0	0	3	0	0	3	
Carnivora indeterminate		0	0	0	0	0	0	0	1	0	1	
Subtotal		**0**	**0**	**0**	**0**	**0**	**0**	**74**	**29**	**3**	**106**	
Mammal indeterminate		0	0	0	0	22	0	370	343	186	921	
Total Mammal		**0**	**0**	**0**	**0**	**22**	**0**	**444**	**372**	**189**	**1027**	**3.49%**
Acipenser fulvescens	lake sturgeon	0	0	0	0	3	0	160	51	65	279	
Lepisosteus osseus	longnose gar	0	0	0	0	0	0	54	73	76	203	
Salvelinus namaycush	lake trout	0	0	0	0	0	0	5	1	0	6	
Esox lucius	northern pike	0	0	0	0	0	0	4	0	0	4	
Catostomidae indeterminate		0	0	0	0	0	0	6	4	1	11	
Catostomus sp.	sucker sp.	0	0	0	0	0	0	1	5	4	10	
Catostomus commersonnii	longnose sucker	0	0	0	0	0	0	0	1	1	2	
Moxostoma sp.	redhorse sp.	0	0	0	0	0	0	2	0	0	2	
Ictaluridae indeterminate		0	0	0	0	0	0	15	15	6	36	
Ictalurus nebulosus	brown bullhead	0	0	0	0	0	0	0	6	0	6	
Ictalurus punctatus	channel catfish	0	0	0	0	0	0	0	1	0	1	
cf. *Ictalurus punctatus*	cf. channel catfish	0	0	0	0	0	0	4	1	0	5	
Ictiobus sp.		0	0	0	0	0	0	1	0	0	1	
Centrarchidae indeterminate		0	0	0	0	0	0	13	7	2	22	
Micropterus sp.	bass sp.	0	0	0	0	0	0	1	0	0	1	
Pomoxis sp.	crappie sp.	0	0	0	0	1	0	1	0	0	2	

Table 5 (cont'd):

Taxon ID	**Common Name**	**Stratigraphic Unit**										
		2	**3**	**4**	**5A**	**6**	**7**	**8a**	**8b**	**8c**	**Total**	**% of Total Specimens**
Roccus chrysops	rock bass	0	0	0	0	0	0	1	0	0	1	
Perca flavescens	yellow perch	0	0	0	0	0	0	1	0	0	1	
Stizostedion vitreum	yellow walleye	0	0	0	0	2	0	13	40	14	69	
cf. *Stizostedion vitreum*	cf. yellow walleye	0	0	0	0	0	0	4	1	0	5	
Aplodinotus grunniens	freshwater drum	0	0	0	0	0	0	2	27	15	44	
Subtotal		**2**	**3**	**4**	**0**	**12**	**7**	**288**	**233**	**184**	**711**	
Osteichthyes sp.		0	0	0	0	324	0	9518	10836	6881	27559	
Total Fish		**2**	**3**	**4**	**0**	**336**	**7**	**9806**	**11069**	**7065**	**28270**	**96.17%**
Apalone spinifera	spiny turtle	0	0	0	0	0	0	0	1	0	1	
Chelydra serpentina	snapping turtle	0	0	0	0	0	0	10	5	0	15	
cf. *Chelydra serpentina*	cf. snapping turtle	0	0	0	0	0	0	1	0	0	1	
Chrysemys picta	painted turtle	0	0	0	0	0	0	2	2	1	5	
Emydoidea blandingii	Blanding's turtle	0	0	0	0	0	0	6	1	0	7	
cf. *Emydoidea blandingii*	cf. Blanding's turtle	0	0	0	0	0	0	2	0	0	2	
Chleonia sp.		0	0	0	0	0	0	23	8	0	31	
Total Reptile		**0**	**0**	**0**	**0**	**0**	**0**	**44**	**17**	**1**	**62**	**0.21%**
Class indeterminate		0	0		0	0	0	2	4	8	14	**0.05%**
Total - All Taxa		**2**	**3**	**4**	**0**	**358**	**7**	**10303**	**11473**	**7267**	**29395**	

	Startigraphic Unit								
	2	**3**	**4**	**5**	**6**	**7**	**8a**	**8b**	**8c**
% of Total Specimens	0.01%	0.01%	0.01%	0.00%	1.22%	0.02%	35.05%	39.03%	24.72%

Table 6: Column T 91-3 Summary Statistics (NISP) for Faunal Remains by Unit from the Schultz Site Flotation Material

Taxon ID	Common Name	Stratigraphic Unit										
		2	3	4	5A	6	7	8a	8b	8c	Total	% of Total Specimens
Aves indeterminate		0	0	0	0	0	1	1	2	4	8	
Total Bird		**0**	**0**	**0**	**0**	**0**	**1**	**1**	**2**	**4**	**8**	**0.04%**
Heteromyidae indeterminate		0	0	0	0	0	0	0	1	0	1	
Rodentia indeterminate		0	0	0	0	0	0	0	3	2	5	
Ondatra zibethicus	muskrat	0	0	0	0	0	0	3	7	11	21	
cf. *Ondatra zibethicus*	cf. muskrat	0	0	0	0	1	0	0	1	0	2	
Castor canadensis	beaver	0	0	0	0	2	0	0	1	0	3	
Odocoileus virginianus	white-tailed deer	0	0	0	0	0	0	2	3	0	5	
cf. *Odocoileus virginianus*	cf. white-tailed deer	0	0	0	0	0	0	0	3	0	3	
Carnivora indeterminate		0	0	0	0	0	0	0	1	0	1	
Subtotal		**0**	**0**	**0**	**0**	**3**	**0**	**5**	**20**	**13**	**41**	
Mammal indeterminate		0	0	0	0	33	3	31	356	78	501	
Total Mammal		**0**	**0**	**0**	**0**	**36**	**3**	**36**	**376**	**91**	**542**	**2.55%**
Acipenser fulvescens	lake sturgeon	0	0	0	0	4	2	21	47	81	155	
Lepisosteus osseus	longnose gar	0	0	0	0	6	4	47	104	61	222	
Esox lucius	northern pike	0	0	0	0	0	0	0	3	0	3	
Catostomidae indeterminate		0	0	0	0	0	0	1	3	0	4	
Catostomus sp.	sucker sp.	0	0	0	0	0	0	1	5	2	8	
Ictaluridae indeterminate		0	0	0	0	0	0	3	10	2	15	
Ictalurus nebulosus	brown bullhead	0	0	0	0	0	0	0	1	0	1	
Ictalurus punctatus	channel catfish	0	0	0	0	0	0	1	0	0	1	
Centrarchidae indeterminate		0	0	0	0	0	0	0	4	3	7	
Micropterus sp.	bass sp.	0	0	0	0	0	0	0	2	0	2	
Percidae indeterminate		0	0	0	0	0	0	0	1	0	1	
Perca flavescens	yellow perch	0	0	0	0	0	0	1	0	0	1	
Stizostedion vitreum	yellow walleye	0	0	0	0	3	0	6	31	10	50	
cf. *Stizostedion vitreum*	cf. yellow walleye	0	0	0	0	0	0	0	0	4	4	

Table 6 (cont'd)

Taxon ID	Common Name	Stratigraphic Unit										
		2	**3**	**4**	**5A**	**6**	**7**	**8a**	**8b**	**8c**	**Total**	**% of Total Specimens**
Aplodinotus grunniens	freshwater drum	0	0	0	0	1	0	2	15	11	29	
Subtotal		**2**	**3**	**4**	**0**	**20**	**13**	**83**	**226**	**174**	**503**	
Osteichthyes sp.		0	0	0	0	736	153	2316	10172	6652	20029	
Total Fish		**2**	**3**	**4**	**0**	**756**	**166**	**2399**	**10398**	**6826**	**20532**	**96.42%**
Chelydra serpentina	snapping turtle	0	0	0	0	0	1	0	0	0	1	
Chrysemys picta	painted turtle	0	0	0	0	0	0	0	1	0	1	
Chleonia sp.		0	0	0	0	0	1	4	8	6	19	
Colubridae indeterminate		0	0	0	0	0	0	0	4	0	4	
Thamnophis sp.	garter/ribbon snake	0	0	0	0	0	0	0	5	4	9	
cf. Thamnophis sp.	cf. garter snake	0	0	0	0	0	0	0	0	1	1	
Total Reptile		**0**	**0**	**0**	**0**	**0**	**2**	**4**	**18**	**11**	**35**	**0.16%**
Class indeterminate		0	0	0	0	2	0	4	68	104	178	**0.84%**
Total - All Taxa		**2**	**3**	**4**	**0**	**794**	**172**	**2444**	**10862**	**7036**	**21295**	

	Startigraphic Unit								
	2	**3**	**4**	**5**	**6**	**7**	**8a**	**8b**	**8c**
% of Total Specimens	0.01%	0.01%	0.02%	0.00%	3.73%	0.81%	11.48%	51.01%	33.04%

The faunal remains in this sample also reflect an intense increase in site occupation during the Middle Woodland time period (Table 2). Recovered faunal specimens in Units 2-7 increase gradually from 25 to 1668 specimens. The remains then increase sharply into the tens of thousands of specimens during the Middle Woodland period. Unit 8a produced 14,092 specimens, Unit 8b produced 22,278 specimens, and Unit 8c produced 14,303 specimens.

Faunal remains described in this study indicate an increasing occupational intensity in the area from the Early to Middle Woodland Period. The numbers of recovered specimens in Stratigraphic Units 2-7 reflect a gradual temporal increase (Table 2); faunal specimens in Units 2-7 increase gradually from 25 to 1668 specimens. Figure 11 also shows increasing evidence of habitation spatially across the site. Figure 11a and 11b illustrate the East-West and North-South correlation of Stratigraphy. Stratigraphic Unit 2 is only evidenced in two flotation columns, whereas Unit 7 is represented in five flotation columns.

Although present in the Early/Middle Woodland Periods, birds (Aves), and turtles and snakes (Reptilia), are only minor components of this faunal assemblage, comprising less than one percent of the total assemblage and diversity (columns 26N, 34.5N, 91-2, 91-3) of any unit (Figures 12-16)(Tables 2-6). Overall, the highest level of faunal concentration occurs in Unit 8b, which yielded nearly 41 percent of the total sample.

Also mirroring the N11 results, fish increase in occurrence during the Early Woodland and the Early-Middle Woodland transition, and constitute over 90 percent of the faunal

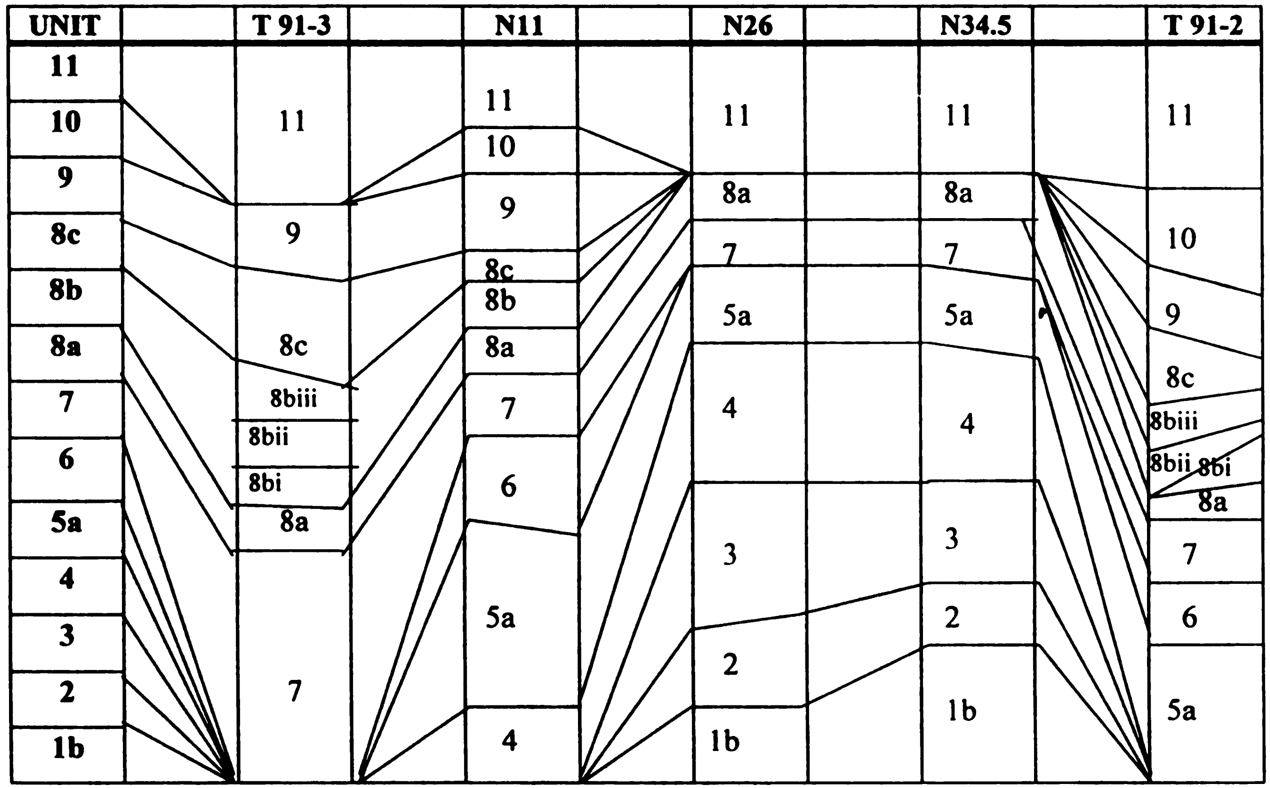

Figure 11: Spatial Stratigraphic Correlation of the Schultz Site

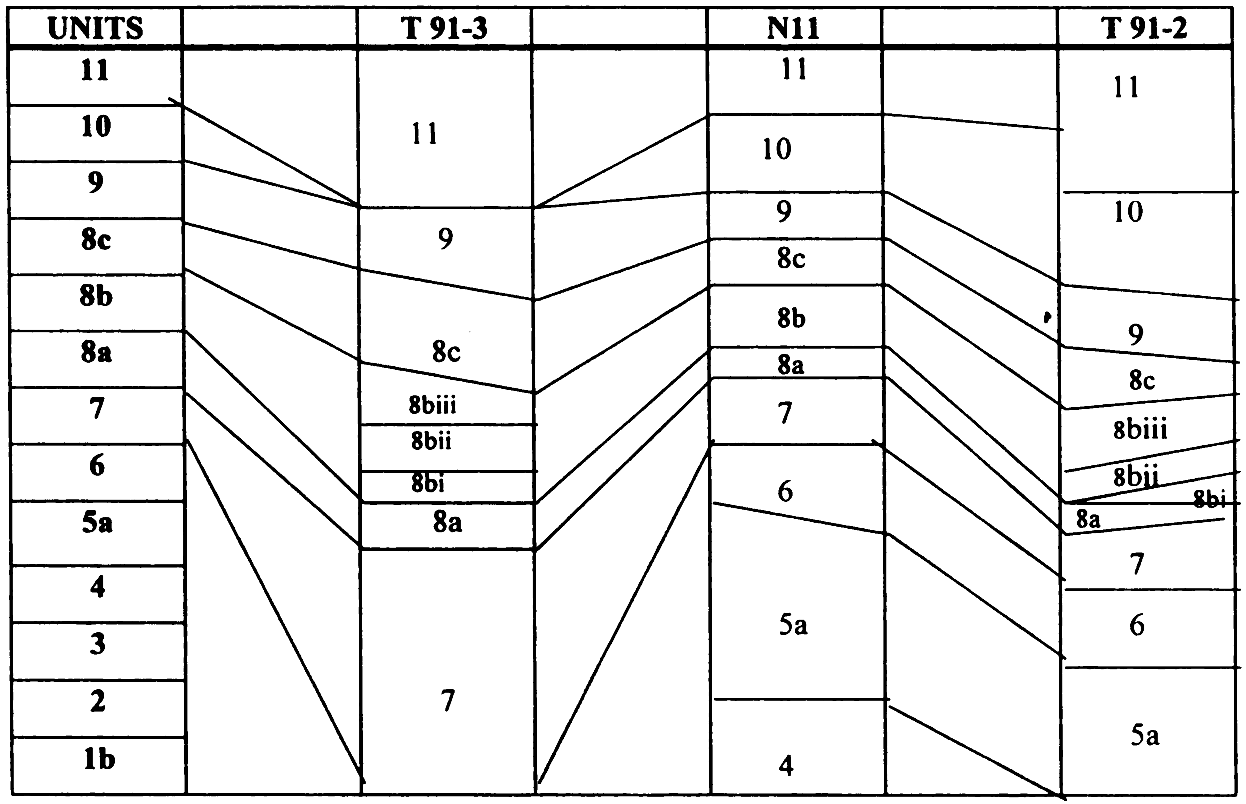

Figure 11a: East-West Spatial Stratigraphic Correlation of the Schultz Site

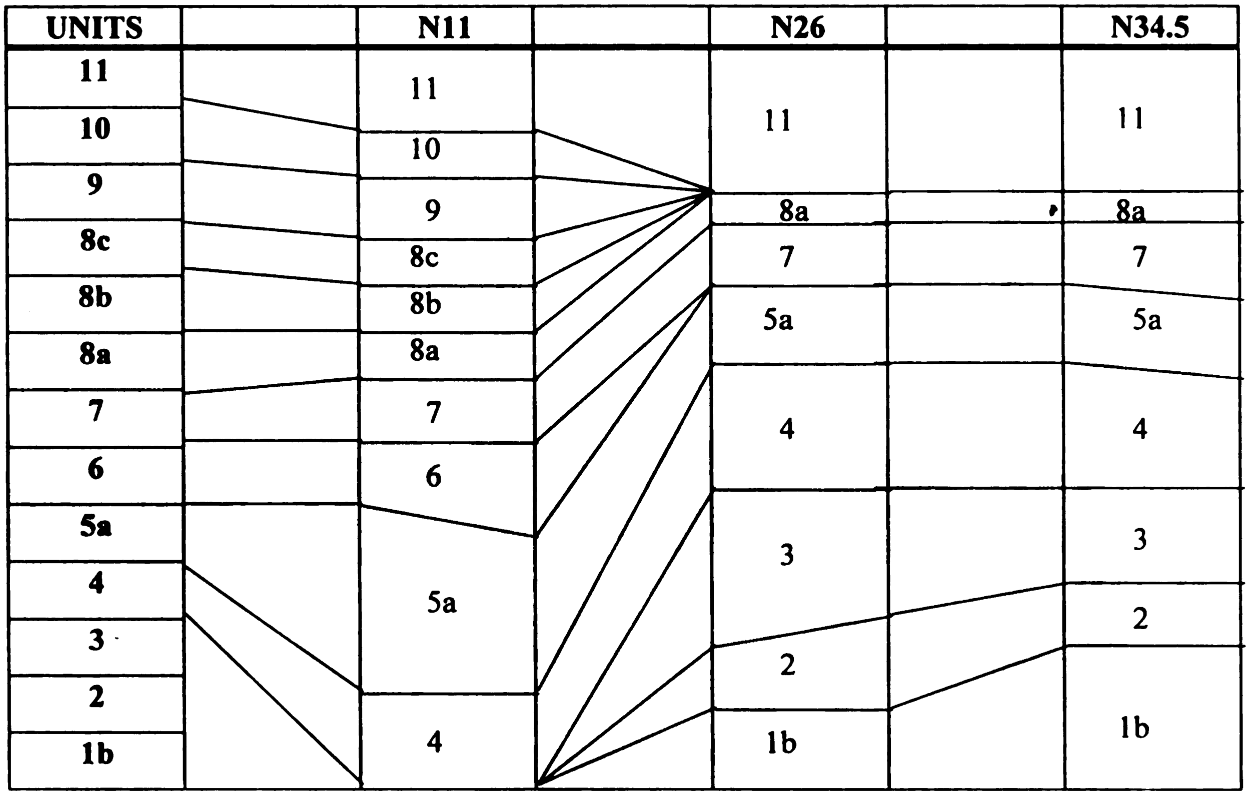

Figure 11b: North-South Stratigraphic Correlation of the Schultz Site

Class Composite

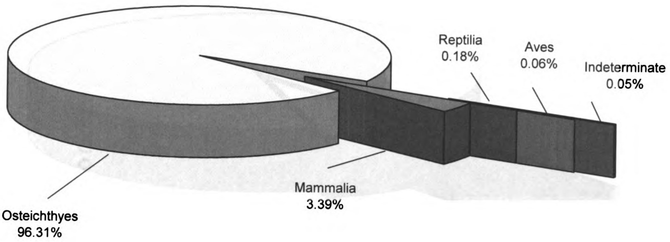

Figure 12: Schultz Site Flotation Material Composite of Faunal Remains
(Flotation Columns 26N, 34.5N, 91-2, 91-3)

Column 26N Class Composite

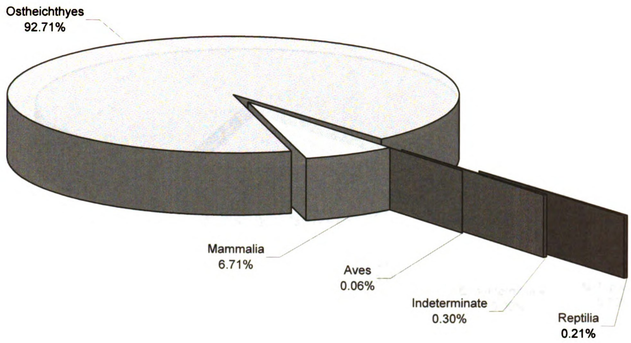

Figure 13: Schultz Site Flotation Material Composite of Faunal Remains
(Flotation Column 26N)

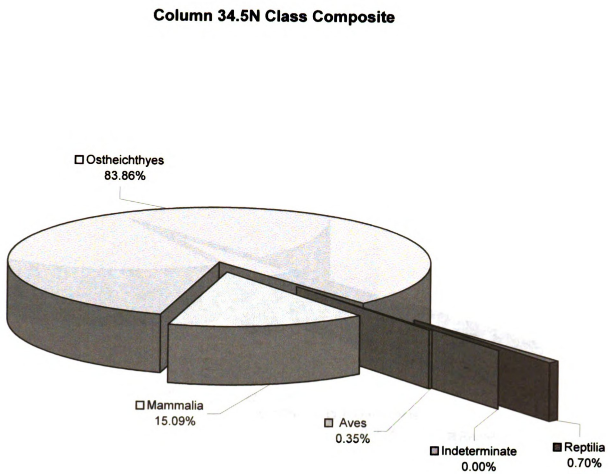

Figure 14: Schultz Site Flotation Material Composite of Faunal Remains
(Flotation Column 34.5N)

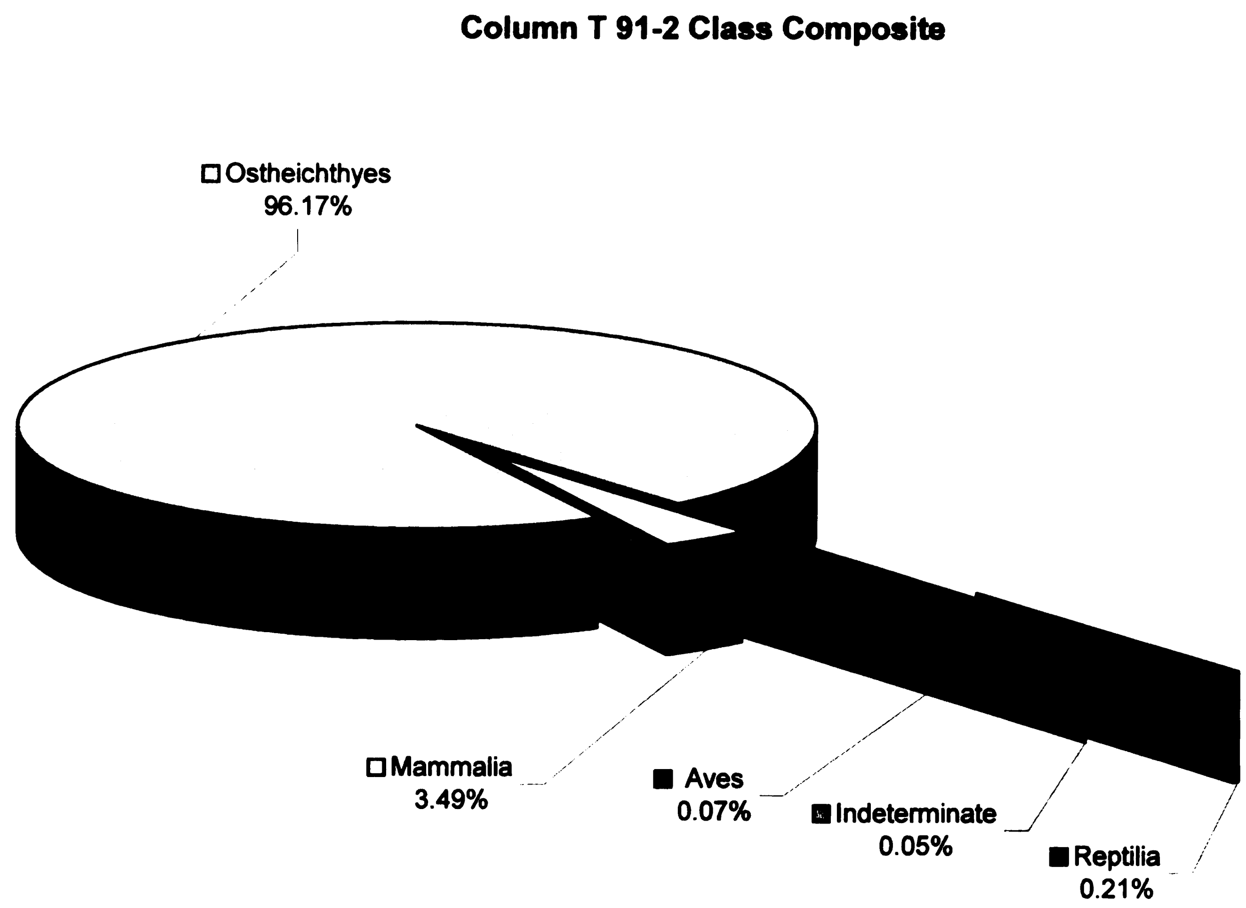

Figure 15: Schultz Site Flotation Material Composite of Faunal Remains
(Flotation Column T 91-2)

Column T 91-3 Class Composite

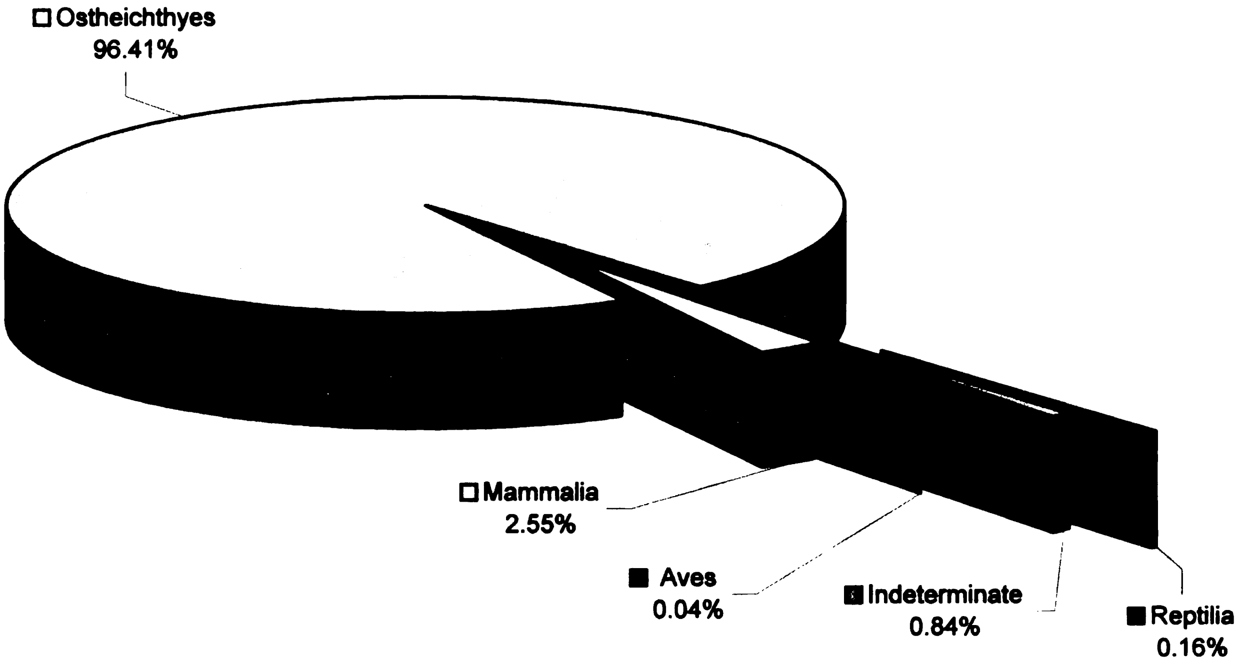

Figure 16: Schultz Site Flotation Material Composite of Faunal Remains
(Flotation Column T 91-3)

assemblage throughout the Middle Woodland occupations (Figure 3). Although the fish remains do increase in representation in Units 2-7, they increase most dramatically during the Middle Woodland Green Point Units (Units 8a-8c). Like the column N11 sample, Unit 8a of this sample reflects a significant increase, over 800%, in the absolute number of fish bones from unit 7 (Lovis et al. 2001: 20). The maximum peak for fish representation occurs in level 8b (Table 2).

The faunal flotation sample was also analyzed by excavation column (26N, 34.5N, 91-2, 91-3) (Figure 17). The results indicate a spatial variation in occupation as well as the temporal variation indicated by unit. Overall, more than 90 percent of the faunal remains were recovered from North-South columns 91-2 and 91-3 (Figure 18). The largest percentage of faunal material was recovered from column 91-2, representing 54.2 percent of the sample, column 91-3 represented 39.2 percent, column 26N represented 6.1 percent, and column 34.5 reflected a minimal representation at 0.5 percent of the entire sample. The distribution of the faunal remains by class shows a similar pattern spatially across the columns. The largest proportion of faunal remains are from Class Osteichthyes, for which the distribution across the columns is 91-3: 54.2 percent, 91-2: 39.4 percent, 26N: 5.9 percent, and 34.5: 0.5 percent (Figure 20). Mammalian and Reptilian remains also indicated similar ratios (Figures 19, 21). Tables 3 through 6 provide a summary of the flotation sample faunal remains recovered from each column, and are identified by Unit.

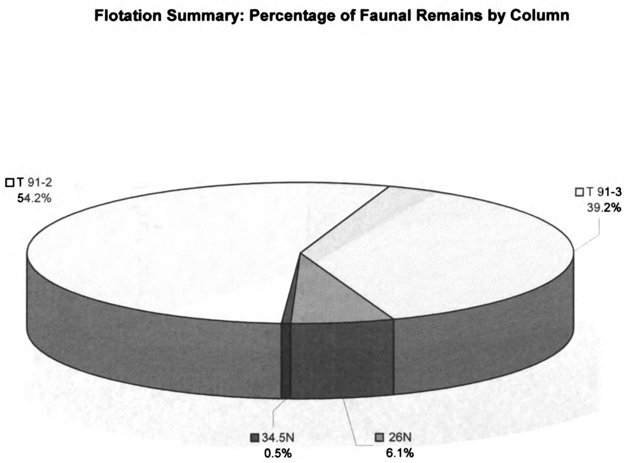

Figure 17: Schultz Site Flotation Material Composite Summary of Faunal Remains by Column
(Flotation Columns 26N, 34.5N, 91-2, 91-3)

Percentage of Floatation Specimens by Column

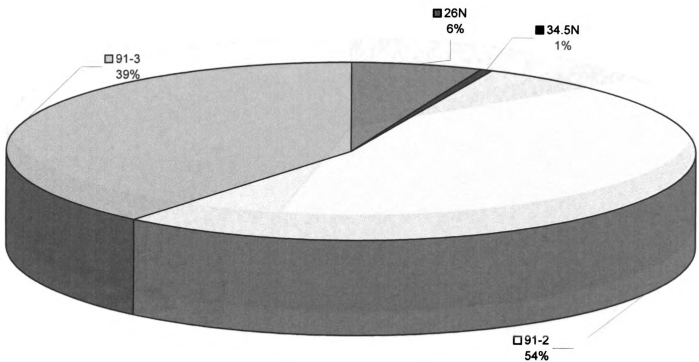

Figure 18: Schultz Site Flotation Material Composite by Column
(Flotation Columns 26N, 34.5N, 91-2, 91-3)

Percentage of Reptilian Flotation Specimens by Column

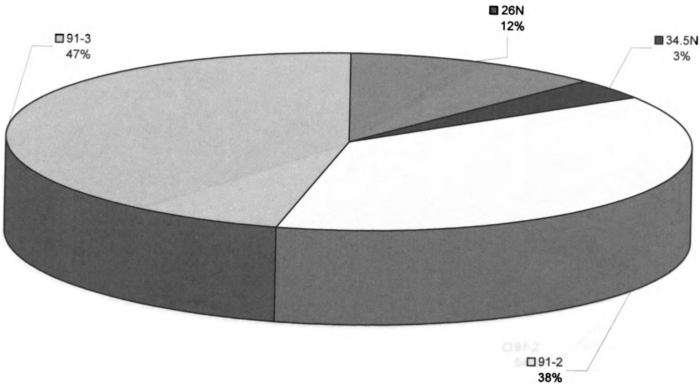

Figure 19: Schultz Site Flotation Material Composite of Reptilian Remains by Column
(Flotation Columns 26N, 34.5N, 91-2, 91-3)

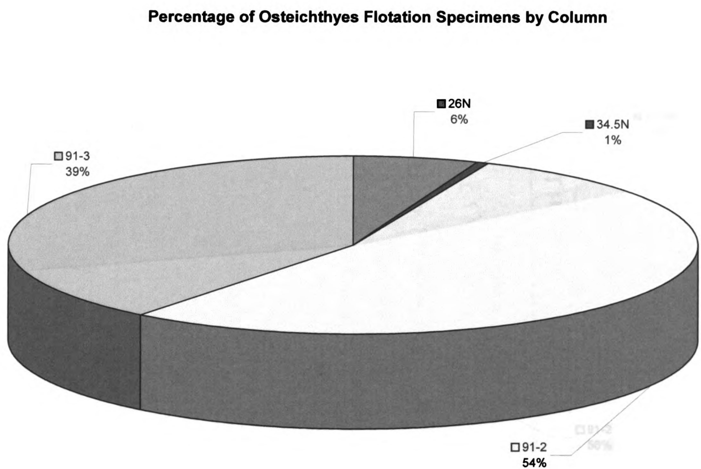

Figure 20: Schultz Site Flotation Material Composite of Osteichthyes Remains by Column
(Flotation Columns 26N, 34.5N, 91-2, 91-3)

Percentage of Mammalian Flotation Specimens by Column

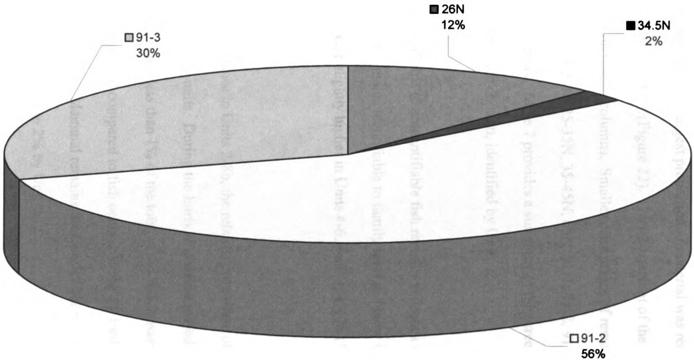

Figure 21: Schultz Site Flotation Material Composite of Mammalian Remains by Column
(Flotation Columns 26N, 34.5N, 91-2, 91-3)

Screened Sample

Screened material was recovered over a much broader spatial area at the Schultz Site. Within the screened samples, the largest proportion of material was recovered in columns 55N, 25N, 35N, 45N respectively (Figure 22). Over 80 percent of the screened materials were recovered from these four columns. Smaller percentages of remains were recovered from the areas between 15-25N, 25-35N, 35-45N, 65N, 91-1, 91-2, 91-3, 91-4, and the plow zone and surface areas. Table 7 provides a summary of the screened sample faunal remains recovered from each column, identified by Unit.

The proportion of identifiable to unidentifiable fish remains reflects a slightly different trend. There are no fish remains identifiable to family level or below in Units 2 or 3. Identifiable remains were slightly higher in Units 4-6, peak at 4% in Unit 7, and average 2.5% in Units 8a-8c.

As fish increase in importance in Units 2-8b, the relative proportion of mammals varies across strata or depositional units. During the Early Woodland period (Units 3-4) the mammal remains constitute less than 1% of the total of the fish remains. The maximum percentage (11%) of mammal compared to fish occurs during the Early Woodland Transitional Period (Unit 5a). Mammal remains decrease to 5% in Unit 6, rise slightly to 9% in Unit 7, before tapering off to 2% by Unit 8c.

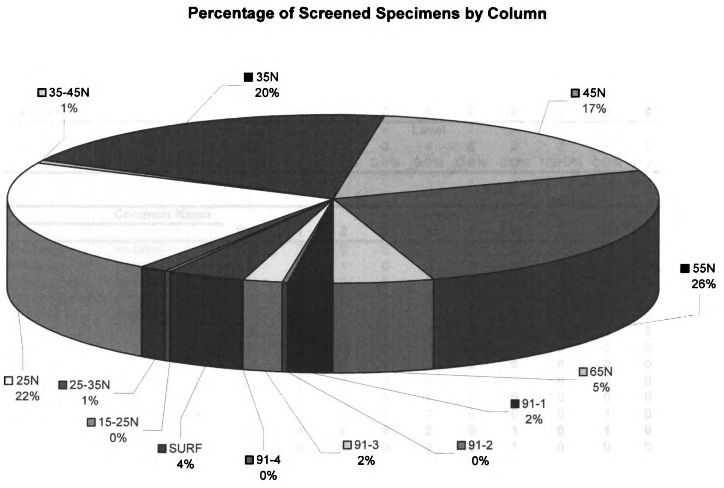

Figure 22: Schultz Site Screened Material Composite Remains by Column

Table 7: Column Summary Statistics (NISP) for Faunal Remains by Level from the Schultz Site Screened Material

	Taxon ID	Common Name	Level											% of Total
			Plow	1	2	3	4	5	6	7	8	9	Total	Specimens
15-25N	Osteichthyes indeterminate		0	0	0	0	0	0	0	2	0	0	2	
	Total Fish		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**2**	**100.00%**
	Total - All Taxa		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**2**	
			Level											
			plow	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**		
		% of Total Specimens	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%		

	Taxon ID	Common Name	Level											% of Total
			Plow	1	2	3	4	5	6	7	8	9	Total	Specimens
25N	*Ondatra zibethicus*	muskrat	0	0	0	0	1	0	0	0	0	0	1	
	Castor canadensis	beaver	0	0	1	0	0	0	0	0	0	0	1	
	Odocoileus virginianus	white-tailed deer	0	0	0	0	1	0	0	0	0	0	1	
	cf. Odocoileus virginianus	cf. white-tailed dee	0	0	0	1	0	0	0	0	0	0	1	
	cf. Ursus americanus	cf. black bear	0	0	0	0	1	0	0	0	0	0	1	
	Subtotal		**0**	**0**	**1**	**1**	**3**	**0**	**0**	**0**	**0**	**0**	**5**	
	Mammal indeterminate		0	0	44	0	4	2	0	0	0	0	50	
	Total Mammal		**0**	**0**	**45**	**1**	**7**	**2**	**0**	**0**	**0**	**0**	**55**	**50.00%**
	Micropterus sp.	bass sp.	0	0	0	0	0	0	1	0	0	0	1	
	Stizostedion vitreum	yellow walleye	0	0	0	0	2	0	0	0	0	0	2	
	Stizostedion sp.	cf. yellow walleye	0	0	0	0	0	0	0	0	1	0	1	
	Subtotal		**0**	**0**	**0**	**0**	**2**	**0**	**1**	**0**	**1**	**0**	**4**	
	Osteichthyes indeterminate		1	0	36	0	3	5	1	0	0	0	46	
	Total Fish		**1**	**0**	**36**	**0**	**5**	**5**	**2**	**0**	**1**	**0**	**50**	**45.45%**
	Class Indeterminate		0	0	2	0	0	2	1	0	0	0	5	**4.55%**
	Total - All Taxa		**1**	**0**	**83**	**1**	**12**	**9**	**3**	**0**	**1**	**0**	**110**	
			Level											
			plow	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**		
		% of Total Specimens	0.9%	0.0%	75.5%	0.9%	10.9%	8.2%	2.7%	0.0%	0.9%	0.0%		

Table 7 (cont'd):

	Taxon ID	Common Name	Plow	1	2	3	4	5	6	7	8	9	Total	% of Total Specimens
25-35N	Mammal indeterminate		2	0	0	0	0	0	0	0	0	0	2	
	Total Mammal		**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**33.33%**
	cf. Acipenser fulrescens	lake sturgeon	1	0	0	0	0	0	0	0	0	0	1	
	Subtotal		**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	
	Osteichthyes indeterminate		1	0	0	0	0	0	0	0	0	0	1	
	Total Fish		**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**33.33%**
	Class Indeterminate		0	0	0	0	2	0	0	0	0	0	2	**33.33%**
	Total - All Taxa		**4**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**6**	

	Level									
	plow	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
% of Total Specimens	66.7%	0.0%	0.0%	0.0%	33.3%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 7 (cont'd):

	Taxon ID	Common Name	Level											% of Total
			Plow	1	2	3	4	5	6	7	8	9	Total	Specimens
35N	*Mustela pennanti*	fisher	0	0	1	0	0	0	0	0	0	0	1	
	cf. *Mustela pennanti*	cf. fisher	0	0	1	0	0	0	0	0	0	0	1	
	Ondatra zibethicus	muskrat	0	3	0	0	0	0	0	0	0	0	3	
	Rodentia indeterminate		0	0	0	1	0	0	0	0	0	0	1	
	Castor canadensis	beaver	0	1	0	0	0	0	0	0	0	0	1	
	Subtotal		**0**	**4**	**2**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**7**	
	Mammal indeterminate		1	59	1	1	0	0	0	0	0	0	62	
	Total Mammal		**1**	**63**	**3**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**69**	**70.41%**
	Acipenser fulvescens	lake sturgeon	0	0	0	0	0	0	0	0	0	0	0	
	Subtotal		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
	Osteichthyes indeterminate		0	2	1	0	0	0	0	0	0	0	3	
	Total Fish		**0**	**2**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**3.06%**
	Apalone spinifera	spiny turtle	0	0	0	0	2	0	0	0	0	1	3	
	Total Reptile		**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**1**	**3**	**3.06%**
	Class Indeterminate		0	0	22	0	1	0	0	0	0	0	23	**23.47%**
	Total - All Taxa		**1**	**65**	**26**	**2**	**3**	**0**	**0**	**0**	**0**	**1**	**98**	
			Level											
			plow	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**		
		% of Total Specimens	1.0%	66.3%	26.5%	2.0%	3.1%	0.0%	0.0%	0.0%	0.0%	1.0%		

Table 7 (cont'd):

	Taxon ID	Common Name	Plow	1	2	3	4	5	6	7	8	9	Total	% of Total Specimens
35-45N	cf. *Procyon lotor*	cf. raccoon	0	0	0	0	0	0	0	1	0	0	1	
	Subtotal		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	
	Mammal indeterminate		0	0	0	0	0	0	0	1	0	0	1	
	Total Mammal		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**2**	**100.00%**
	Total - All Taxa		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**2**	
			plow	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**		
		% of Total Specimens	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%		

	Taxon ID	Common Name	Plow	1	2	3	4	5	6	7	8	9	Total	% of Total Specimens
45N	*Ondatra zibethicus*	muskrat	0	2	8	1	0	0	0	0	0	0	11	
	Castor canadensis	beaver	0	0	0	0	2	0	0	0	0	0	2	
	Odocoileus virginianus	white-tailed deer	0	0	0	0	0	0	1	0	0	0	1	
	Subtotal		**0**	**2**	**8**	**1**	**2**	**0**	**1**	**0**	**0**	**0**	**14**	
	Mammal indeterminate		0	22	14	2	6	0	1	0	0	0	45	
	Total Mammal		**0**	**24**	**22**	**3**	**8**	**0**	**2**	**0**	**0**	**0**	**59**	**71.08%**
	Ictalurus punctatus	channel catfish	0	1	0	0	0	0	0	0	0	0	1	
	Stizostedion sp.	cf. yellow walleye	0	0	0	1	0	0	0	0	0	0	1	
	Subtotal		**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	
	Osteichthyes indeterminate		0	0	2	5	3	0	0	0	0	0	10	
	Total Fish		**0**	**0**	**2**	**5**	**3**	**0**	**0**	**0**	**0**	**0**	**10**	**12.05%**
	Class Indeterminate		0	0	7	1	3	3	0	0	0	0	14	**16.87%**
	Total - All Taxa		**0**	**24**	**31**	**9**	**14**	**3**	**2**	**0**	**0**	**0**	**83**	
			plow	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**		
		% of Total Specimens	0.0%	28.9%	37.3%	10.8%	16.9%	3.6%	2.4%	0.0%	0.0%	0.0%		

Table 7 (cont'd):

55N

Taxon ID	Common Name	Level											% of Total
		Plow	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**	**Specimens**
Aves indeterminate		0	0	0	0	1	0	0	0	0	0	1	
Total Bird		**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**0.79%**
Ondatra zibethicus	muskrat	0	0	0	0	1	4	0	0	0	0	5	
Odocoileus virginianus	white-tailed deer	0	1	0	0	0	0	0	0	0	0	1	
Subtotal		**0**	**1**	**0**	**0**	**1**	**4**	**0**	**0**	**0**	**0**	**6**	
Mammal indeterminate		1	6	7	0	31	50	7	0	0	0	102	
Total Mammal		**1**	**7**	**7**	**0**	**32**	**54**	**7**	**0**	**0**	**0**	**108**	**85.04%**
Centrarchidae		0	0	1	0	0	1	0	0	0	0	2	
Esox lucius	northern pike	0	0	1	0	1	0	0	0	0	0	2	
Ictalurus punctatus	channel catfish	0	0	0	0	0	1	0	0	0	0	1	
Stizostedion sp.	cf. yellow walleye	0	0	0	0	0	1	0	0	0	0	1	
Subtotal		**0**	**0**	**2**	**0**	**20**	**59**	**0**	**0**	**0**	**0**	**6**	
Osteichthyes indeterminate		0	0	0	0	1	2	0	0	0	0	3	
Total Fish		**0**	**0**	**2**	**0**	**21**	**61**	**0**	**0**	**0**	**0**	**9**	**7.09%**
Class Indeterminate		0	0	3	0	0	3	0	3	0	0	9	**7.09%**
Total - All Taxa		**1**	**7**	**12**	**0**	**54**	**118**	**7**	**3**	**0**	**0**	**127**	
						Level							
		plow	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**		
	% of Total Specimens	0.8%	5.5%	9.4%	0.0%	42.5%	92.9%	5.5%	2.4%	0.0%	0.0%		

Table 7 (cont'd):

	Taxon ID	Common Name	Plow	1	2	3	4	5	6	7	8	9	Total	% of Total Specimens
65N	*Odocoileus virginianus*	white-tailed deer	0	1	0	0	0	0	0	0	0	0	1	
	Subtotal		**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	
	Mammal indeterminate		1	4	2	0	0	7	3	0	0	0	17	
	Total Mammal		**1**	**5**	**2**	**0**	**0**	**7**	**3**	**0**	**0**	**0**	**18**	**75.00%**
	Ictaluridae		0	0	0	0	0	1	0	0	0	0	1	
	Subtotal		**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	
	Osteichthyes indeterminate		0	0	0	1	0	0	0	2	0	0	3	
	Total Fish		**0**	**0**	**0**	**1**	**0**	**1**	**0**	**2**	**0**	**0**	**4**	**16.67%**
	Class Indeterminate		0	0	0	0	0	2	0	0	0	0	2	**8.33%**
	Total - All Taxa		**1**	**5**	**2**	**1**	**0**	**10**	**3**	**2**	**0**	**0**	**24**	
			plow	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**		
		% of Total Specimens	4.2%	20.8%	8.3%	4.2%	0.0%	41.7%	12.5%	8.3%	0.0%	0.0%		

	Taxon ID	Common Name	Plow	1	2	3	4	5	6	7	8	9	Total	% of Total Specimens
91-1	Mammal indeterminate		3	0	0	0	0	0	0	0	0	0	3	
	Total Mammal		**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**27.27%**
	Percidae		1	0	0	0	0	0	0	0	0	0	1	
	Subtotal		**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	
	Osteichthyes indeterminate		1	0	0	0	0	0	0	5	0	0	6	
	Total Fish		**2**	**0**	**0**	**0**	**0**	**0**	**0**	**5**	**0**	**0**	**7**	**63.64%**
	Class Indeterminate		1	0	0	0	0	0	0	0	0	0	1	**9.09%**
	Total - All Taxa		**6**	**0**	**0**	**0**	**0**	**0**	**0**	**5**	**0**	**0**	**11**	
			plow	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**		
		% of Total Specimens	54.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	45.5%	0.0%	0.0%		

Table 7 (cont'd):

91-2

Taxon ID	Common Name	Plow	1	2	3	4	5	6	7	8	9	Total	% of Total Specimens
Odocoileus virginianus	white-tailed deer	0	0	0	0	0	0	0	0	1	0	1	
Ursus americanus	black bear	1	0	0	0	0	0	0	0	0	0	1	
Subtotal		**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**2**	
Total Mammal		**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**2**	**100.00%**
Total - All Taxa		**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**2**	

	plow	1	2	3	4	5	6	7	8	9
% of Total Specimens	50.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%

91-3

Taxon ID	Common Name	Plow	1	2	3	4	5	6	7	8	9	Total	% of Total Specimens
Odocoileus virginianus	white-tailed deer	1	0	0	0	0	0	0	0	0	0	1	
Subtotal		**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	
Mammal indeterminate		0	0	0	0	0	0	0	0	7	0	7	
Total Mammal		**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**7**	**0**	**8**	**88.89%**
Osteichthyes indeterminate		0	0	0	0	0	0	0	0	1	0	1	
Total Fish		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**11.11%**
Total - All Taxa		**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**8**	**0**	**9**	

	plow	1	2	3	4	5	6	7	8	9
% of Total Specimens	11.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	88.9%	0.0%

Table 7 (cont'd):

	Taxon ID	Common Name	Level											% of Total
			Plow	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**	**Specimens**
91-4	Mammal indeterminate		1	0	0	0	0	0	0	0	0	0	1	
	Total Mammal		**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**100.00%**
	Total - All Taxa		**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	
							Level							
			plow	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**		
		% of Total Specimens	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		

Table 7 (cont'd):

	Taxon ID	Common Name	Level											% of Total
			Plow	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**	**Specimens**
SURF	*Procyon lotor*	raccoon	1	0	0	0	0	0	0	0	0	0	1	
	Castor canadensis	beaver	2	0	0	0	0	0	0	0	0	0	2	
	Odocoileus virginianus	white-tailed deer	1	0	0	0	0	0	0	0	0	0	1	
	cf. *Odocoileus virginianus*	cf. white-tailed dee	1	0	0	0	0	0	0	0	0	0	1	
	Cervus elaphus	elk	3	0	0	0	0	0	0	0	0	0	3	
	Subtotal		**8**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**8**	
	Mammal indeterminate		8	0	0	0	0	0	0	0	0	0	8	
	Total Mammal		**16**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**16**	**80.00%**
	Lepisosteus osseus	longnose gar	1	0	0	0	0	0	0	0	0	0	1	
	Subtotal		**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	
	Osteichthyes indeterminate		3	0	0	0	0	0	0	0	0	0	3	
	Total Fish		**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**20.00%**
	Total - All Taxa		**20**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**20**	
			Level											
			plow	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**		
		% of Total Specimens	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		

The number of faunal specimens for each class by unit, illustrated in Table 2, clearly demonstrates that Unit 8b, during the Green Point occupation, represents the highest absolute number of specimens in the Schultz Site sequence. This matches the findings from Column 11 (Lovis et al. 2001: 19-20). The notable increase in fish remains likely reflects an increased targeting of aquatic habitats through time (Table 2). The increase in aquatic targeting is supported by the large number of muskrat and fish remains occurring in Units 7, 8a, 8b, 8c. Overall, 71% of the mammal remains identifiable to a family level or lower were muskrat (Figure 23). This large percentage of concentrated muskrat remains demonstrates clear resource targeting by the indigenous population.

Trends

The examination of faunal remains from flotation samples suggests additional trends in utilization through time at the Schultz Site. Mammalian species are listed by the number of identified specimens (NISP) and the percent of identified mammalian assemblage in Table 2. As previously noted, muskrat (*Ondatra zibethicus*) is the most common mammalian species with a total of 113 elements identified; muskrat is present in Unit 5A and Units 7-8c. White-tailed deer (*Odocoileus virginianus*) reflect a similar trend, increasing in importance during the Middle Woodland period and reaching a maximum in Unit 8a. Like the Column 11 results, white-tailed deer outnumber the muskrat in absolute frequency. Beaver *(Castor canadensis)* are present in Units 6-8a. Black bear (*Ursus americanus*) are only represented in the Middle Woodland Transition Unit 8a.

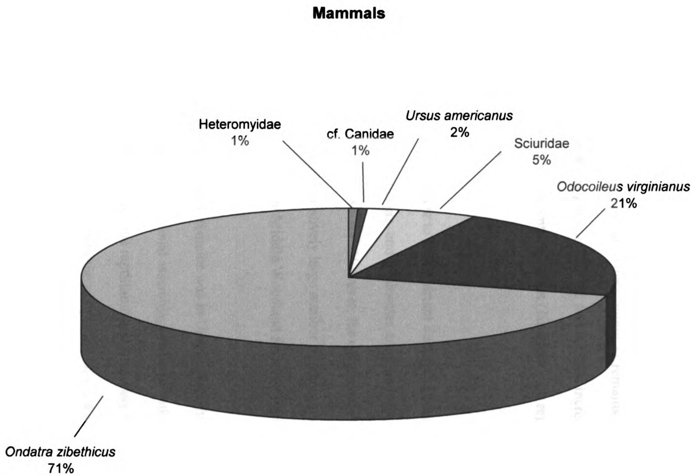

Figure 23: Schultz Site Flotation Material Mammalian Remains Identified to Family Level or Lower (Flotation Columns 26N, 34.5N, 91-2, 91-3)

The assemblage of fish species reflects a similar trend toward increased diversity in the Middle Woodland period. Major fish species are listed by NISP and by percent of identified fish assemblage in Table 2. Like the Column N11 sample, the most commonly identified fish species in this sample is gar (*Lepisosteus sp.),* seconded closely by lake sturgeon (*Acipenser fulvescens*). Similar to the Column 11 remains, fish species are minimal in Units 2-4, increase slightly in Unit 5a, and begin to increase notably in Unit 6. By Units 8a-8c, all fish species, except the burbot (*Lota lota*), are represented in their highest levels of occurrence.

While gar and yellow walleye appear to be important during the transitional period (Unit 7) the centrarchids, ictalurids, suckers, and freshwater drum increase in occurrence in the Middle Woodland periods (Units 8a-8c). However, the occurrences of these fish species is minimal compared to the comparatively large number of gar and lake sturgeon remains that dominate the sample during the Middle Woodland Periods (Table 2).

The only small concentration of bird remains was in Unit 8b, and they are entirely lacking in Units 2, 4, and 6. Reptiles in this faunal assemblage include both snakes and turtles. The maximum is in Unit 8a, in which the reptilian fauna is entirely represented by turtles (Table 2). Reptile remains are absent from the sample in Units 2-4 and 6. Snapping turtle *(Chelydra serpentina)* is identified in Units 7-8b, with a maximum in Unit 8a. Spiny soft-shell turtle (*Apalone spinifera)* was present as a single specimen in Unit 8b. Painted turtle (*Chrysemys picta)* and Blanding's turtle (*Emydoidea blandingii*) occur during the Middle Woodland Period. Snake remains were identified only in Units 5a, 8b, and 8c. Two unidentifiable snake vertebras were recovered from Unit 5A, as well as one vertebra identified as *Thamnophis,* the Eastern ribbon snake and/or the common garter snake. Four additional unidentifiable snake vertebras were recovered in Unit 8b, along with 5 additional *Thamnophis* vertebrae. Unit 8c produced 4 additional *Thamnophis* vertebrae and one vertebra that was likely *Thamnophis* as well.

Some fraction of the difference in density of forest living mammalian versus near-shore and aquatic species may be attributable to taphonomy and/or sedimentation rates. The remains of mammals such as black bear, fisher, and elk that tend to inhabit more highly acidic, forested areas would be less likely to preserve compared to the near shore animals such as the muskrat, reptile, and fish species. However, this is unlikely as an overlying scenario as all of these remains were deposited in the near shore sediments.

Much of the mammalian material was highly fragmented, weathered, or otherwise unidentifiable below class level. Out of 2076 total mammal bones recovered from the flotation sample, 171, or 8.2%, of them were calcined or charred. In contrast, 542, or 1%, of the 52,023 fish bones were charred (Table 2). The considerable volume of highly fragmented bone, as well as the presence of fragmented charred bone indicates proximity to a cooking area while the remains themselves simply represent discarded refuse.

The occurrence of episodic flooding events, particularly during the Middle Woodland occupation of the site, may also have been a factor in the apparent resource targeting of the inhabitants. The Early Woodland occupations occurred while a relatively dry, stable flood plain environment was present at the Schultz Site (Lovis et al. 2001: 9). This relatively dry period was followed by a period of intense flooding during the deposition of Units 8a-8c (Lovis et al. 2001: 10). The resulting increase in sedimentation rates, due to the episodic flooding, is concurrent with the relative abundance of animal material in these units (Lovis et al. 2001: 11).

Fish comprised a large portion of the diet of Schultz Site residents, compared with the relative abundance of other animals recovered. The large number of fish remains recovered at the Schultz Site do not initially seem to support the above basin-wide variation model (Larsen 1985), because lake levels varied, and the people in the region were eating substantial amounts of fish. The fluctuating occupation intensity indicated by cultural remains and changing abundance of faunal remains does, however, lend support to the basin-wide variation model (Lovis et al. 1994: 9-26).

As a second goal of the 1991 MSU excavation was to address changing subsistence patterns as a result of environmental fluctuations as the people changed from a hunting and gathering to a horticultural society (Lovis et al. 2001: 4). Overall, the faunal remains recovered at the Schultz Site are sufficient indicators of culturally selective taphonomy in the death assemblages as well as seasonal exploitation of resources. The faunal analysis seems to indicate seasonally variable resource targeting as a means to fulfill certain subsistence goals.

CHAPTER 3: WORKED BONE AND ARTIFACTS

The Schultz Site excavation in 1991 yielded several pieces of modified bone, tooth, and antler. A variety of implements were fashioned out of the animal remains of several species of local, Saginaw Valley mammals. Unlike previous excavations and artifact analyses (Cleland 1966, Luxenberg 1972) from the Schultz Site, in which the artifacts came from reptiles as well as mammals, this sample is entirely mammalian.

Similar to earlier findings, the condition of the artifacts is quite well preserved, suggesting that the sample is representative of the site during the Middle Woodland Period (Murray 1972). Five artifacts were identifiable and has been categorized below by material, function, and finally by type, following the methodology of Murray (1972).

Antler Artifacts

Elk antler remains were found in the plow zone, indicating a likely deposition within the last 800 years. Three pieces of elk antler were recovered (Figure 24). One of the three pieces is a small, socketed handle (Figure 25). The end of the antler has been drilled to receive a narrow, pointed implement, such as an awl (Murray 1972). The larger, slightly bent piece cf antler may also have been utilized as a handle. However, the shape and lack of additional alteration suggests it may not have been shaped for utilization efficiency. The third, and final piece of elk antler is un-worked and likely a discarded fragment.

FIGURE 24: Elk *(Cervus elaphus)* Antler Fragments

FIGURE 25: Worked Elk *(Cervus elaphus)* Antler Close-Up

The next possible artifact is a fragment of a deer antler, with the antler base still firmly attached to a portion of the cranium (Figure 10). The skull fragment shows striations along it edges that suggest the skull fragment was modified by human-made tools during butchering (Figure 10). It is unclear if the cut marks are simply from butchering or represent an artifact in process (Murray 1972).

The antler and skull piece provides evidence of an early fall hunt because the deer had not yet shed its antlers for the season. The antler fragment was found in stratigraphic Unit 8a, in Trench 91-3, supporting a fall occupation for the Middle Woodland occupation of the site.

Another notable artifact is a toggling harpoon fragment made from antler, found in Trench 91-2, also from stratigraphic Unit 8a (Figure 26). The harpoon has a hole gouged into one side, for line attachment, and the center has been hollowed out. Similar to the harpoon described by Murray (1972), there is evidence of a barb, cutting away about half of the base, leaving the rest to project at an angle over the shaft.

The harpoon may have been used for spearing large fish during spawning. The most frequently occurring fish in Stratigraphic Unit 8a are the Lake Sturgeon and the Longnose Gar (Table 2). Both species frequent the shallows in the spring to spawn, suggesting a spring occupation of the site, as well as the aforementioned fall occupation.

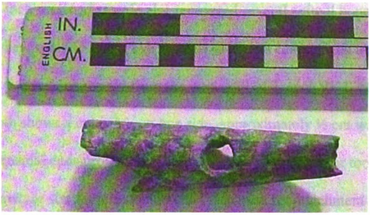

FIGURE 26: Worked Antler Harpoon

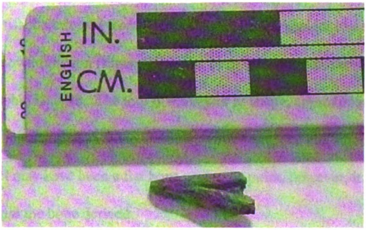

FIGURE 27: Worked Bone Tool

Bone and Tooth Artifacts

The one-quarter-inch screened sample also recovered several animal bone artifacts. The first is a worked bear tooth (Figures 8 & 9). The tooth is a canine from an adult black bear (*Ursus americanus*), recovered from the west wall of Trench 91-1, 60 cm below the surface. The tooth shows a cut notch on one side, approximately ½ cm wide, in the area where the tooth enamel ends proximally (Figure 9). This worked bear tooth may have been used as an awl, or similar tool, the notched area used for attachment to another implement.

The final bone artifact recovered from the Schultz Site is a fragment of a small worked bone tool of unknown function (Figure 27). The bone tool was recovered from Trench 91-3, in Stratigraphic Unit 8b. The tool is triangular in shape, approximately 2 cm long and displays a triangular groove along one side, while being flat and smooth on the other side. This artifact may have been a flat bone projectile point, however, it is unclear from what large mammal the bone derived.

Murray (1972) indicates that by the Middle Woodland Period, all four projectile point categories and toggle head harpoons were in use. In addition, the toggle head harpoons were limited to Units 8a-8b. The presence of large game-related artifacts may indicate the exploitation of large game, particularly during the fall. The presence of the worked bear tooth may further support a winter exploitation of black bear as a resource. Finally, the presence of the toggle head harpoon may be indicative of a well-developed fishing economy.

CHAPTER 4: SITE ANALYSIS AND CONCLUSIONS

Paleoenvironment

The hypothesis put forth by Lovis et al. (2001) indicated that the Early Woodland period was a relatively drier period, with lower water levels and fewer episodic floods. They further suggest that there was a distinctive change during the Middle Woodland period, during which time the Huron basis lake levels rose considerably, flooding was frequent and extensive, and the overall climatic environment was warmer. By the Late Woodland period, the environment became drier once again, although much of the region was still a wetland type habitat. Their overall conclusion was that microenvironmental changes affected the region and associated wetland habitat and that these changes thereby affected the subsistence alternatives available to the people utilizing the site.

The location of the Schultz Site is geologically significant in regards to its placement in the Saginaw Valley. The Schultz Site, is at the confluence of several major rivers which are cumulatively responsible for the drainage of the northwest, west, and south. However, all of the drainage must be funneled in-between the moraine immediately to the northwest of the Schultz Site and the Port Huron moraine, southeast of the site across the Saginaw River. Therefore, these regions were subject to seasonal flooding of the region behind the moraines, creating an additional lake environment above the moraines as well as the river discharge and higher Lake Huron levels downstream.

Review of the Early Woodland fauna, Stratigraphic Units 3-5a, in this sample include minimal amounts of bird and reptile material, some mammal remains, and proportionally larger amounts of fish material (Table 2). The abundance of fauna increase from 75 specimens in Unit 3, 273 specimens in Unit 4, and 593 specimens in Unit 5a. The species of fish present include longnose gar, burbot, lake trout, lake sturgeon, northen pike and some species of sucker. These types of fish are indicative of a range of weedy near-shore and deep-water habitats, with cool to moderate temperature, relatively calm water conditions (Table 3).

The Middle Woodland fauna, Stratigraphic Units 6-8, are much more diverse and more numerous. The primary fauna are still fish, however, a broader range of near-shore mammals are also present. In particular, there is a substantial amount of muskrat remains contained within the Middle Woodland sample. The fish remains are primarily Ictalurids, Centrarchids, and Yellow Walleye indicating the presence of warmer, weedy, near-shore, relatively calm water conditions (Table 3). In addition, there is the largest percentage of reptile remains during this period, of which Turtle remains, are the majority.

Overall, it is likely that as lake levels increased, due to precipitation and other climatic factors, flooding filled much of the Saginaw Valley region surrounding the Schultz Site. This flooding, over the minimally increasing gradient present in the area, likely created large areas of wetlands with large areas of shallow, vegetated, bodies of water. The presence of these fauna and the relative lack of bird material, suggest that these areas were quite unlike the broad, tree-less, flat expanses that are present further downstream.

The area surrounding the Schultz site was partially wooded, with extensive wetlands and aquatic environments, but lacked the expanses necessary for utilization by large flocks of migratory birds.

The combination of the unique geology present at the Schultz Site and surrounding area created several different habitats over time. It may be assumed that the exploitation strategies of the site's occupants must also have shifted as a result. Therefore, the results of this paleoenvironmental reconstruction generally support the Lovis et al. (2001) conclusions.

Resource Targeting.

The species recovered from the Schultz Site provide an indication of the resource procurement strategies during the sequence of occupations at the site. The second goal of the 1991 MSU excavation was to address changing subsistence patterns as a result of environmental fluctuations as the people changed from a hunting and gathering to a horticultural society (Lovis et al. 2001: 4). Intensity of site occupation during the Early Woodland periods, Units 3-4, is very low and the minimal faunal component of the archaeological record suggests minimal site usage. There is little evidence to support intensive or even regular exploitation of the aquatic habitat during these early occupations.

Similar to the Column N11 findings, and consistent with prior research, the findings of this faunal analysis indicate an increased targeting of aquatic resources during the Transitional period, represented by Units 5-7 (Lovis et al. 2001: 22). Muskrat, beaver, lake sturgeon, gar, and yellow walleye are the increasingly important faunal representatives during this time period and the Middle Woodland period to follow (Table 2). Also indicative of aquatic habitat targeting is the presence of snapping turtle remains in Unit 7.

By the Middle Woodland Period, represented in Units 8a-8c, bone density reaches maximum levels and aquatic faunal elements dominate the sample. The large number of gar, yellow walleye, perch, centrarchid and ictalurid remains suggest that the targeted habitat was a relatively shallow, clear, quiet, warm aquatic environment with a muddy bottom and abundant vegetation (Table 3). The large number of lake sturgeon and freshwater drum would have been found proximal to that, in slightly deeper water (Table 3). This type of aquatic habitat would also have been ideal for a significant muskrat and beaver population. Additional evidence for aquatic targeting is provided by the fact that the majority of turtle remains were recovered from the Middle Woodland Units. Nearly 25% of the identifiable turtle remains during this period were snapping turtle (Table 2).

White-tailed deer were exploited throughout the Middle Woodland sequence, and would have been found near the forest edge and water margins. Lovis et al. (2001) suggest that the presence of this mobile, terrestrial species in low to moderate frequency throughout the Middle Woodland units attests to its importance as a targeted food resource (Lovis et al. 2001:23).

The idiosyncratic presence of black bear in the Unit 8a faunal assemblage suggests at least some terrestrial exploitation of resources near the Schultz Site, although terrestrial animals were clearly not a primary resource (Table 2)(Lovis et al. 2001:25).

Although the resources utilized during the early occupational sequence at the Schultz Site are minimal and varied, by the Middle Woodland period the environment proximal to the site was clearly both productive and diverse in terms of its aquatic resources, allowing intensive exploitation of the region by the site's inhabitants (Lovis et al. 2001:26).

Flotation vs. Screening

The third primary goal of the 1991 MSU excavation was to further evaluate the differences in identification rate between samples recovered by screening methods and those recovered through flotation (Lovis et al. 2001: 4). Flotation samples may intuitively be thought to have a higher percentage of unidentifiable specimens and difference in taxon proportions in the sample, due to the smaller recoverable fragment size of specimens, and increased volume of material (James 1997). However, the initial N11 flotation sample, compared to screened materials in the previous Cleland (1966) and Luxenberg (1972) analyses, did not show this trend, but rather showed similar percentages between flotation and screened samples.

One means of calculating the rate of identification is to determine the ratio of specimens identified to the Family level or lower versus those identifiable only to Order or higher. Identification to the Family level has become the standard in zooarchaeological procedure as meaningful in using the identification for additional purposes.

The remaining composite (columns 26N, 34.5N, 91-2, 91-3) of faunal remains does reflect a difference in identification rates. From the 54,468 total specimens, only 1,437 were identifiable to family level or below, an identification rate of less than 3%. The Schultz Site flotation material (Columns 26N, 34.5N, 91-2, 91-3) minimally reflects four species of mammals (Figure 28), 16 species of fish in 12 families (Figure 29), and five species of reptiles (Table 8).

Cleland (1966) had an identification rate of 8.5%; Luxenberg (1972) had an identification rate of 6.7% using coarse screening methods. In the N11 sample, there was a flotation sample identification rate of 6.5%, similar to those found by Cleland and Luxenberg, although differing recovery methods were employed.

The screened samples reported by Cleland (1966) and Luxenberg (1972) also suggested a higher diversity of species, although represented in smaller quantities. Indeed, the analysis of 1991 excavation Schultz Site remains does show a broader mammalian species range than the screened samples. The 1991 excavation screened sample shows a lower number of overall specimens, only 501 total elements and an identification rate of

Mammal Composite

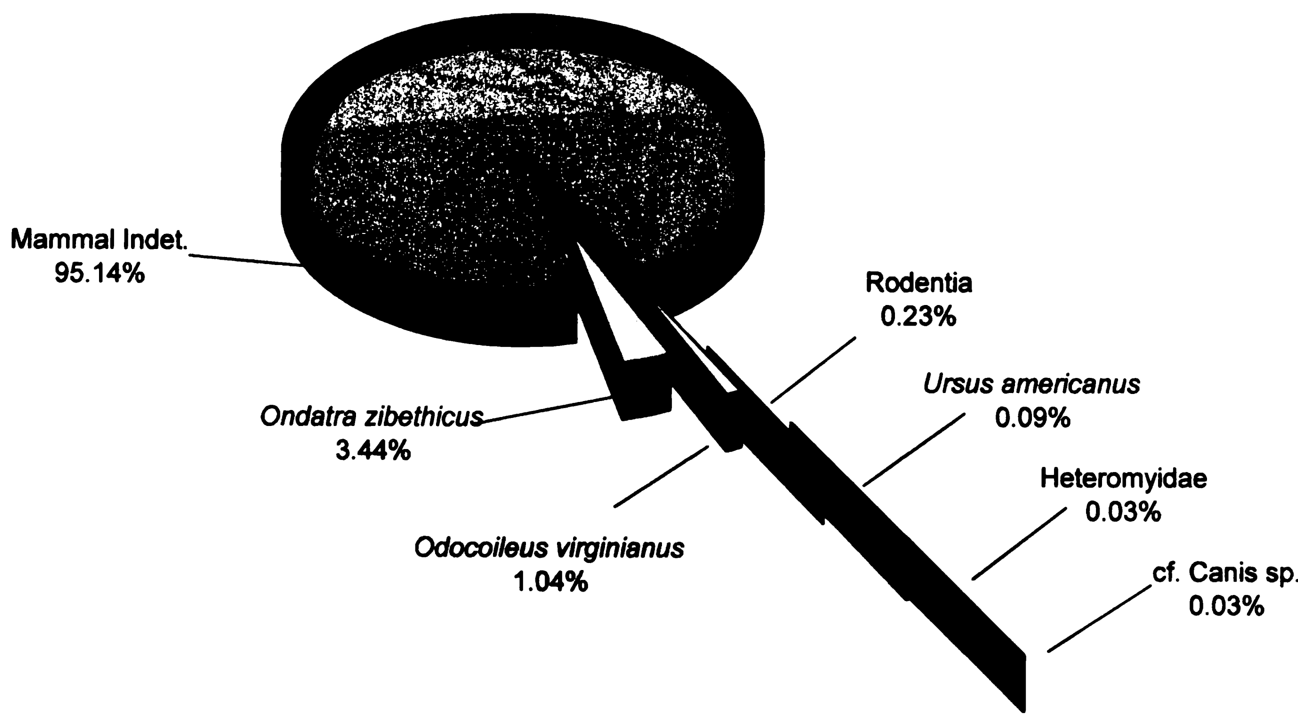

Figure 28: Schultz Site Flotation Material Composite of Mammalian Remains
(Flotation Columns 26N, 34.5N, 91-2, 91-3)

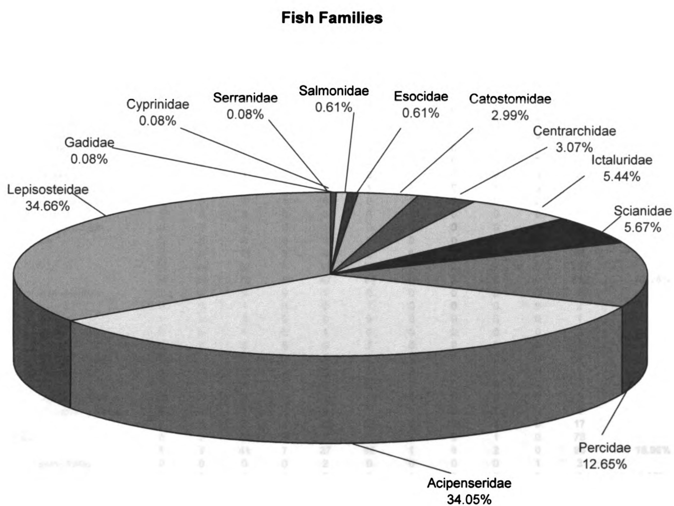

Figure 29: Schultz Site Flotation Material Reflects 12 Families of Osteichthyes
(Flotation Columns 26N, 34.5N, 91-2, 91-3)

Table 8: Summary Statistics (NISP) for Faunal Remains by Level from the Schultz Site Screened Material

Taxon ID	Common Name	Level											% of
		Plow	1	2	3	4	5	6	7	8	9	Total	Total Specimens
Aves indeterminate		0	0	0	0	1	0	0	0	0	0	1	
Total Bird		**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**0.20%**
Martes pennati	fisher	0	0	1	0	0	0	0	0	0	0	1	
cf. *Martes pennati*	cf. fisher	0	0	1	0	0	0	0	0	0	0	1	
Procyon lotor	raccoon	1	0	0	0	0	0	0	0	0	0	1	
cf. *Procyon lotor*	cf. raccoon	0	0	0	0	0	0	0	1	0	0	1	
Ondatra zibethicus	muskrat	0	5	8	1	2	4	0	0	0	0	20	
Rodentia indeterminate		0	0	0	1	0	0	0	0	0	0	1	
Castor canadensis	beaver	2	1	1	0	2	0	0	0	0	0	6	
Odocoileus virginianus	white-tailed deer	1	2	0	0	1	1	1	0	1	0	7	
cf. *Odocoileus virginianus*	cf. white-tailed deer	1	0	0	1	0	0	0	0	0	0	2	
Ursus americanus	black bear	1	0	0	0	0	0	0	0	0	0	1	
cf. *Ursus americanus*	cf. black bear	0	0	0	0	1	0	0	0	0	0	1	
Cervus elaphus	elk	3	0	0	0	0	0	0	0	0	0	3	
Subtotal		**9**	**8**	**11**	**3**	**6**	**5**	**1**	**1**	**1**	**0**	**45**	
Mammal indeterminate		15	91	68	3	41	59	11	2	7	0	297	
Total Mammal		**24**	**99**	**79**	**6**	**47**	**64**	**12**	**3**	**8**	**0**	**342**	**68.26%**
Acipenser fulvescens	lake sturgeon	1	0	0	0	1	0	0	0	0	0	2	
Centrarchidae		0	0	1	0	0	1	0	0	0	0	2	
Micropterus sp.	bass sp.	1	0	0	0	0	0	0	0	0	0	1	
Esox lucius	northern pike	0	0	1	0	1	0	0	0	0	0	2	
Ictaluridae		0	0	0	0	0	1	0	0	0	0	1	
Ictalurus punctatus	channel catfish	0	1	0	0	0	1	0	0	0	0	2	
Lepisosteus osseus	longnose gar	1	0	0	0	0	0	0	0	0	0	1	
Percidae		1	0	0	0	0	0	0	0	0	0	1	
Stizostedion vitreum	yellow walleye	0	0	0	0	2	0	0	0	0	0	2	
Stizostedion sp.	cf. yellow walleye	0	0	0	1	0	1	0	0	1	0	3	
Subtotal		**0**	**0**	**2**	**1**	**20**	**59**	**0**	**0**	**1**	**0**	**17**	
Osteichthyes indeterminate		6	2	39	6	7	7	1	9	1	0	78	
Total Fish		**6**	**2**	**41**	**7**	**27**	**66**	**1**	**9**	**2**	**0**	**95**	**18.96%**
Apalone spinifera	spiny turtle	0	0	0	0	2	0	0	0	0	1	3	
Total Reptile		**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**3**	**0.60%**
Class Indeterminate		3	0	34	1	4	10	1	7	0	0	60	**11.98%**
Total - All Taxa		**33**	**101**	**154**	**14**	**81**	**140**	**14**	**19**	**10**	**0**	**501**	
						Level							
		plow	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**		
	% of Total Specimens	6.59%	20.16%	30.74%	2.79%	16.17%	27.94%	2.79%	3.79%	2.00%	0.00%	**501**	

12% (Table 8). The screened samples include: 7 species of mammal, 7 fish, and 1 reptile (Table 8).

The animals identified from the flotation material include muskrat, beaver, white-tailed deer, black bear, indeterminate rodent species, lake sturgeon, longnose gar, lake trout, northern pike, suckers, several species of catfish, burbot, large and smallmouth bass, crappie, yellow perch, yellow walleye, freshwater drum, eastern spiny soft-shell turtles, snapping turtles, painted turtles, Blanding's turtle, and garter snakes (Table 2).

The screened material contains fisher, raccoon, muskrat, beaver, white-tailed deer, black bear, elk, lake sturgeon, bass, northern pike, catfish, longnose gar, perch, yellow walleye, and spiny turtle (Table 8).

Although the screened sample is less than one percent of the frequency of the flotation sample, the diversity of mammals is clearly higher. Most notable in the screened material is the presence of fisher and elk. A partial left mandible, with most of the associated teeth, of a fisher was recovered from Level 4 (Figure 30)(Powell 1993).

FIGURE 30: Fisher (*Mustela penanti*) Jaw Fragments

Conclusions

The focus of this thesis was to link the identification of vertebrate faunal remains to changes in the environment and human exploitation patterns throughout the Schultz Site occupation. Four important conclusions can be summarized from this analysis of the Schultz Site fauna as derived from columns 26N, 34.5N, 91-2, and 91-3.

First, the refined recovery facilitated by the flotation technique does not significantly decrease the rate of identification at this site, and in fact supports the Lovis et al. (2001) perception of the relative importance of fishes and mammals, versus the earlier Cleland (1966) and Luxenberg (1972) analyses.

Second, the Schultz Site environment varied seasonally and temporally over the course of several hundred years, affecting the habitability of the site and the intensity of occupation and its utilization through time. The Middle Woodland Period reflected a warmer period, during which time flooding was frequent and extensive throughout the Saginaw Valley, due to its unique geology.

Third, this fluctuation resulted in multiple season usage of the site through time, and a changing subsistence strategy that included clear resource targeting of aquatic habitats at particular times, to fulfill certain subsistence goals.

Finally, the analysis of these faunal samples from the 1991 Michigan State University excavation of the Schultz Site confirmed, supported, and broadened the earlier analyses of the column 11 of Lovis et al. (1994, 2001).

APPENDIX

APPENDIX: HABITAT PREFERENCES OF COMMON SCHULTZ SITE FAUNA

Certain animals are found in specific habitats, and a coexisting group of animals and plants comprises an ecological community. Relative abundances of animals found together can often be indicative of a particular habitat. Some of these animal communities have keystone species, such that the identification of a particular animal can be important in recreating the habitat (Rackham 1994).

By the first recorded habitation of the Schultz Site, circa 2600 B.P., essentially modern faunas were present in the Saginaw Bay area (Fitting 1975). The inhabitants of the Schultz Site hunted animals in aquatic, near-shore, and woodland habitats; these habitats likely existed proximal to the Schultz Site, or at least within a short distance (Lovis et al. 2001). The faunal analysis presented here assumes that the habitat preferences of the animals at that time were similar to those that exist now, as were the taste preferences of the people using the animals.

The following species recovered from the Schultz Site were common aquatic, semi-aquatic, and forest animals that inhabited the Great Lakes Region during the Schultz Site's occupational periods, and were hunted, trapped, or collected for use by human populations (Table 9).

Table 9: Taxa Identified at the Schultz Site 20SA2.

Taxon	Common Name
OSTEICHTHYES	
Acipenseriformes: Acipenseridae	
Acipenser fulvescens	lake sturgeon
Semionotiformes: Lepisosteidae	
Lepisosteus osseus	longnose gar
Amiiformes: Amiidae	
Amia calva	bowfin
Salmoniformes: Salmonidae	
Salvelinus namaycush	lake trout
Esociformes: Esocidae	
Esox lucius	northern pike
Esox sp.	northern pike, muskellunge, or hybrid
Cypriniformes: Cyprinidae	
Cypriniformes: Catostomidae	
Catostomus commersoni	longnose sucker
Catostomus sp.	longnose or white sucker
Moxostoma sp.	redhorse sucker
Siluriformes: Ictaluridae	
Ictalurus melas	black bullhead
Ictalurus natalis	yellow bullhead
Ictaluris nebulosus	brown bullhead
Ictalurus sp. (large)	yellow or brown bullhead
Ictalurus puctatus	channel catfish
Ictalurus sp.	yellow or brown bullhead or channel catfish
Gadiformes: Gadidae	
Lota lota	burbot
Perciformes: Centrarchidae	
Roccus chrysops	rock bass
Lepomis sp.	green sunfish, pumpkinseed, bluegill, or hybrid
Micropterus dolomieu	smallmouth bass
Micropterus salmoides	largemouth bass
Mocropterus sp.	smallmouth or largemouth bass
Pomoxis sp.	black or white crappie
Perciformes: Percidae	
Perca flavescens	yellow perch
Stizostedion vitreum	walleye
Stizostedion sp.	sauger or walleye
Perciformes: Scianidae	
Aplodinotus grunniens	freshwater drum

Table 9 (cont'd).

Taxon	Common Name
REPTILIA	
Chelonia: Chelydridae	
Chelydra serpentina	snapping turtle
Chelonia: Emydidae	
Emydoidea blandingi	blanding's turtle
Chrysemys picta	painted turtle
Chelonia: Trionychidae	
Apalone spinifera	eastern spiny softshell turtle
Squamata: Colubridae	
Thamnophis sp.	garter or ribbon snake
MAMMALIA	
Rodentia: Sciuridae	
Rodentia: Heteromyidae	
Rodentia: Castoridae	
Castor canadensis	beaver
Rodentia: Cricetidae	
Ondatra zibethicus	muskrat
Carnivora: Canidae	
Carnivora: Ursidae	
Ursus americanus	black bear
Carnivora: Procyonidae	
Procyon lotor	raccoon
Carnivora: Mustelidae	
Mustela pennanti	fisher
Lutra canadensis	river otter
Artiodactyla: Cervidae	
Cervus elaphus	elk
Odocoileus virginianus	white-tailed deer

Note: Taxonomy follows Scott and Crossman (1973) for fish; Harding (1997) for reptiles; and Baker (1983) for mammals.

FISH

Fish are often targeted as a food source and although subject to taste, most are caught based upon availability. The large presence of fish in the faunal assemblage indicates a strong reliance on fish as a food source, however, the assemblage also offers additional information on the availability of fish as a food source throughout the year.

Some species of fish are very habitat specific, living within narrow ranges of temperature, pH, depth, water flow, water clarity, and vegetative conditions (Table 10). Seasonal and other changes in water conditions can cause fish to migrate, become dormant, or perish. The following fish were present in the faunal assemblage at the Schultz Site (20SA2).

Lake sturgeon (*Acipenser fulvescens*)

Sturgeon are one of the most long-lived fish, living in excess of 100 years (Scott and Crossman 1973: 82), reaching lengths over five feet, and weights of over 100 pounds (Table 10). These large fish spawn in the shallows of large lakes and rivers in the spring (Scott and Crossman 1973: 82). In the past, lake sturgeon aggregated in huge numbers and were speared or netted (Cleland 1966: 171). Sturgeon are prized for the large amount of meat they can provide.

Longnose gar (*Lepisosteus osseus*)

The longnose gar is one of the most habitat-specific species found in the Great Lakes region, inhabiting shallow, weedy bays and back waters (Table 10)(Scott and Crossman 1973: 108). In particularly turbid waters, gars use their special air bladders to obtain air

Table 10: Freshwater Fish Habitat Preferences

Species (Common Name)	Schultz Site Stratigraphic units	Average Length	Average Weight	Water Depth	Water Clarity	Water Temp.	Water Circulation	Bottom Type
lake sturgeon	5-8c	3-5 ft	10-20 lbs.	moderate	n/a*	moderate	n/a*	various
longnose gar	4-8c	2-3 ft	< 10 lbs.	shallow	various	warm	quiet	various, weeds
lake trout	5a, 7-8b	1-2 ft	10 lbs.	deep	n/a*	cool-cold	n/a*	rocky
northern pike	5a, 8a-8b	2 ft	10 lbs.	shallow-moderate	clear	warm	slow	muck, weeds
longnose sucker	8b, 8c	12-14 in.	< 5 lbs.	various	various	moderate	moderate	various
shorthead redhorse	8a	14-18 in.	<2 lbs.	shallow	clear	moderate	moderate	sand, gravel
bullhead catfish	8a-8b	8-14 in.	< 1 lb.	shallow	clear	n/a*	slow	muck, gravel, heavy vegetation
channel catfish	8a-8b	1-2 ft	2-4 lbs.	moderate	clear	moderate	moderate	sand, gravel, little vegetation
burbot	5a	15 in.	2 lbs.	moderate-deep	n/a*	cool	n/a*	sand, gravel
large-mouth bass	8a	8-15 in.	< 2 lbs.	shallow	n/a*	warm	slow	mud/muck, heavy vegetation
small-mouth bass		8-15 in.	< 2 lbs.	moderate	clear	moderate	n/a*	rock, sand
bluegill		7-8 in.	< 1 lb.	shallow	moderate	warm	slow	various, weeds
black crappie	6, 8a	7-10 in.	< 1 lb.	shallow	clear	warm	quiet	muck, sand, heavy vegetation
rock bass	8a	6-10 in.	< 1/2 lb.	shallow	n/a*	warm	slow	ravel, rocky
yellow perch	7, 8a	6-14 in.	< 1 lb.	shallow	clear	warm-cool	slow	muck, gravel, sand, some vegetation
yellow walleye	4, 6-8c	13-20 in.	< 5 lbs.	shallow-moderate	clear-turbid	various	slow	various
freshwater drum	6-8c	18-20 in.	1 lb.	moderate	clear-turbid	various	slow	various

*n/a indicates the fish is not generally affected by varying conditions from the surface, so they can survive in water with lower oxygen content than can most other species (Scott and Crossman 1973: 108).

Gars spawn in late spring to early summer, in shallow water, among aquatic vegetation or on gravelly or stony shoals (Scott and Crossman 1973: 107). Males remain to protect the nests until the young reach several inches in length. Adult gars may reach sizes exceeding 2 feet in length. Gars prey largely upon other fish, either as predator or scavenger, and often lurk near the surface.

Longnose gar tend to be caught by netting methods rather than typical angling methods (Cleland 1966: 172). Although *Lepisosteus osseus* are not preferentially eaten today, they were a primary food source in the past (Scott and Crossman 1973: 109). Gar can be identified on the basis of their vertebrae (Figure 32), which are convex in front and concave behind, rather than concave at both ends, and by their large, thick, diamond-shaped, enamel-covered scales (Figure 31).

Gars are voracious eaters and will feed on nearly any fish sharing their warm water habitat. Prey can include sunfish, bass, suckers, perch, darters, catfish, and pike. Gar will also devour amphibians and invertebrates (Scott and Crossman 1973: 109).

Bowfin (*Amia calva*)

Amia calva is found in the Great Lakes region, although it is rarer than either *Acipenser fulvescens* or *Lepisosteus osseus* (Scott and Crossman 1973: 115). This carnivorous fish

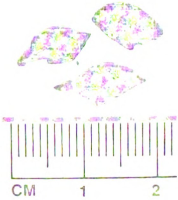

FIGURE 31:
Longnose Gar *(Lepisosteus osseus)*
Scales

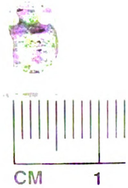

FIGURE 32:
Longnose Gar *(Lepisosteus osseus)*
Vertebrae

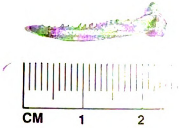

FIGURE 33:
Catfish *(Ictalurus sp.)*
Pectoral Spine

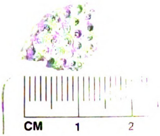

FIGURE 34:
Freshwater Drum *(Aplodinotus grunniens)*
Pharyngeal Toothplate

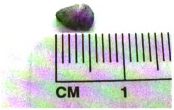

FIGURE 35:
Freshwater Drum *(Aplodinotus grunniens)*
Pharyngeal Tooth

inhabits relatively warm sluggish rivers, often taking to the shallows to spawn in the spring (Scott and Crossman 1973: 113). It is said to have a jelly-like consistency to the meat, and so has not been highly favored for eating by most peoples. Like gars, the bowfin can utilize surface air in poorly oxygenated water (Scott and Crossman 1973: 115).

Lake Trout (*Salvelinus namaycush*)

Of notable size, lake trout are one of a few deep-water species in the Great Lakes region. They require cool, well-oxygenated, rocky depths for survival, only leaving those depths for the shallows to spawn in the fall (Table 10)(Cleland 1966: 172). Spawning season is the best time to catch lake trout, using gill nets (Scott and Crossman 1973: 227).

Northern Pike (*Esox lucius*)

Esox lucius (northern pike) can be found in marshy areas, sandbars, and channels between lakes (Scott and Crossman 1973: 360). This species typically inhabits very shallow water, rarely exceeding depths of 20 feet (Table 10). Pike grow to a large size and can be caught through the ice in the winter months (Scott and Crossman 1973: 362).

Pike are very solitary fish, perhaps as a factor of their large size and voracious feeding habits (Walden 1964). Growing in excess of four feet and 20 pounds, they are certainly worth the effort in capturing (Cleland 1966: 174). Pike may travel large distances into the shallows and tributary rivers in the spring months to spawn, then abandon their eggs as they continue swimming (Scott and Crossman 1973: 359). During spawning, pike can be readily caught in nets. Summer heat tends to make the pike sluggish and less responsive to bait. Pike are often caught in the winter months, when people can fish far offshore on the ice (Walden 1964).

Catfish (Ictaluridae)

Several species of catfish, Family Ictaluridae, inhabit tributaries and lakes. *Ictalurus nubulosus*, *I. melas*, and *I. natalis* (northern brown, black, and yellow bullhead catfish respectively) are very flexible in the range of environmental conditions in which they can survive (Table 10). These species are found in mud-bottomed, weedy near-shore regions, in slowly flowing rivers, and in faster cold-water streams (Cleland 1966: 173). Ictalurids are generally tolerant of high temperatures and low oxygen levels (Scott and Crossman 1973: 588-603).

Most catfish species, including the three mentioned above, are somewhat nocturnal, moving shoreward or into faster-moving water to feed at dusk (Scott and Crossman 1973: 588). Catfish meat is firm and flaky, with a rich flavor. These fish can be caught using a wide variety of net or rod and line methods. The above-mentioned catfish species are about a foot in length and a pound or two in weight (Scott and Crossman 1973: 601). They can be readily identified by their large, serrated pectoral fin spines (Figure 33)(Scott and Crossman 1973: 591-599).

The bullhead (northern brown, black, and yellow) catfish are spring spawners, making large saucer-shaped nests in well-protected areas. Both parents protect the eggs and the fry until the young catfish can move about independently (Scott and Crossman 1973: 593).

Burbot (*Lota lota*)

Burbot have an average weight of one to three pounds, and can occur throughout deep-water lakes (Table 10)(Scott and Crossman 1973: 643). Deep-water netting is the most common form of capture. They are winter spawners, in rocky shallows, with no parental care (Scott and Crossman 1973: 643). The meat is distasteful to most people, although the liver oil can be used in a fashion similar to cod liver oil (Scott and Crossman 1973: 645).

Bluegill (*Lepomis macrochirus*)

Sunfishes (Family Centrarchidae), particularly bluegill, are schooling species and are relatively abundant. Dwelling in warm, weedy waters of ponds and lakes, they are tolerant of high water temperatures but require high levels of oxygen for survival (Table 10). Increased levels of turbidity in the water, which can affect oxygen-gathering abilities, can be fatal to centrarchids (Scott and Crossman 1973: 722).

Bluegill are spring spawners, usually in June in the northern regions (Scott and Crossman 1973: 721). They may also spawn multiple times in one season. Bluegill are not particularly valuable as food sources, usually weighing less than a pound and only 7-8 inches in length. Bluegill will take bait during all seasons, and can be caught in large numbers, to make up for a smaller body size (Scott and Crossman 1973: 723).

Largemouth bass (*Micropterus salmoides*)

Smallmouth bass (*Micropterus dolomieui*)

The species of *Micropterus* (large and small-mouth bass) generally inhabit clean, cool waterways and gently flowing streams (Table 10). These fish often dwell in slightly deeper water than bluegills, 25-30 feet, and slightly offshore. Smallmouth bass are much less often associated with dense growths of aquatic vegetation than the largemouth bass and prefer a lower water temperature (Cleland 1966: 174). These two species of bass rarely overlap in their habitats.

Both large and smallmouth bass are evening feeders, preferring shady or deeper waters during the day, and the open shallows during the night. These tend to be dormant during the winter months. Weighing in at a couple of pounds apiece, they have flaky, tender meat. They strike at moving bait and lures readily, making them easy prey for human anglers (Scott and Crossman 1973: 733).

Bass are late-spring spawners, usually in May or June (Cleland 1966: 174). Male bass are very territorial during their spawning period, and although they cease feeding, they often fall prey to anglers due to their aggression towards lures near the nest (Walden 1964).

Yellow Perch (*Perca flavescens*)

Yellow Walleye (*Stizostedion vitreum*)

Perca flavescens (yellow perch) are often found associated with the centrarchids, both because of similar habitat preferences, and because they are part of a reciprocal food web with the *Micropterus* species (Scott and Crossman 1973). Perch can tolerate slightly reduced levels of oxygen, but suffocate with added turbidity or silty conditions that are favorable to the walleye (Table 10).

Many species of Percidae, including *Stizostedion vitreum* (yellow walleye) require flowing water for breeding and for transgressing tributary rivers (Scott and Crossman 1973: 772). Percids spawn in early to mid-spring in the Great Lakes region (Scott and Crossman 1973: 757). Perch do not remain to tend their eggs or young (Scott and Crossman 1973: 758). The perch often travel large distances up tributary rivers during the spawning run, making them easy prey, in large quantities, for spring anglers (Scott and Crossman 1973: 757).

Yellow perch are generally about a foot in length, and close to a pound in weight (Cleland 1966: 174). Being schooling fish, perch are readily caught in numbers using basic lures and bait methods (Scott and Crossman 1973: 761). Yellow walleye, on the other hand, obtain lengths of several feet, and can weigh up to 25 pounds, making them a highly prized catch (Cleland 1966: 174). However, because they frequent deeper waters during most of the year, the best angling techniques involve deep-water trolling (Scott and Crossman 1973: 773-774).

Freshwater Drum (*Aplodinotus grunniens*)

Freshwater drum are relatively large fish, although their meat is said to get tougher as they mature. The meat is not normally eaten but is edible (Scott and Crossman 1973: 816). These bottom dwellers live in the muddy or sandy shallows of many rivers and lakes (Table 10)(Cleland 1966: 175). They are early summer spawners, with no parental care, and can be caught by typical angling methods, often using nets. Their remains are readily identified by the presence of their distinctive pharyngeal teeth and pharyngeal toothplates, which are used to grind up freshwater mussels (Figures 34 & 35)(Scott and Crossman 1973: 813).

REPTILES

Reptiles are not commonly targeted as a food source, but subject to taste, collected when easily accessible. Reptiles may also have been harvested for cultural purposes unrelated to subsistence. The presence of reptiles in the faunal assemblage would thereby indicate that the reptiles were relatively abundant and, therefore, opportunistically available. Remains from the following reptiles were present in the faunal assemblage at the Schultz Site (20SA2).

Common Snapping Turtle *(Chelydra serpentina)*

Snapping turtles are large, robust, aquatic turtles. They can achieve shell diameters of 18 inches and a weight of over 10 pounds. Common snapping turtles can be found in a variety of freshwater habitats, although they prefer quiet, mucky-bottomed areas with dense vegetation (Harding 1997: 169).

Snapping turtles are bulky enough that they rarely leave the water to bask, preferring to float at the surface. They hibernate from October to April, near shore, often just sitting on the bottom (Harding 1997: 170).

Adult snapping turtles do not have many natural predators, although their eggs and young can easily become prey to raccoons, minks, foxes, large fish, herons, and larger water snakes (Harding 1997: 170-171).

Adult snapping turtles were certainly large enough to be utilized as a food resource. Approximately 50% of the turtle's body weight is edible meat (Cleland 1966: 136).

Blanding's Turtle *(Emydoidea blandingii)*

Blanding's turtles are smaller turtles, usually not exceeding 10 inches in diameter (Harding 1997: 201). They prefer quiet water, and live in and around shallow, weedy areas and marshes (Cleland 1966: 171). Blanding's turtles will venture out onto land in the spring and fall months, and spend considerable time basking in the sun. They avoid summertime heat extremes, preferring to limit summer activity to mornings and evenings (Harding 1997: 204). These turtles hibernate from late October to early spring, hidden under debris near the water's edge.

Primary predators of Blanding's turtle include raccoons, foxes, herons, fish, and snakes (Harding 1997: 204). The young are particularly prone to predation as nesting sites are built away from water in more upland areas. These small turtles are surprisingly long-lived and virile. Active breeding life spans of 50 years are not uncommon (Harding 1997: 205).

Painted Turtle *(Chrysemys picta)*

The painted turtle is a small, brightly colored aquatic turtle that prefers quiet, weedy waters (Cleland 1966: 171). Hibernation for painted turtles, like most of the Great Lakes turtles, takes place underwater from October to early spring (Harding 1997: 213). These small turtles spend considerable time basking during the cooler fall and spring months, and limit their summer basking to morning and evening hours (Harding 1997: 213).

Painted turtle eggs and juveniles are frequent prey to raccoons, herons, and other wetland predators, but they are largely protected in the water as adults, becoming prey only when leaving the water (Harding 1997: 214). These small turtles are unlikely to be sought for human consumption; even as adults, their shell diameters rarely reach 10 inches (Harding 1997: 215).

Eastern Spiny Soft-shell Turtle *(Apalone spinifera)*

The spiny soft-shell turtle is almost entirely aquatic, inhabiting rivers and larger streams, inland lakes, and bays (Harding 1997:223). These turtles can adapt to most current types but require a muddy or sandy bottom with little or no vegetation. Spiny soft-shell turtles spend large amounts of time basking on logs and riverbanks. They are dormant from October to April, buried in the shallow bottom substrate (Harding 1997: 224). Predators include raccoons, herons, and large fish. They are easily caught in traps and set hooks, by hand collection in the sediment, and with bow and arrow (Harding 1997: 226). A 13-inch long soft-shell turtle may weigh up to seven pounds.

Garter Snake *(Thamnophis* sp.)

There are several species of the colorful garter snake. Garter snakes can reach lengths of over 4 feet, although they are slender (Harding 1997: 269). Most species of garter snake are found near the water's edge and nearby grassy areas (Harding 1997: 271). They hibernate from late fall until early spring near the waters edge, often partially submerged in the water (Harding 1997: 272). Garter snakes often become prey to fish, frogs, turtles, other snakes, birds, raccoons, rodents, and bears (Harding 1997: 272).

MAMMALS

White-Tailed Deer (*Odocoileus virginianus*)

Deer are large mammals, ranging in weight from 100-300 pounds. They roam over large areas, and are found throughout Michigan. They thrive in areas bordering forests, feeding on sprouting vegetation, shrubs, and leaves (Cleland 1966: 165). In the fall they eat large quantities of fallen acorns when available (Baker 1983: 588).

Female deer tend to live together in small herds with their fawns (Baker 1983: 585). Although usually isolated from females during much of the year, the males can be found together with does in pairs and groups in the fall (Baker 1983: 583). Deer mate in the fall, following a period of rutting behavior by the males.

During the rutting season male antler growth is at its peak for display (Baker 1983: 586). Following mating, in late fall, the males will lose their antlers, to be regrown the following year. The presence or lack of antler material in faunal assemblages can thus be a good indicator of seasonality (Figure 10).

Deer provide a substantial amount of meat. From an average adult deer of 200 pounds, approximately 50% of the weight will be edible meat (Cleland 1966: 136). Deer could be hunted and utilized on a year-round basis for meat, as well as more intensively during the fall rutting season. Although there is little direct evidence regarding the method by which the people of the Schultz Site targeted deer, they were likely hunted by driving, stalking, and trapping (Cleland 1966: 140).

Beaver (C*astor canadensis*)

One of the largest of all rodents, the beaver is easily recognizable by its flat tail. In fossil records, it is readily identifiable by it long, yellowish-orange incisors (Figure 36). Beaver are highly sought after for both their plush pelt and their edible meat. Approximately 70% of the beaver's 45-pound weight is usable as a food source (Cleland 1966: 135).

FIGURE 36:
Beaver *(Castor canadensis)*
Incisor

FIGURE 37:
Muskrat *(Ondatra zibethicus)*
Left Mandible

They are most commonly trapped near their dam, and can be found near any flowing waterway (Baker 1983: 253).

Beaver live in family groups of parents and kits, and previous year's offspring, in groups of up to 12 (Baker 1983: 257). They breed during the late winter months, with the kits being born in the late spring. Their regional density is controlled by the availability of food resources. Their ability to consume vast acres of foliage in a season often forces them to change location.

The ponds created by beaver dams can adversely affect fish species, such as trout, by blocking their waterways, or altering water flow (Baker 1983: 260). However, muskrats, turtles, frogs, and aquatic snakes can flourish in the associated ponds. Carnivores are often found living near the beaver, including mink and river otter, as well as great blue herons and bitterns (Baker 1983: 260).

Muskrat (*Ondatra zibethicus*)

The muskrat inhabits wetland and semi-aquatic environments year round (Cleland 1966: 165). Like the beaver, it is prized for its pelt and edible meat. Approximately 70% of the muskrat's three-pound weight is usable as a food source (Cleland 1966: 135). Muskrat must be trapped near their burrows, or along the shore, as they are adept swimmers. Muskrat eat aquatic vegetation, and must be in water deep enough to prevent solid freezing in the winter months (Baker 1983: 327).

This territorial species lives in family groups in its tunneled burrows. They move seasonally, searching for fresh habitats to occupy (Baker 1983: 327). These movements usually correspond to higher water levels. Muskrats are sensitive to weather fluctuations; dry, hot weather, as well as very cold weather, have an adverse effect (Baker 1983: 329). Muskrat remains are often identified by their unique star-shaped vertebrae, or lower jaws (Figure 37).

Black bear (*Ursus americanus*)

The black bear is a large mammal, weighing 250-500 pounds (Baker 1983: 431). They inhabit both hardwood and coniferous forests near water, where they can forage easily (Baker 1983: 433). Black bears will eat meat on occasion, but prefer insects, fruits, nuts, berries, and honey. Black bears vary their foraging routine with extremes in temperature, and seasonally (Baker 1983: 437). They are active at twilight in the spring, diurnal in the summer, nocturnal in the fall, and relatively inactive during the winter.

Black bears reproduce slowly compared to many other large mammals (Baker 1983: 436-437). Adult females usually only have offspring every other year, and are not receptive to males during summer months. The gestation period of black bears is also prolonged, 210 days, resulting in young being born in mid-winter.

Black bears are prized for their large size, which provides an abundance of rich food and a large thick pelt (Baker 1983: 439). Approximately 70% of the bear's body weight is a usable meat source (Cleland 1966: 135). Black bears can be easily tracked either by following their tracks or by following paths of broken and overturned logs. They are largest in the late fall months, prior to denning, when they accumulate fat deposits of up to 40% of their normal body weight (Baker 1983: 436). Black bears are usually dormant from early November until April (Baker 1983: 436).

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