SHARING AND CONSUMING WILD HARVESTED MEAT: PROVIDERS AND RECEIVERS OF VENISON

By

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ABSTRACT

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Sharing and consuming wild harvested meat (WHM)—a culturally significant interaction within nature worldwide —creates links between human and natural systems. Little is known about the dynamics of WHM sharing and consumption in modern society, particularly in areas of the global north. My objective was to identify provisional and cultural ecosystem services provided by WHM in Michigan. I assessed how much venison is harvested, revealed sharing behaviors of hunters, and estimated the number and attributes of individuals providing and receiving venison. Questions about provider behaviors were included in the statewide 2013 Michigan Deer Harvest Study. In addition, telephone interviews with adult Michigan residents identified statewide WHM consumption patterns and receiver characteristics. I estimate 26-33 million pounds of wild harvested venison were procured during the 2013 Michigan deer hunting season. More than 85% of hunters who harvested a deer in 2013 shared their venison. Approximately 72% of Michigan residents have consumed venison at least once in their lifetime, nearly 50% of who reported consuming venison at least once in the past 12 months. Hunter providing behaviors magnify the potential number of people coupled to natural systems through hunting. In the absence of economic markets for WHM, the distribution of the provisional ecosystem service is extensive throughout the Michigan landscape. Nonetheless, the closed nature of sharing networks creates potential limits to the number and types of beneficiaries within this system. Policies or programs that encourage sharing of WHM can be expected to broaden the number and type of people connected to hunting and natural systems.

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ORGANIZATION OF THESIS

This thesis is organized into four chapters; two as separate manuscripts, plus an introductory and concluding chapter. Throughout, this thesis follows the style of the *Publication Manual of the American Psychological Association (6th Edition)* required for submission to the journal *Human Dimension of Wildlife*. Chapter 1 consists of a literature review on a wide range of subjects relating to the consumption and sharing of wild harvested meat. Chapter 2 presents results on edible venison yield and describes behaviors and characteristics of providers of wild harvested venison based on responses to a mail back questionnaire. Chapter 3 highlights findings from telephone interviews about receiving and consuming wild harvested meat, with a particular focus on venison and non-hunters. Chapter 4 identifies potential implications from this thesis for wildlife management and policy and explores future directions for research on the topic of wild harvested meat sharing and consumption. Appendices contain data collection instruments, additional data tables, and detailed information on open-ended response coding not included in the chapters.

CHAPTER 1

Sharing and Consumption of Wild Harvested Meat: Background and Significance to Society

Humans have been hunting and consuming meat from wildlife (wild harvested meat (WHM) from the earliest of moments in human history. This sustained interaction with WHM has guided research on the topic from a variety of fields, most of which focus on the traditional relationship between communities and WHM in subsistence cultures. There are few studies that look at WHM outside of subsistence communities, and fewer still on WHM in urbanized societies of the global north. In this chapter, I attempt to compile and review literature from a wide reach of disciplines – sociology, anthropology, philosophy, ecology, biology, natural resource management, human ecology, public health, and social network analysis – to identify roles of WHM in society and its potential effects on humanity, with a particular focus on non-subsistence communities of the global north. Undoubtedly, there are gaps in my inquiry as a consequence of the volume of related literature and the lens through which I view WHM. However, I hope this review creates a backdrop for my thesis, establishes the relevance of my research to wildlife conservation and management, and serves as a building block from which to develop theory about sharing and consumption of WHM.

This chapter begins by providing a definition for WHM, discussing the significance of WHM in society from the development of humans to the modern locavore movement, the risks and benefits of WHM consumption and access to this valuable resource in the US. I continue my synthesis by discussing the roles of sharing in WHM consumption from multiple perspectives and identify the importance of WHM sharing in modern society. I apply the theoretical

framework Coupled Human and Natural Systems (CHANS) (Liu et al., 2015; Liu et al., 2007) to the sharing and consumption of WHM, to clarify the functional roles of WHM in society. Finally, I introduce wild harvested venison (deer meat) as the centerpiece of my thesis and argue why venison is an ideal WHM on which to focus my inquiry.

Part 1: Significance of Meat in Society

Meat--animal tissue or flesh derived from a mammal--"is the most universally valued and sought after source of human nutrition" (Beardsworth & Bryman, 2004). The evolution of hunting and increased consumption of meat during the Pliocene epoch is thought to have played a major role in the physiological and social development of hominids (Larsen, 2003; O'Keefe & Cordain, 2004; Smil, 2002). The value of meat to society resulted in the industrialization and commoditization of meat (Bruckner, 2007; Magdoff, 2012), leading to an increased separation of source and consumer (Gouveia & Juska, 2002; Heinz & Lee, 1998), decline in the quality of meat (Larsen, 2003; O'Keefe & Cordian, 2004), and concerns about the morality of meat consumption (Bruckner, 2007; Cahoone, 2009; M. N. Peterson, 2004; Smil, 2002). Local food movements seeking to disassociate with industrialized meat, have in fact pointed a spotlight at WHM in recent years, popularizing it through publications such as Pollan's (2006) *The Omnivores Dilemma* or Cerulli's (2012) *The Mindful Carnivore*. The role of meat in human history and the status of meat in modern society makes this research relevant and valuable.

What is Wild Harvested Meat?

Game meat is likely the most common term used to identify WHM. Broadly, game meat refers to the meat of game animals--wild animals hunted for food and sport such as elk, deer, turkey, ducks, rabbits, raccoons, and squirrel. The Michigan Food Law of 2000 defines wild game as "animals from their natural state and not cultivated, domesticated, or tamed" (Michigan Department of Agriculture and Rural Development, 2012, p. 6). Although strict definitions for game meat may exist, application and interpretation of the term has become increasingly difficult as the line between domestic and wild is blurred with the advent of farming wild game, the creation of game sanctuaries for hunting, the feeding of wildlife as a management practice, and nomadic pastoral practices of herding wildlife populations (Geist, 1988). Even strictly wild populations are not immune to human intervention, as most are managed in some fashion by state and federal agencies. This study examines and assesses the various functions of meat procured through hunting animals in their wild state (i.e., not fenced, farmed, fed or herded). Due to the myriad of uses of the term "game meat" I use the more specific term wild harvested meat (abbreviated WHM for ease of reading) in lieu of game meat.

Risks and Benefits of Consuming Wild Harvested Meat

Meat has been part of the human diet for over 5 million years (Larsen, 2003). Modern domestic meat consumption in the US has been associated with obesity, hypertension, diabetes, and cardiovascular disease (O'Keefe & Cordain, 2004). WHM, however, can be a healthy source of lean protein, high in energy content and essential macronutrients (Larsen, 2003; O'Keefe & Cordain, 2004). WHM, such as venison, has 16-23% less fat and higher percentages of monounsaturated fats and omega 3 fatty acids compared to domestic beef, which is high in

saturated fats associated with cardiovascular disease (O'Keefe & Cordain, 2004). The omega 3 fatty acids in WHM are partially responsible for its 'gamey' taste (O'Keefe & Cordain, 2004). In addition, WHM is free of antibiotics, hormone supplements, and other additives, and is not subject to engineered genetic modifications (GMO), although deer may still consume GMO crops.

However, WHM handling and consumption can pose adverse health risks from zoonotic diseases (Karesh & Cook, 2005) and ingestion of bio-accumulated chemical contaminants such as pesticides, dioxins, polychlorinated biphenyls (PCB's) and heavy metals (Burger, 2000). For example, the consumption of palm civets in Asia has been identified as the source of the SARS coronavirus outbreak (Bell, Roberton & Hunter, 2004). Of particular concern for hunters and their families is the mounting evidence that the use of lead shot contaminates meat with lead at levels that may be unsafe for consumption, especially by women who are pregnant or may become pregnant, and by children under 6 years of age (Danieli et al., 2012; Iqbal et al., 2009; Mateo, Rodriguez-De La Cruz, Vidal, Reglero & Camarero, 2007).

Access to Wild Harvested Meat in the United States

Meat from game animals raised on ranches or farms and processed according to U.S. Department of Agriculture (USDA) standards is available for purchase in US supermarkets or restaurants, and is frequently referred to as 'game meat.' Often, this farm raised meat from wildlife species is simply referred to as game meat, or even wild meat, without direct reference to its husbandry, making it difficult for the average consumer to differentiate between wild harvested and farm raised sources. Additionally, the average consumer may be unaware that the meat available for purchase in US stores and restaurants does not come from hunters. In fact, the

sale and trade of WHM is illegal within the US. A few exceptions exist in the form of legal markets for other wildlife parts such as antlers and pelts and alligator meat (Abhat & Unger, 2010). The absence of markets in WHM is a key tenet of US wildlife conservation: Unregulated and unsustainable market driven hunting for food and fashion were identified as key threats to wildlife at the turn of the 19th century and a catalyst to the subsequent development of wildlife conservation in the US (Organ, Mahoney & Geist, 2010). The current system of wildlife management in the US, often referred to as the North American Model of Wildlife Conservation[1], or simply the North American Model, is unique in this fact compared to many of its European counterparts, where some form of regulated market in WHM exists.

The only way to legally access WHM in the US is through a hunter or someone who knows a hunter. Hence, sharing and social networks play a large role in how WHM is distributed throughout the country. This is evidenced by the number of people who have consumed WHM in comparison to the number of hunters- who make up approximately 6% of the population (U.S. Fish and Wildlife Service [USFWS], 2012). A 1996 study in New York reported that 61.6% of non-hunters had eaten WHM (Stedman & Decker, 1996). A 2011 national survey by Responsive Management (RM) and the National Shooting Sports Foundation (NSSF) revealed that 42% of Americans had consumed WHM over the past 12 months. (Note: Both of these studies used the term game meat in their data collection and analysis.) Other methods of obtaining WHM are beginning to develop in the US, for example the Nebraska Deer Exchange (NDE). The NDE is a website created in 2008 and hosted by the Nebraska Game and Parks Commission where deer

[1] North American Model of Wildlife Conservation is the result of wildlife management in the US over past two centuries and is the basis for modern wildlife conservation in the U.S (Organ et al, 2010). The model is made of seven pillars: (1) Wildlife as a public trust resource; (2) Elimination of markets for wildlife; (3) Allocation of wildlife by law; (4) Wildlife can only be killed for a legitimate purpose; (5) Wildlife is considered an international resource; (6) Science is the proper tool for discharge of wildlife policy; (7) Democracy of hunting (Organ et al., 2012).

hunters and those who want wild harvested venison can make connections to share the harvest (Hildreth, Hygnstrom, Hams &VerCauteren, 2011). The website specifically states that venison cannot be sold, but recipients can pay hunters for other services such as the processing of the meat (Hildreth et al., 2011). In some states, efforts are being made to legalize the sale of WHM. For instance, lawmakers in New Jersey recently put forth a bill to allow the commercial harvest and sale of venison (New Jersey Assembly Bill No. 3039, 2014). Generally, the decision to allow the sale of WHM rests in the states' legislature who are entrusted to manage the states wildlife for the benefit of current and future generations (Batcheller et al., 2010). Thus, variation exists from state to state regarding specific regulations for wildlife and enforcement of those regulations.

Part 2: The Importance of Sharing

Although WHM is not available in US stores or restaurants, hunters and non-hunters still consume WHM (Burger, 2000 & 2002; RM & NSSF, 2011; Stedman & Decker, 1996; Titus, Haynes & Paragi, 2009). Because only 6% of the US population hunts, interactions between hunters and non-hunters are essential for the transfer of WHM to 94% of the US population (USFWS, 2012). The word I am using to describe this interaction, or exchange, is sharing. Sharing is defined as "to give [or have] a portion (of something) with another or others" (The Oxford American College Dictionary, 2002, p.1258). The act of sharing WHM involves a provider (most often a hunter) and a receiver, who can either be a hunter or a non-hunter. WHM can be given directly from a provider to a receiver, such as a raw piece of meat, or can be enjoyed together such as sitting down for a meal, where the act of sharing is no so direct.

Most often WHM (in both raw and cooked forms) is shared through informal networks between hunters, their families, relatives, friends, neighbors, coworkers and the landowners whose property they hunt. More formalized sharing exists in the common practice of hosting community wild game dinners and through charitable meat donation programs, such as Hunters for the Hungry. In Michigan, churches are known for their large wild game dinners, sometimes hosting 200-400 guests. In 2009 and 2010 the Hunters for the Hungry program provided 2.6 million pounds of WHM[2], equaling an estimated 10.5 billion meals, to America's hungry (National Rifle Association [NRA], 2010). Sharing, in particular the sharing of meat, has been a topic of keen interest for many researchers in the social sciences.

Anthropological Theories and Studies on Food Sharing

Anthropologists interested in the evolution of human societies often study food sharing in hunter-gather communities. Analysis of food transfer in various hunter-gather societies has produced four distinct evolutionary theories about sharing: kin selection, reciprocal altruism, tolerated scrounging, and costly signaling (Gurven, 2004a; Kaplan & Gurven, 2005; Koster, 2011; Nolin, 2010). The theory of kin selection posits that sharing food evolved as a way to aid others who carry the same alleles, increasing the likelihood one's own genes are passed on (Kaplan & Gurven, 2005). Reciprocal altruism refers to food sharing as a way to garner future support in a time of need (Kaplan & Gurven, 2005). Tolerated scrounging describes when food is shared because the cost of defending it outweighs the cost of sharing (Kaplan & Gurven, 2005). Costly signaling indicates when food is shared to signal unobservable traits about the donor, such has his hunting skills or cooperative nature (Kaplan & Gurven, 2005). It has been

[2] WHM totals are only from the following species: Deer, Elk, Antelope, Moose, Pheasant, and Waterfowl (NRA, 2010).

suggested that these theories are not mutually exclusive, and likely are components of a complex system (Koster, 2011; Moore, 2004)

Studies of hunter-gather communities have shown that WHM is treated differently than other natural resources (Kameda, Takezawa & Hastie, 2005). Meat is shared more extensively than non-animal based food products or gathered resources (Kaplan et al., 1985). Some studies of hunter-gather communities site inability to store large quantities of meat for long periods of time as the main reason behind the high incidence of WHM sharing (Kaplan et al., 1985). Kaplan et al. (1985) also found that resource availability impacted sharing behaviors, concluding that sharing is more prominent in societies where meat is available year round. For example, migrating herds of caribou offer access to meat during short periods each year, requiring that meat be saved to last the entire season possibly limiting sharing behaviors (Kaplan et al., 1985). Other studies counter these arguments, noting that food preservation techniques allow food to last for longer periods of time (Gurven, 2004b). However, storage also has a down side, because stores must be guarded and decrease mobility (Kaplan et al., 1985). Kaplan et al. (1985) also found that meat sharing, compared to the sharing of other resources, had the greatest impact on nutritional status. Gurven (2004b) found that sharing large, more difficult to acquire food items with high variability in acquisition (such as large game) is more common than the sharing of small easily acquired food items.

Bliege Bird and Bird (1997) report that hunters seek both consumptive and social benefits from sharing of meat. Alvard (2004) argues that the cost of not sharing is higher than the cost of sharing, due to the network of relations built by the act of sharing meat. Using social network theory, Koster (2011) and Nolin (2010) found that kinship, interhousehold distance, and reciprocity were strong predictors of sharing behavior. Koster (2011) found that resources tend to

move based on lines of kinship associated with need and not reciprocity, and also found differences between lineal and collateral kin. Koster's study contradicts findings by Allen-Arave, Gurven and Hill (2008) where reciprocity was reported to be the main motivator of sharing among kin. Bliege Bird et al. (2001) propose costly signaling as an offset to discrepancies in motivation for reciprocal altruism, claiming that signaling is a benefit derived from giving without immediate returns. These studies demonstrate that sharing WHM can be motivated by many factors and that it can positive impacts on providers and receivers.

Commensality

Food sharing has been studied outside of hunter gather communities focusing on a wide range of topics: fostering a sense of community in academic and organizational environments (Roderick, Carr & Zundel, 2009; Watland, Hallenbeck & Kresse, 2008) as a form of aid and support in at risk communities (Quandt, Aroury, Bell, McDonald & Vitolins, 2001); connecting diverse groups of people (Wise, 2011); relationships between culture and health (Fischler, 2011; Pachucki, Jacques & Christakis, 2011); intimacy (Miller, Rozin & Fiske, 1998); and the broader cultural context of food (Mintz & DuBois, 2002).

For Kass (1994), the common saying "you are what you eat" appears true. He states, "eating comprises the appropriation, incorporation, and de-formation of a complex other, and its homogenization into simples, in preparation for their transformation into complex same" (Kass, 1994, p. 26). In essence, ingesting the flesh of another animal connects us to that being. For many people, the act of eating may not be so profound, but it is a pleasurable and social act, that connects us to those with whom we share our meal (Miller et al., 1998; Rozin, 1999). Simmel (1997) states, "Of all the things that people have in common, the most common is that they must

eat and drink" (p. 130). He goes on to explain that one of the most significant things about our common need to consume, is that anyone can sit down together at a meal; it is a universal act and opportunity to bring diverse groups together (Simmel, 1997). Commensality, or the act of eating together, promotes and improves the flow of communication, nurtures relationships, and fosters sense of community in families, organizations, and communities (Fischler, 2011; Watland et al., 2008). These effects are observed across cultural, ethnic, and religious boundaries (Patton, 2005; Wise, 2011;).

Throughout European history there is evidence that providing venison to others was a way to build social capital and strengthen social connections (Fletcher, 2011). In the Canadian artic, the Inuit credit WHM with maintaining the Inuit ethnic identity of subsistence hunters, maintaining social relationships, and enforcing connections to nature and wildlife (Omura, 2013). For Inuit, the key tenets of hunting are that the wildlife must be respected and their meat must be used and shared (Omura, 2013). In summary, food sharing is a social activity that helps build and maintain social bonds and a vehicle through which these bonds are expressed (Jimenez, Monton-Subias & Romero, 2011).

Socialization Through Sharing

Socialization is the process through which attitudes, behaviors and values are learned (Stedman, 2012). Primary socialization occurs through parents (or their social equivalent), while secondary socialization occurs through broader sources of influence such as peers and community (Stedman 2012). Socialization is an important component of hunting culture, as it is often the primary mechanism for the recruitment of new hunters (Ryan & Shaw, 2011; Stedman & Heberlein, 2001). Heberlein (1991) proposed that participation in social activities where

WHM is shared might develop acceptance of the activity among non-hunters by strengthening or developing shared beliefs. Stedman and Decker (1996) found that sharing game meat at meals or in other ways may be one readily available and effective means of enhancing positive social interaction among hunters, or of socializing non-hunters to hunters via food and stories about hunting. As discussed in the previous section, sharing provides occasions for diverse groups to gather over the universal act of eating and is the basis for building and maintaining social bonds in many societies (Jimenez et al., 2011; Simmel, 1997; Wise, 2011). Anthropological theories speculate sociality may be responsible for the emergence of the modern day human race, and that hunting and subsequent meat sharing may be responsible for at least some of this instrumental development (Kawai, 2013; Stanford & Bunn, 2011). Programs such as the Orion Institute's Windsor Dinners or Michigan's Gourmet Gone Wild®, use socialization theory to provide opportunities for hunters and non-hunters to interact over a shared meal of WHM.

Socialization and Social Networks

In their 2014 publication Larson, Stedman, Decker, Siemer & Baumer proposed a social structure (or habitat) for hunting recruitment in the US based on social-ecological theories about individual behavior. Starting with the individual, the social structure expands outward to the micro level (family), meso level (community support networks such as peers and extended family), and the macro level (society) (Larson et al., 2014). Essentially, this theory models a hunters ego network and their level of influence. Increasing social distance reflects weaker connections between the individual and their relations, however, it also means a broader audience. In part, the hunter recruitment structure based on primary socialization suffers from homophily – the social network concept that explains the phrase "birds of a feather flock

together" (McPherson, Smith-Lovin & Cook, 2001). Hunters have close social relationships with other hunters, forming a more 'closed' network. In relation to sharing, this supports anthropological theories about the role of kin selection in resource distribution.

Granovetter's (1973) theory on the strength of weak ties posits that connections outside ones inner circle provide the opportunity for the flow of new information. Through using weaker ties, one is able to converse with the community, rather than preach to the choir. Focusing on secondary forms of socialization accesses the meso and macro levels of a hunter's social network. Sharing WHM can be both a primary and secondary form of socialization to hunting and presents its self as a way for hunters to communicate at the community level and extend their social reach. Ljung, Riley, Heberlein & Ericsson (2012) conducted research to test the potential societal implications of socialization to hunting through the act of sharing WHM. In Sweden they found that WHM consumption positively influenced attitudes toward hunting (Ljung et al., 2012). Further evidence from Sweden suggests the effects of WHM sharing are similar in rural and urban settings, although availability – and thus frequency of consumption- are markedly different in these two environments (Ljung, Riley & Ericsson, 2014).

Expanding Wild Harvested Meat's Impact on Society

Sharing WHM doesn't simply put protein on the table. WHM provides opportunities for sharing the culture of hunting, and also to extend the benefits provided by hunting. As Heffelfinger (2014) put it "venison has to be earned" (p. 43). There is an entire process that goes into putting venison on the table and what it takes to be 'earned' is part of what makes it special. Hunting is a valuable part of US culture and tradition that enriches quality of life by connecting people to nature, one another, and their food (Bruckner, 2007; Knezevic, 2009; M. N. Peterson,

Hansen, M. J. Peterson, & T. Peterson, 2010; M.N. Peterson, 2004). Hunting can build connections to nature through the act of self-sufficiency, by functioning to remind hunters of their 'traditional relationship' with nature, by increasing ecological knowledge, and through "render[ing] the materiality of food production explicit" (M. N. Peterson et al., 2010, p. 127) (Cahoone, 2009; Franklin, 1998; Organ et al., 2010; M. N. Peterson, 2004). WHM serves as a vehicle for sharing these experiences and embodies their social and ecological significance (M. N. Peterson et al., 2010). Fletcher (2011) claims that venison's "intangible symbolic worth" was often greater than it's economic value in European history, placing a weighty meaning on the gift of venison (p. 210). The Inuit of the Canadian artic use the phrase "real food" to describe meat that is obtained by hunting (Omura, 2013). This simple translation emphasizes the importance of WHM to Inuit culture. Linking back to the meso level of a hunter's social network and the importance of secondary socialization, sharing expands the potential impact WHM can have on society.

Part 3: Conceptual Framework

Coupled Human and Natural Systems (CHANS)

The CHANS framework proposed by Liu et al. (2007) identifies reciprocal interactions and feedback loops between human and natural systems that occur through time and space. For this reason the CHANS framework is useful in identifying couplers: factors that link human and natural systems. In essence, couplers are the threads that stitch human and natural systems together. Having connections within and across systems provides resistance, resilience, adaptability, stability, and sustainability (Levin & Lubchenco, 2008; Liu et al., 2007).

Fundamentally, the more connections that exist, the stronger a system becomes. Sharing and consuming WHM has been identified as a potentially significant coupler (Freese, 1997; M. N. Peterson et al., 2010). Essential elements linking human and natural systems are the ecosystem services provided by the environment to humans and the impact they have on human well-being and society. I propose that WHM couples human and natural systems through the provisional and cultural ecosystem services it provides. Applying the CHANS framework to the sharing and consumption of WHM integrates research conducted on WHM across many disciplines, which was discussed in Parts 1 & 2 of this chapter.

Ecosystem Services Provided by Wild Harvested Meat

In the CHANS framework, natural systems provide ecosystem services to humans, such as the air we breathe or the feeling we get after taking a walk in the woods (Liu et al., 2007; Millennium Ecosystem Assessment [MEA], 2005). WHM can be associated with two types of ecosystem services: provisional and cultural.

Provisional ecosystem services are the tangible benefits people receive (Liu et al., 2007; MEA, 2005), such as the nutritional value (fresh lean local healthy protein that is antibiotic and chemical free) of WHM. Food security in many developing countries is unavoidably linked to WHM consumption, creating confounding conservation issues trying to balance local livelihoods and biodiversity (Richardson, 2010). Bushmeat (a term often used to describe WHM in the tropics) is an important source of protein for many remote communities, but has largely been driven to unsustainable levels of harvest due to urban demand and income generated from the market sale of bushmeat, another provisional ecosystem service provided by WHM (VanVliet & Mbazza, 2011; Wilkie & Carpenter, 1999). In some areas of the tropics, the bushmeat trade has

become an essential part of local economics (Bowen-Jones, Brown & Robinson, 2003; VanVliet & Mbazza, 2011).

Reliance on WHM extends to many cultures beyond the tropics. For example, indigenous subsistence communities, such as the Inuit of Alaska and Canada, rely on protein harvested from the wild for survival (Titus et al., 2009). There is also speculation that WHM may play an important role in the diets of recreational hunters in the US and their families and those in need (Burger, 2000 & 2002; K. Tidball, M. Tidball & Curtis 2013). Burger (2002) posits that recreational hunters and their families may be overlooked in terms of their dietary dependence on WHM. Burger (2002) estimated that the mean rate of venison consumption by attendees at a sportsmen event was one 4oz meal every four days and that 5% of venison consumers ate 8oz of venison a day. Additionally, Burger (2000) reported that some non-hunters eat WHMs (including fish) year round thanks to the generosity of friends and family. Burger (2000) also noted that gifted venison made up at least 50% of some non-hunters diets, emphasizing the importance of sharing in distributing provisional ecosystem services.

Although many of the previous examples describe dietary dependence, to be considered a provisional ecosystem service, WHM does not need to be consumed at the subsistence level, e.g. comprising a major part of an individual's diet. No matter the frequency of consumption the nutritional benefits provided by a serving of WHM are the same. WHM may be consumed to offset the cost of purchasing meat, or simply on its own merit.

Cultural ecosystem services are more difficult to quantify and measure: These are the non-tangible benefits people derive from natural systems (Lui et al., 2007; MEA, 2005). Culture and nature are inevitably linked; many aspects of human society are influenced and shaped by the natural system in which that society is located (MEA, 2005). Cultural ecosystem services can

be categorized as spiritual and religious, recreational, aesthetic, inspirational, social interactions, sense of place, cultural heritage, and educational (Hernandez-Morcillo, Plieninger & Bieling, 2013; MEA, 2005).

WHM does not have to be an essential part of someone's diet to maintain its importance. For many people, WHM is not a part of everyday life, but saved for special occasions. Almost every culture in the world has customs and traditions surrounding the sharing and consumption of WHM. In China, particularly in urban areas, the consumption of wildlife meat is considered a rare delicacy and a status symbol of a fashionable lifestyle (Zhang, Hua & Sun, 2008). For indigenous Alaskans the sharing and consumption of WHM provides not only an essential protein source, but plays an important role in cultural activities (e.g. ceremonies) and personal relationships, and is central to their sense of identity (Dombrowski, 2007; Titus et al., 2009). Urban consumers of bushmeat believe that bushmeat possesses cultural, spiritual and nutritional values (Milner & Bennett, 2003; Van Vilet & Mbazza, 2011).

Researchers have struggled to define and measure cultural ecosystem services, often resulting in oversight of their importance in decision-making and conservation policy (Hernandez-Morcillo et al., 2013; MEA, 2005). When cultural ecosystem services are lost or devalued, ties between human and natural systems are weakened, creating environmental and societal disruptions (MEA, 2005). Conversely, environmental and social disruptions may also result in the devaluation or loss of ecosystem services. Regardless of the mechanism, once cultural ecosystem services are lost, they are difficult to be reestablished or replaced, increasing the gap between human and natural systems and decreasing the systems resiliency (Hernandez-Morcillo et al., 2013).

Sharing and the Amplification of Ecosystem Services

Sharing WHM is not only an important element of many cultures, but it also functions to extend the provisional and cultural ecosystem services WHM provides to a larger portion of society. Hunters are not the only ones who receive ecosystem services provided by WHM; recipients of the hunter's harvest are additional beneficiaries, expanding the potential number of people engaged in this system. Societal impacts created by WHM are manifested from perceived benefits or costs an individual identifies when interacting with WHM. If an individual has no interaction with WHM, they cannot directly perceive benefits or costs, and the impact of WHM goes unrecognized. Creating opportunities to share WHM may help society recognize these impacts and the important role WHM plays in coupling human and natural systems.

Part 4: Venison

Cervidae are present in ecosystems throughout the world (Geist, 1998). Roth and Merz (1996) claim that the deer family may be the most economically important wildlife taxa. Deer are the most common species pursued by hunters in the US – 80% of all US hunters hunt deer (Aiken & Harris, 2011). White-tailed deer (*Odocoileus virginianus*) are one of the most widely distributed mammals in the Western Hemisphere (Demarais, Miller & Jacobson, 2000). VerCauteren et al. (2011) identify white-tailed deer as the world's most popular big-game species. Additionally, white-tailed deer are one of the most abundant species in the US and are of increasing concern to wildlife managers (Campa et al., 2011; Dougherty, Fulton & Anderson, 2003; VerCauteren et al., 2011). In 2010 the estimated population of white-tailed deer in the US was 30 million (VerCauteren et al., 2011). Burger (2000) reported that venison is the most

commonly consumed wild-harvested protein. When harvested, deer provide large quantities of lean protein, which may increase the prevalence of meat sharing (Gurven, 2004b). Wild harvested venison in the US embodies many of the benefits accredited to WHM – it is a fresh lean local free-range healthy protein that is antibiotic and chemical free.

Deer hunting in the US is steeped in tradition - some communities are known for their deer hunting culture and actually cancel school and close businesses on the first day of deer season. In parts of the country where deer hunting is popular, deer may be considered a cultural keystone species (Brent Rudolph, personal communication, April 2, 2015; Garibaldi & Turner, 2004). The concept of cultural keystone species, a parallel to the concept of ecological keystone species, identifies species that play an important role in local culture, are harvested and managed intensely, and are often used as symbols (Garibaldi & Turner, 2004).

Because deer are wildly distributed, used and valued by humans, focusing on the sharing of venison increases the generalizability of this study. The popularity of deer and availability of venison, ensure a wide range of experiences with venison and the ability to conduct research across large populations.

CHAPTER 2

The Extent of Venison Sharing and Consumption: Hunters as Providers

The consumptive use of natural resources has long played an important role in the cultures of many societies and in connecting humans to nature. As traditional natural resources users decline in number and urban populations with protectionist wildlife value orientations grow, questions arise about the role of utilitarian activities, such as hunting, in 21st century American society (Heberlein & Ericsson, 2005; Manfredo, Teel & Bright, 2003; Manfredo, Teel & Henry, 2009; USFWS, 2011; Whittaker, Vaske & Manfredo, 2006; Zinn, Manfredo & Barro, 2002). Hunting has long been the focus of studies in the biological and social sciences, however, little research in the US has been conducted on the meat produced through hunting, or wild harvested meat (WHM). Increased importance on the roles of WHM, originating from public trust resources (Organ & Batcheller, 2009), warrants systematic inquiry into the use of WHM and the ecosystem services it provides in present day society. Identifying the extent of WHM sharing and consumption can have implications for wildlife management, conservation policy, public health and the preservation of traditional natural resource use cultures.

The framework of Coupled Human and Natural Systems (CHANS) proposed by Liu et al. (2007) identifies the ecosystem services natural systems provide to humans, and more broadly society, as important components connecting humans and nature. Sharing and consuming WHM has been identified as a potentially significant coupler of human and natural systems (Freese, 1997; M. N. Peterson et al., 2010), however little research has been conducted to support this theory in the global north. WHM is associated with two types of ecosystem services: provisional

and cultural. Provisional ecosystem services are the tangible benefits people receive, for example, WHM (Liu et al., 2007; MEA, 2005). Identifying the amount of WHM produced by hunters establishes the potential provisional ecosystem services WHM can provide to society.

Cultural ecosystem services are more difficult to quantify and measure: These are the non-tangible benefits people derive from natural systems (Lui et al., 2007; MEA, 2005). Cultural ecosystem services are often categorized as spiritual and religious, recreational, aesthetic, inspirational, social relations, sense of place, cultural heritage, and educational (Hernandez-Morcillo et al., 2013; MEA, 2005). The cultural ecosystem services produced by WHM are mainly derived from the act of sharing, either providing WHM to others or receiving WHM from others. Food sharing is a social activity that helps build and maintain social bonds and is a vehicle through which these bonds are expressed (Jiménez et al. 2011). Identifying sharing behaviors of hunters may be an innovative way to measure the cultural ecosystem services provided by WHM.

Sharing WHM is not only an important element of the hunting process, but sharing also functions to extend the provisional and cultural ecosystem services WHM provides to a larger portion of society. Because the sale of WHM is illegal within US borders, the only way to legally access WHM in the US is from a hunter. Thus, hunters are the main providers of WHM and hunter social networks likely play a key role in how WHM is distributed throughout the country. Sharing increases the number of beneficiaries of hunting, may socialize non-hunters to hunting (Heberlein, 1991; Stedman & Decker, 1996), and has been credited with positively influencing attitudes toward hunting (Ljung et al., 2012; Ljung et al., 2014).

In recent years, multiple stakeholders have increased their attention on WHM, such as locavores seeking local healthy ethically raised meat and wildlife managers looking to recruit

new hunters based on interests in local foods (Larson et al., 2014; Ryan & Shaw, 2011; K. Tidball et al., 2013). Some have even go so far as to propose changes to laws pertaining directly to WHM by allowing for the commercial harvest and sale of WHM in areas of abundant deer populations in New Jersey (Adams, 2015; NJ Assembly Bill No. 3039; Thogmartin, 2006; VerCauteren et al., 2011). Better knowledge and insight into the extent of WHM sharing and consumption, and the provisional and cultural ecosystem services WHM provides to society, will contribute to current deliberations about the role of hunting in American culture and wildlife policy decision-making. This can be accomplished, in part, by investigating the amount of WHM produced by hunters, and by exploring hunter WHM sharing behvaiors such as how many hunters share, to whom, and any defining characteristics of hunters who share.

Methods

Study Area and Population

Michigan, noted for its upper and lower peninsulas, is located in the north central US with a land area of 56,539 mi^2 (U.S. Census, 2010). Human density and intensity of land use decrease south to north across the state (Michigan Department of Environmental Quality [MDEQ], 2014; Michigan Department of Technology, Management and Budget [MDTMB] Center for Shared Solutions [CSS], 2011) Approximately 75% of Michigan's population lives in urban areas and 25% in rural areas (U.S. Census, 2010). In 2010, Michigan's population was estimated to be 9,883,706, comprised of 77% white non-Hispanic or non-Latino, 49% male, with an overall median age of 39 years (U.S. Census, 2010).

Deer are one of the most economically important and sought after big game species throughout the world (Geist, 1998; Roth & Merz, 1996). In the US, white-tailed deer (*Odocoileus virginianus)* are the most abundant and popular big game species. Nearly 80% of all hunters in the US hunt deer, of which white-tailed deer are most wide-spread and abundant (Aiken & Harris, 2011; VerCauteren et al., 2011). Large quantities of lean protein produced from wild harvested deer may increase the prevalence of meat sharing (Gurven, 2004b). Furthermore, deer hunting has a long history and heritage in many communities where deer are found (Stransky, 1984). Because deer are wildly distributed, used and valued by humans, focusing on the sharing of venison increases the generalizability of this study.

Michigan's population has the greatest proportion of deer hunters in the US and ranks third in the total number of resident deer hunters 16 years and older (Aiken & Harris, 2011). Approximately 90% of all Michigan hunters hunt white-tailed deer, the most abundant deer species present in Michigan (Frawley, 2006). In 2013, 712,404 people purchased a deer hunting license in Michigan, 661,788 of whom were estimated to have hunted (Frawley, 2014). An estimated 9.2 million days were spent afield by deer hunters in 2013, culminating in a harvest of approximately 385,000 deer (Frawley, 2014). In 2013, the mean age of Michigan deer hunting license buyers was 42 years, 89% of whom were male (Frawley, 2014). Besides contributing substantially to the Michigan Department of Natural Resources (MDNR) budget, hunting has an estimated $1.16 billion annual impact on the state's overall economy and is considered an important cultural heritage among the states residents (Langenau, 1994; MDNR, 2010; Rudolph, 2005).

Sampling Design

Questions were included on the MDNRs 2013 Michigan Deer Harvest Study, a well-established annual survey with standardized protocols (Frawley, 2014). The 2013 Michigan Deer Harvest Study used a mixed methods approach to collect data from hunters (Greene, Caracelli & Graham, 1989). Hunters either voluntarily reported their harvest online or they were randomly selected through a stratified random sample of deer license buyers to respond to a mail back questionnaire. The online survey was promoted in the 2013 Deer Hunters Digest, on the MDNR website, and in an email to all 2013 deer license purchasers for whom MDNR had an email address (N= 98,143). Hunters who voluntarily reported their harvest online (n=3,774) were removed from the total possible population prior to drawing a sample for the mail back questionnaire creating an effective population size of N=708,632.

The remaining population of hunters was divided into four mutually exclusive strata based on the type of deer hunting license purchased (firearm, archery, antlerless, mentored youth, or combination) and the season in which it was valid. In 2013, Michigan had seven deer hunting seasons: Early antlerless firearm (Sept 21-22); Liberty Hunt (Sept 21-22); Archery (Oct 1-Nov14, Dec 1-Jan 1); Independence Hunt (Oct 17-20); Regular firearm (Nov 15-30); Muzzle loading (Dec 6-22); Late antlerless firearm (Dec 23-Jan1) (MDNR, 2013). Youth (16 and under) and disabled hunters were eligible for the Liberty Hunt, while the Independence Hunt was only for disabled hunters (MDNR, 2013). The first stratum included hunters eligible only for the archery, firearm and muzzleloader seasons (N=439,173). The second stratum included hunters eligible only for the early and late antlerless seasons in addition to the seasons in the first stratum (N=208,866). The third stratum included hunters eligible for the Liberty season (N=56,931) and the fourth stratum included only disabled hunters (N=3,662). Strata were sampled separately to

ensure all types of hunters had sample sizes large enough for statistical tests. The final stratified random sample contained 57,432 hunters: 28,591 from the first stratum, 13,469 from the second stratum, 11,714 from the third stratum and 3,658 from the fourth stratum. However, 1,895 hunters selected for the sample did not have addresses. Thus, the final sample of hunters who were mailed questionnaires, totaled 55,537 hunters: 27,438 from the first stratum, 13,106 from the second stratum, 11,517 from the third stratum and 3,476 from the fourth stratum. The sample size and sampling scheme of the 2013 Michigan Deer Harvest Study was designed to minimize coverage and sampling errors (Dillman, Smyth & Christian, 2009).

Data Collection

The 2013 Michigan Deer Harvest Study used a modified Dillman Total Design method with three mailings (Dillman, Smyth & Christian, 2009). The first mailing was sent on January 22, 2014, the second mailing was sent on March 14, 2014, and the third mailing was sent on April 26, 2014. Also included in the mailing was a letter of consent describing the study from the chief of the MDNR Wildlife Division (Appendix B) and an offer from Safari Club International to be entered in a drawing to win a firearm or bow if the questionnaire was returned by February 20, 2014 (Appendix C).

Data on age, sex and residence of respondents was extracted from the MDNR deer hunting license database along with questionnaire responses. Permission to access this data was given my MDNR and approved by the MSU Human Research Protection Program (HRPP) Social Science / Behavioral / Education Institutional Review Board (SIRB) to ensure the protection of human subjects (IRB #x13-721e). Basic demographic information is collected by the MDNR with all hunting license purchases. Hunters' community type was identified as

belonging to one of three categories based on the location of the zip code used in survey mailing in relation to census defined urbanized areas. The 2010 U.S. Census identified urban areas as densely populated census tracks and/or blocks that have at least 2,5000 residents, 1,500 of whom must reside outside intuitional group quarters (U.S. Census, 2011). An urbanized area is an urban area with 50,000 people or more (U.S. Census, 2011). Michigan zip codes and U.S. Census urban areas where mapped using ArcGIS 10.1 (Environmental Systems Research Institute [ESRI], 2012). Michigan zip codes (Tl_2010_26_zcta510.zip) and urban area (Tl_2013_26_us_uac10.zip) data files were downloaded from the U.S. Census TIGER/line Shapefiles website (www.census.gov/geo/maps-data/data/tiger.html). Michigan zip codes were selected by location in relation to the urbanized area source layer. Zip codes completely within the urbanized area layer were identified as urban. Zip codes that intersected the urbanized area, but were not completely within the urbanized area, were identified as the urban buffer. Zip codes not touching the urbanized areas layer were identified as not urban.

Survey Instrument

The 2013 Michigan Deer Harvest Study is a four-page questionnaire that asks questions about hunter harvest, activities and satisfaction, and statewide deer management issues. Hunters who harvested deer with a Damage Management Assistance (DMA) permits were asked not to report DMA harvest on the questionnaire because it is mandatory to report DMA harvest directly to the MDNR. I included additional questions asking hunters if they shared any of the venison they harvested in the past 12 months, with whom did they share venison (immediate household members, relative not within household, friends, neighbors or coworkers, landowner who's property they hunted, community group game dinner, food bank or other donation program, or

other open ended response) and the estimated total number of people they directly shared venison with in the past 12 months (See Appendix A for a complete version of the questionnaire).

Categories for possible relations a hunter shared their venison with were derived from pilot interviews with hunters, discussions with MDNR researchers, and previous surveys asking non-hunters about their relationships with hunters (Ljung et al., 2012; Ljung et al., 2014; Stedman & Decker, 1996). Sharing was defined as offering raw (meat) or prepared (cooked) venison to another person. All questions about venison sharing behaviors were limited to a reference period of 12 months to assist respondent recall (Dillman et al., 2009; Vaske, 2008). An open-ended estimate for the total number of people with whom hunters directly shared their venison was used to elicit a full list of possible answers and avoid influencing potential answers with response options (Tourangeau, Rips, & Rasinski, 2000; Vaske, 2008). Additionally, researchers had little information from which to formulate appropriate response options. I purposely asked hunters to estimate the total number of people they directly shared their venison with after prompting them to identify with whom they shared their venison, assuming that responding to the first question would assist them with their estimate for the second.

Variable Construction

Dependent variables. Type of venison receivers was created from responses to question nine in the 2013 Michigan Deer Harvest Study questionnaire. It is comprised of seven binary variables describing all the possible relations with whom a hunter shared their venison; immediate household members, relative not within household, friends, neighbors or coworkers, landowner who's property they hunted, community group game dinner, food bank or other

donation program, or other not specified. Respondents who checked off the "other" category and provided an explanation were coded into the previously defined categories based on the type of relationship they described. For example, hunting buddies was coded as friends and church potluck as community event. Respondents, who checked off the "other" category and expressed that they had no deer/venison to share were coded as "did not share". Respondents who provided responses such as "the wolves" or "my dog" were removed from the "other" category and coded as "did not share" unless they also provided a response to one of the established sharing categories.

Number of venison receivers was a continuous count variable created from responses to question ten on the 2013 Michigan Deer Harvest Study questionnaire. It details the estimated number of people with whom a hunter directly provided venison.

Venison Providers was a binary variable identifying whether or not a hunter shared their venison with at least one other person. This "venison providers" variable was created from the combined responses to questions nine and ten on the 2013 Michigan Deer Harvest Study questionnaire. If a hunter responded having shared or not shared their venison to at last one of the two possible questions they were identified as sharing or not sharing, respectively. These two questions were combined to maximize the number of respondents to questions on sharing behaviors due to issues of non-response.

Covariates. Harvested in 2013 was a binary variable identifying if a hunter harvested at least one deer in the 2013 deer hunting season(s).

Harvested antlered deer in 2013 was a binary variable identifying if a hunter harvested at least one antlered deer in the 2013 deer hunting season(s). In 2013 hunters were allowed to harvest a maximum of 2 antlered deer.

Harvested antlerless deer in 2013 was a binary variable identifying if a hunter harvested at least one antlerless deer in the 2013 deer hunting season(s). This does not include antlerless deer harvested using a DMA permit.

Total Harvest was a continuous count variable identifying the total number of deer a hunter harvested during the 2013 deer hunting season(s).

Participated in Early and/or Late Antlerless Season(s) was a binary variable describing whether or not a hunter participated in at least one of the early or late antlerless firearm seasons.

Participated in Muzzleloader Season was a binary variable describing whether or not a hunter participated in the muzzleloader season.

Participated in Archery Season was a binary variable describing whether or not a hunter participated in the archery season.

Participated in Regular Firearm Season was a binary variable describing whether or not a hunter participated in the regular firearm season.

Equipment Used was a categorical variable describing the type of equipment a hunter used during the 2013 deer hunting season(s) where: 0= just a bow (include recurved, compound and cross bows); 2=just a firearm (includes all firearms eligible to be used during any of the deer hunting seasons); 3=both bow and firearm; 4=just participated in disabled hunts. If a hunter just participated in the disabled hunts it is impossible to figure out what type of equipment they used. If a hunter participated in the disabled hunts and another season they are classified as using the

equipment required for the other season, however, they may have used a different type of equipment during the disabled season.

Sex was a binary variable where 0=male and 1=female.

Age was continuous variable describing the respondent's age in years at the time of the study.

Ecoregion was a categorical variable that identifies what MDNR Ecoregion the hunter lives in as described by Frawley (2014) where: 0= Upper Peninsula; 1=Northern Lower Peninsula; and 2=Southern Lower Peninsula.

Community type was a categorical variable describing the level of urbanization of a respondent's community where 0=not urban; 2=urban buffer; and 3=urban.

Calculating Edible Venison Harvest

Equations for edible venison yield. Although many estimates exist, relatively few formal inquiries using actual specimens have been conducted to determine the total amount of edible venison that can be obtained from a white-tailed deer. I was only able to find five studies, the most recent of which was conducted in 1983, that used wild white-tailed deer, provided some information about methodologies, and reported either raw data, regression equations or both to determine edible venison yield. Table 2.1 provides a short summary of each study including author(s), year, data source description and final edible venison yield equations. Taking into account the composition of the Michigan deer harvest and ranges in deer size based on age, sex and nutrition, the average of these equations was used to estimate the maximum edible venison yield from the 2013 Michigan deer harvest.

Table 2.1: Summary of studies conducted on the amount of edible venison produced from a white-tailed deer (WTD). Regression equations for edible venison yield from this table were used to calculate edible venison yield from the 2013 Michigan deer harvest.

Author(s)	Year	Data Source		Equations/Averages
		Sample Description	Location	
Hamilton	1947	9 WTD	5 Western NY abandoned farmland; 2 Adirondack region NY; 2 Ontario	EV=0.6791*LW-16.57
				EV=0.859*HDW-16.078
				EV=0.573*LW
Severinghaus	1949	109 WTD: 22 Bucks, 78 Does; Aged 5 months – 11 years; plus Hamilton's data.	Majority Catskills and Western NY; few Adirondack region NY plus Hamilton's data	EV=0.655*LW-13.64
Hamerstrom & Camburn	1950	24 WTD: 5 Fawns (2 doe, 3 buck); 6 yearlings (2 doe, 4 buck); 13 adults (4 doe, 9 buck)	Edwin S. George Reserve, Livingston County, Michigan	EV=0.538*LW-1.48
Cowan, Hartsook, Whelan, Watkins, Lindzey, Wetzel & Liscinsky	1968	13 WTD aged 12-39 months	Not specified, likely Pennsylvania.	EV=0.4354*LW+1.5163
				EV=0.4945*FDW+5.3977
				EV=0.5092*HDW+6.6179
Marchello, Berg, Slanger & Harrold	1983	15 WTD	North Dakota	EV = 0.49*LW
				EV=0.59*FDW
				EV=0.72*SDW

Abbreviations		Definitions from Cowan et al. (1968).
EV	Edible Venison	Weight of edible red meat (muscular tissue). This does not include the heart or other organs that may be used for consumption.
LW	Live Weight	Total weight of the deer before it is harvested (before bleeding).
FDW	Field Dressed Weight	Weight of deer with its entrails (not including heart, liver, lungs) removed but its' hide still intact.
HDW	Hog Dressed Weight	Weight of deer with its entrails (including heart, liver, lungs) removed but its' hide still intact. Often FDW and HDW are used interchangeably, however, the technical difference is defined here.
SDW	Skinned and Dressed Weight	Weight of a carcass that has been hog dressed and then skinned.

Additional measures for calculating edible venison yield for Michigan deer.

Information on the average size of Michigan white-tailed deer and composition of the 2013 harvest were also used to calculate the maximum edible venison yield for the 2013 Michigan deer hunting season. Average live weights for Michigan white-tailed deer by age (0.5, 1.5, 2.5, 3.5, 4.5, and 5.5+), sex (doe or buck) and year round nutrition (poor or good) can be found in Table 2.2. This table is adapted from reported field dressed weights by Ozoga, Doepker & Sargent (1993; Table 3, p. 43). Field dressed weights were multiplied by the conversion factor 1.28 to obtain live weights (Case & McCullough, 1987; Harder, 1980). The average weights from poor and good nutrition, respectively, were used as the low and high ends of the range for the maximum edible venison yield estimate. The age structure and total antlered and antlerless harvest from the 2013 Michigan deer hunting season(s) was determined from 2013 MDNR deer checking station data (Mayhew, 2014) and from the 2013 Michigan Deer Harvest Survey Report (Frawley, 2014), respectively (Table 2.3).

Calculating edible venison yield for the 2013 deer season(s). Equations from each of the five individual studies reported in Table 2.1 were used independently to calculate edible venison yield, and then outputs were averaged together for final maximum venison yield estimates. First, the edible venison yield for one deer based on age, sex and nutrition was calculated using the average live weight (in pounds) for Michigan white-tailed deer from Table 2.2 (Table 2.4). These values were then multiplied by the total number of deer harvested per sex and age class (Table 2.3) to determine the total venison yield from the 2013 Michigan deer hunting season by age, sex and nutrition. These estimates were averaged by equation and then in total, to determine the maximum edible venison yield from the 2013 Michigan deer hunting season(s).

Table 2.2: Average live weights for Michigan white-tailed deer by age, sex and year round nutrition adapted from reported field dressed weights by Ozoga et al (1993, p. 43). Field dressed weights were multiplied by the conversion factor 1.28 to obtain live weights (Case & McCullough, 1987; Harder, 1980).

Deer Age (in years) and Sex (M=male; F=female) by antler status	Live weight by year round nutrition		
	Poor Nutrition	Good Nutrition	Average
Antlered Deer			
M 1.5	125	163	144
M 2.5	164	202	183
M 3.5	178	229	204
M 4.5	186	239	212
M 5.5+	192	251	221
Average	169	217	193
Antlerless Deer			
M 0.5	65	90	77
F 0.5	59	77	68
F 1.5	115	136	125
F 2.5	131	152	141
F 3.5	143	161	152
F 4.5	151	163	157
F 5.5+	154	166	160
Average	117	135	126
Antlered and Antlerless			
Average	143	176	159

Table 2.3: Composition of 2013 Michigan deer harvest by age and antlered/antlerless deer. Age structure determined from 2013 Michigan Department of Natural Resources deer checking station data (Mayhew, 2014). Antlered and antlerless division and total harvest numbers determined from the 2013 Michigan Deer Harvest Survey Report (Frawley, 2014).

Deer Age (in years) and Sex (M=male; F=female) by antler status	Estimated Number of Deer in 2013 Harvest	Estimated Percentage of 2013 Harvest
Antlered Deer		
M 1.5	98,599	25.6%
M 2.5	62,584	16.2%
M 3.5	34,112	8.9%
M 4.5	6,620	1.7%
M 5.5+	1,139	0.3%
Total	203,054	52.7%
Antlerless Deer		
M 0.5	27,578	7.2%
F 0.5	27,815	7.2%
F 1.5	38,614	10.0%
F 2.5	32,565	8.5%
F 3.5	26,964	7.0%
F 4.5	12,879	3.3%
F 5.5+	15,833	4.1%
Total	182,248	47.3%
Antlered and Antlerless		
Total	385,302	100.0%

Table 2.4: Edible venison yield for one deer based on age, sex and nutrition calculated using the average live weight (in pounds) for Michigan white-tailed deer from Table 2.2. The five different equations presented in Table 2.1 and the average of these equations were used to calculate edible venison yield.

Deer Age (in years) and Sex (M=male; F=female) by antler status	Edible venison yield (in pounds) from one deer by equation and nutrition status																	
	Hamilton, 1947			Severinghaus, 1949			Hamerstrom & Camburn, 1950			Cowan et al., 1968			Marchello et al., 1983			Average of five equations		
	Poor	Good	Avg.	Poor	Good	Avg.	Poor	Good	Avg.	Poor	Good	Avg.	Poor	Good	Avg.	Poor	Good	Avg.
Antlered Deer																		
M 1.5	69	94	81	69	93	81	66	86	76	56	72	64	61	80	71	64	85	75
M 2.5	95	121	108	94	119	106	87	107	97	73	90	81	80	99	90	86	107	96
M 3.5	104	139	122	103	136	120	94	122	108	79	101	90	87	112	100	94	122	108
M 4.5	109	146	128	108	143	126	98	127	113	82	106	94	91	117	104	98	128	113
M 5.5+	114	154	134	112	151	131	102	133	118	85	111	98	94	123	109	101	134	118
Average	98	131	114	97	128	113	89	115	102	75	96	86	83	106	95	88	115	102
Antlerless Deer																		
M 0.5	28	44	36	29	45	37	34	47	40	30	41	35	32	44	38	30	44	37
F 0.5	23	36	30	25	37	31	30	40	35	27	35	31	29	38	33	27	37	32
F 1.5	62	76	69	62	75	69	61	72	66	52	61	56	56	66	61	58	70	64
F 2.5	72	87	79	72	86	79	69	80	75	58	68	63	64	75	69	67	79	73
F 3.5	81	93	87	80	92	86	76	85	80	64	72	68	70	79	75	74	84	79
F 4.5	86	94	90	85	93	89	80	86	83	67	72	70	74	80	77	78	85	82
F 5.5+	88	96	92	87	95	91	81	88	85	68	74	71	75	82	78	80	87	83
Average	63	75	69	63	75	69	61	71	66	52	60	56	57	66	62	59	69	64
Antlered and Antlerless																		
Average	78	98	88	77	97	87	73	89	81	62	75	68	68	83	75	71	89	80

Analysis

Weighting. The results reported in this thesis are those of the analysis of the aggregate unweighted data. Because of the stratified sampling design of the 2013 Michigan Deer Harvest Study the probability of selection in the sample differed across strata. Vaske (2008) suggests weighting the sample by population proportions to obtain results that can be generalized to the target population. Since the entire population of hunters in each stratum was known prior to sampling, design weights were calculated using the formula population percentage divided by sample percentage (Vaske, 2008). When compared with weighted data, results from unweighted data did not differ statistically (Appendix D).

Statistical tests. All analysis was conducted using Stata Version 13 (StataCorp, 2013a). Pearson's Chi squared (χ^2) was used to test whether or not a hunter shared their venison in the past 12 months (venison providers) differed across the binary and categorical covariates. The phi (Φ) coefficient and Cramér's *V* were used to measure of the strength of association (effect size) between venison providers and the binary and categorical covariates, respectively. These coefficients range from 0-1, where 0 is no relationship and 1 is a perfect relationship. Two-sample t-tests were used to test whether or not a hunter shared their venison in the past 12 months (venison providers) differed across the continuous covariates. Point biserial correlations (r_{pb}) were used to measure the strength of association between venison providers and continuous covariates. Point biserial correlations are a special case of the Pearsons r that reports values ranging from -1 to 1 and can be interpreted the same where 0 means no linear relationship and absolute value of the coefficient is the strength of the relationship. In addition to tests of statistical significance and effect size, all predictors were used in a binary logistic regression to predict a hunter's sharing behaviors. Ninety-five percent confidence intervals for the proportion

of the sample observed with trait of interest ($\hat{p}$) were calculated using the formula for confidence intervals with a known population from Zar (1996).

Incorporating non-response bias into estimations. Hunters who did not harvest a deer in 2013 were more likely to skip questions about venison sharing than hunters who harvested a deer. To minimize potential biases associated with those non-respondents, I report sharing behaviors in the combined venison provider variable (described above) and use a lower estimate that takes into consideration the fact that non-respondents were less likely to have harvested a deer and thus less likely to have shared venison. Instead of eliminating non-respondents from the results, which would likely inflate sharing estimates, this estimate applies the reported sharing percentages for respondents based on if a hunter harvested a deer or not in 2013 (harvested in 2013 variable) to non-respondents based on their 2013 deer harvest.

Results

Respondent Characteristics and Analysis Sample

An initial 55,537 surveys were mailed, however, 1,260 questionnaires were non-deliverable, resulting in an effective sample size of 54,277. Out of the 54,277 delivered questionnaires, 27,834 questionnaires were retuned by hunters (net response rate ~ 51%). Respondents were 89% male and had a mean age of 44, which closely resembles population parameters for all deer hunting license buyers: 89% male and an average age of 42 years. Minors (under the age of 18, n=5,856), hunters who reported they did not participate in the 2013 season (n=1,775), and non-Michigan resident hunters (n=1,041) were dropped from the sample for analysis, resulting in a final sample size of 19,981.

Hunters as Venison Providers

Approximately 51.6% of adult hunters who participated in the 2013 deer-hunting season reported sharing their venison in the past 12 months. This percentage increased to an estimated 85.1% if a hunter reported harvesting a deer in 2013. Twenty-five percent of hunters who did not harvest a deer in 2013 still reported sharing venison in the 12 months prior to receiving the questionnaire. Extrapolating to all Michigan hunters who participated in the 2013 deer hunting season; approximately 341,483 ± 4,500 Michigan deer hunters are estimated to have shared their venison.

Although many variables were considered statistically different between hunters who did and did not share, only variables related to harvest (harvested in 2013, harvested antlered deer in 2013, harvested antlerless deer in 2013, and total harvest) resulted in a large enough effect size to be considered for any sort of functional relationship when taking into account sample size (Table 2.5). Further analyses were conducted looking for predictors of sharing behaviors in hunters including comparisons between all Michigan counties, hunters who shared with many or few people, hunters who shared only within the household, only outside the household or both, and age as a categorical variable. None yielded any statistically significant results with effect sizes large enough to warrant reporting. Some predictors were significant in the binary logistic regression to predict a hunter's sharing behaviors, however their effect size was also small and the overall model was neither statistically significant nor correctly specified.

Table 2.5: Hunting related characteristics and demographic profile of hunters who did and did not share their venison in the past 12 months from the 2013 Michigan Deer Harvest Study questionnaire. (2,719 observations were dropped from this analysis due to non-response).

Variable	All respondents who provided information on sharing behaviors (n=17,262)*		Shared venison in past 12 months (n=9,475)		Did not share venison in past 12 months (n=7,787)		Statistical test for significant difference between variables on sharing behaviors	Strength of the relationship between variables and sharing behaviors
	N	%	n	%	n	%		
Harvested in 2013								
Yes	8,537	49%	7,263	77%	1,274	16%	x2= 6200 p<0.001	phi=0.600
No	8,725	51%	2,212	23%	6,513	84%		
Harvested Antlered Deer in 2013								
Yes	5,675	33%	4,861	51%	814	10%	x2= 3200 p<0.001	phi= 0.433
No	11,587	67%	4,614	49%	6,973	90%		
Harvested Antlerless Deer in 2013								
Yes	4,507	26%	3,898	41%	609	8%	x2=2500 p<0.001	phi= 0.378
No	12,755	74%	5,577	59%	7,178	92%		
Total number of Deer Harvested								
0	8,725	51%	2,212	23%	6,513	84%	t=-81.567 p<0.001	rpb=0.509 t=77.603 p<0.001
1	5,817	34%	4,834	51%	983	13%		
2	1,994	12%	1,747	18%	247	3%		
3	535	3%	507	5%	28	0%		
4	133	1%	119	1%	14	0%		
5	36	0%	34	0%	2	0%		

Table 2.5 (cont'd):

6	18	0%	18	0%	0	0%		
7	4	0%	4	0%	0	0%		
Mean	0.71	0.007	1.122	0.009	0.209	0.006		
Participated in Early and/or Late Antlerless Firearm Season								
Yes	2,066	12%	1,385	15%	681	9%	x2=140.13 p<0.001	phi=0.090
No	15,181	88%	8,080	85%	7,101	91%		
Participated in Archery Season								
Yes	9,137	53%	5,664	60%	3,473	45%	x2=395.24 p<0.001	phi=0.151
No	8,125	47%	3,811	40%	4,314	55%		
Participated in Muzzleloader Season								
Yes	4,908	28%	3,087	33%	1,821	23%	x2=177.61 p<0.001	phi=0.101
No	12,354	72%	6,388	67%	5,966	77%		
Participated in Regular Firearm Season								
Yes	15,390	89%	8,451	89%	6,939	89%	x2=0.030 p=0.862	phi= 0.001
No	1,872	11%	1,024	11%	848	11%		
Type of Equipment Used								
Just Bow	1,232	7%	673	7%	559	7%	x2=423.58 p<0.001	Cramer's V = 0.158
Just Gun	7,782	45%	3,641	38%	4,141	53%		
Bow and Gun	7,900	46%	4,988	53%	2,912	37%		
Age								
18-29	1,988	12%	1,120	12%	868	11%	t= 9.041 Pr (T>t) = 0.000	rpb=-0.069 t=-9.041 p<0.001
30-39	2,173	13%	1,273	13%	900	12%		
40-49	3,352	19%	1,965	21%	1,387	18%		

Table 2.5 (cont'd):

50-59	4,405	26%	2,537	27%	1,868	24%		
60-69	3,851	22%	1,902	20%	1,949	25%		
70-79	1,255	7%	576	6%	679	9%		
80-89	230	1%	97	1%	133	2%		
90+	8	0%	5	0%	3	0%		
mean	51.45	0.115	50.51	0.151	52.59	0.175		
Sex								
Male	15,940	92%	8,754	92%	7,186	92%	x2=0.0711 p=0.790	phi=-0.002
Female	1,322	8%	721	8%	601	8%		
Ecoregion								
Upper Peninsula	1,468	9%	752	8%	716	9%	x2=9.016 p=0.011	Cramer's V=0.023
Northern Lower Peninsula	3,523	20%	1,931	20%	1,592	20%		
Southern Lower Peninsula	12,271	71%	6,792	72%	5,479	70%		
Community Type								
Not Urban	9,838	57%	5,443	58%	4,395	57%	x2=1.830 p=0.400	Cramer's V=0.010
Urban Buffer	5,944	35%	3,224	34%	2,720	35%		
Urban	1,433	8%	782	8%	651	8%		

* For community type variable n= 17,215 for all respondents who provided information on sharing behaviors.

Venison Receivers

Michigan deer hunters who shared their venison, shared with a mean of 5.6 people (SD = 4.52, Figure 2.1). Considering the estimated number of hunters who share, an estimated 1,912,305 people ± 67,209 people, or 19.35% ± 0.68% of the total Michigan population, received venison from hunters during the 12 months prior to survey administration.

Of hunters who reported sharing venison, approximately 68.8% shared with members of their household, 52.0% with relatives, and 50.4% shared with friends, neighbors, or coworkers (Table 2.6). Only 2.4% of hunters who shared reported donating venison to a food bank or other donation program. This proportion, however, equates to an estimated 15,882 ±1,390 hunters statewide during the 2013 deer hunting seasons.

Maximum Edible Venison Yield for 2013

A maximum estimated 26-33 million pounds of edible venison were harvested during the 2013 deer hunting seasons: 10-12 million pounds from antlerless deer and 16-20 million pounds from antlered deer (Table 2.7).

Discussion

Hunters as Venison Providers

In the absence of legal markets in WHM, Michigan hunters share frequently and widely with a variety of people in their social network. This highlights the ubiquity of sharing behaviors among hunters, but also the limitations in the extent of venison consumption under a non-market system. However, these results also suggest that that many people, beyond just hunters, benefit

Figure 2.1: Distribution of the number of people hunters reported sharing their venison with over the past 12 months from the 2013 Michigan Deer Harvest Study (Mean=5.6, SD=4.52).

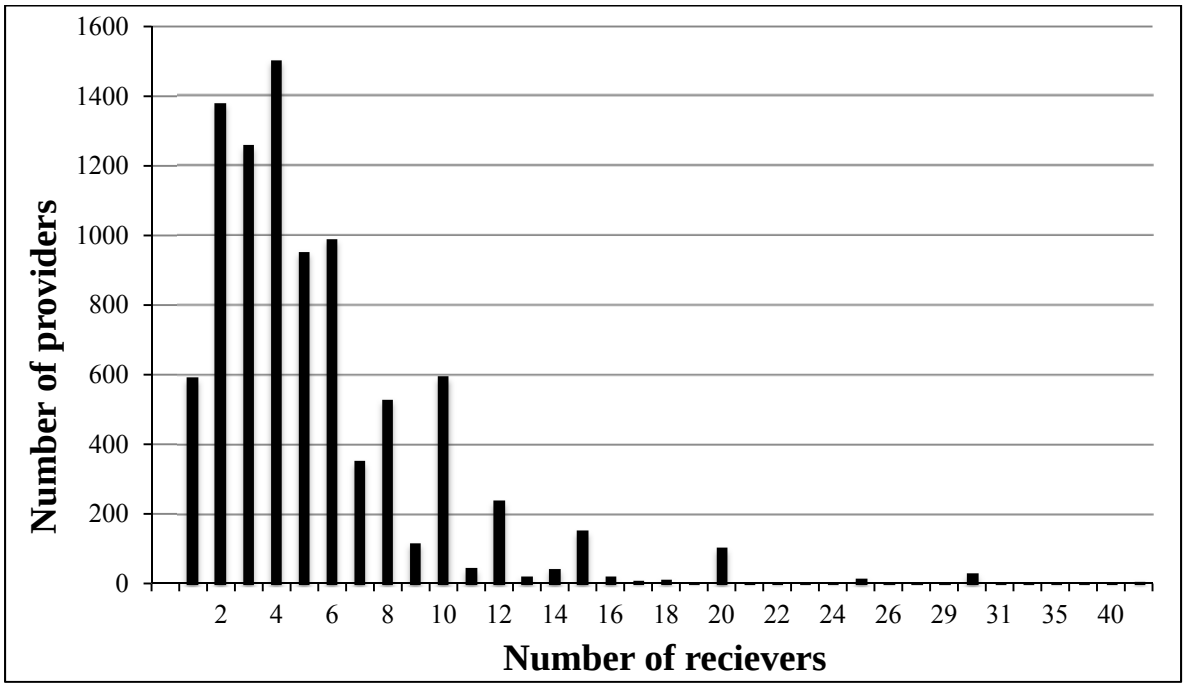


Table 2.6: To whom Michigan deer hunters provided venison during the past 12 months from the 2013 Michigan Deer Harvest Study questionnaire. (4,758 observations dropped due to non-response.)

Receivers	n	% Out of those who shared (n= 9,063)	% Out of all respondents to the question (n= 15,223)
I did not share any of my venison	6,160		40%
Members of my household	6,243	69%	41%
Relatives not in my household	4,713	52%	31%
Friends, neighbors or coworkers	4,568	50%	30%
Landowner whose property I hunted	1,165	13%	8%
Community Group game dinner	243	3%	2%
Food bank or other donation program	219	2%	1%
Other Not Specified	75	1%	0%

Table 2.7: Total venison yield in pounds from the 2013 Michigan deer hunting season by age, sex and nutrition calculated using the values from Tables 2.3 and 2.4.

Deer Age (in years) and Sex (M=male; F=female) by antler status	Edible venison yield (in pounds) by equation and nutrition status for the 2013 Michigan deer hunting season(s)								
	Hamilton, 1947			Severinghaus, 1949			Hamerstrom & Camburn, 1950		
	Poor	Good	Avg.	Poor	Good	Avg.	Poor	Good	Avg.
Antlered Deer									
M 1.5	6,765,506	9,251,011	8,008,259	6,756,326	9,153,625	7,954,976	6,508,203	8,477,283	7,492,743
M 2.5	5,926,276	7,558,296	6,742,286	5,862,532	7,436,634	6,649,583	5,423,866	6,716,793	6,070,329
M 3.5	3,556,321	4,742,378	4,149,349	3,510,002	4,653,968	4,081,985	3,214,710	4,154,334	3,684,522
M 4.5	724,740	966,440	845,590	714,525	947,648	831,087	651,266	842,747	747,007
M 5.5+	129,690	175,251	152,471	127,756	171,701	149,728	116,015	152,110	134,063
Total	17,102,533	22,693,377	19,897,955	16,971,141	22,363,577	19,667,359	15,914,060	20,343,267	18,128,664
Antlerless Deer									
M 0.5	765,617	1,221,091	993,354	803,034	1,242,344	1,022,689	927,749	1,288,587	1,108,168
F 0.5	651,289	989,777	820,533	693,316	1,019,792	856,554	839,928	1,108,087	974,007
F 1.5	2,381,043	2,918,089	2,649,566	2,386,978	2,904,964	2,645,971	2,336,069	2,761,529	2,548,799
F 2.5	2,347,683	2,828,896	2,588,290	2,340,633	2,804,769	2,572,701	2,239,178	2,620,407	2,429,792
F 3.5	2,178,291	2,506,426	2,342,359	2,164,136	2,480,626	2,322,381	2,039,749	2,299,705	2,169,727
F 4.5	1,107,635	1,208,393	1,158,014	1,098,490	1,195,672	1,147,081	1,027,503	1,107,326	1,067,415
F 5.5+	1,389,206	1,526,836	1,458,021	1,376,986	1,509,732	1,443,359	1,284,976	1,394,010	1,339,493
Total	10,820,764	13,199,508	12,010,136	10,863,573	13,157,899	12,010,736	10,695,151	12,579,652	11,637,401
Antlered and Antlerless									
Total	27,923,297	35,892,885	31,908,091	27,834,714	35,521,476	31,678,095	26,609,211	32,922,918	29,766,065

Table 2.7 (cont'd):

Deer Age (in years) and Sex (M=male; F=female) by antler status	Edible venison yield (in pounds) by equation and nutrition status for the 2013 Michigan deer hunting season(s)								
	Cowan et al., 1968			Marchello et al., 1983			Average of five equations		
	Poor	Good	Poor	Poor	Poor	Avg.	Poor	Good	Poor
Antlered Deer									
M 1.5	5,534,651	7,128,215	6,331,433	6,060,453	7,853,853	6,957,153	6,325,028	8,372,797	7,348,913
M 2.5	4,559,355	5,605,713	5,082,534	5,024,312	6,201,885	5,613,098	5,359,268	6,703,864	6,031,566
M 3.5	2,694,225	3,454,657	3,074,441	2,973,876	3,829,668	3,401,772	3,189,827	4,167,001	3,678,414
M 4.5	545,034	699,998	622,516	602,085	776,482	689,283	647,530	846,663	747,097
M 5.5+	96,983	126,194	111,588	107,200	140,075	123,637	115,529	153,066	134,297
Total	13,430,248	17,014,777	15,222,513	14,767,926	18,801,962	16,784,944	15,637,182	20,243,392	17,940,287
Antlerless Deer									
M 0.5	825,670	1,117,694	971,682	882,150	1,210,794	1,046,472	840,844	1,216,102	1,028,473
F 0.5	755,238	972,258	863,748	802,483	1,046,717	924,600	748,451	1,027,326	887,888
F 1.5	1,995,367	2,339,689	2,167,528	2,179,696	2,567,198	2,373,447	2,255,830	2,698,294	2,477,062
F 2.5	1,900,534	2,209,060	2,054,797	2,083,295	2,430,511	2,256,903	2,182,265	2,578,729	2,380,497
F 3.5	1,723,937	1,934,318	1,829,128	1,894,110	2,130,873	2,012,491	2,000,044	2,270,390	2,135,217
F 4.5	866,507	931,107	898,807	953,191	1,025,892	989,542	1,010,665	1,093,678	1,052,172
F 5.5+	1,082,895	1,171,136	1,127,016	1,191,674	1,290,980	1,241,327	1,265,148	1,378,539	1,321,843
Total	9,150,149	10,675,263	9,912,706	9,986,599	11,702,965	10,844,782	10,303,247	12,263,057	11,283,152
Antlered and Antlerless									
Total	22,580,397	27,690,041	25,135,219	24,754,525	30,504,928	27,629,727	25,940,429	32,506,450	29,223,439

from WHM in a non-market system and that changes to this system could have impacts on how WHM is distributed and used.

Other research suggests sharing of WHM provides cultural ecosystem services to hunters and the recipients of their harvest. Although conclusions about the importance of sharing to Michigan deer hunters cannot be made directly from this study, the vast number of hunters who share their harvest provides evidence of the cultural ecosystem services WHM sharing and consumption produce in Michigan. Research that identifies and assesses the specific nature and effect of cultural ecosystem services provided by sharing WHM would inform deliberations about social relevance of hunting (Larsen et al., 2014).

It is not surprising that hunter-sharing behaviors were highly correlated with having a deer; you cannot share what you do not have. Besides harvesting a deer, there were no other variables that explained whether or not a hunter shared their venison. Either, there are no differences between hunters who do and do not share, the variables measured in this study (besides harvest) are not sufficient to define characteristics of venison providers, or measurement error exists in assessing sharing behaviors.

Anthropological theories on food sharing credit the social environment surrounding a hunter as a driver for their sharing behaviors (Kaplan & Gurven, 2005; Koster, 2011; Nolin, 2010). This study did not measure these factors, such as number of household members or interhousehold distance between the hunter and their relatives and friends. Other potential factors that may be responsible for sharing behaviors that were not measured are how a hunter uses their venison and individual personality traits.

There are two main sources of measurement error for questions relating to hunter's sharing behaviors. It is possible that there may be social desirability bias in reporting sharing

behaviors, thus more hunters may have reported sharing than actually do share. There is no way to assess the influence of social desirability bias on hunter response to these questions. Previous research, however, suggests that when hunters report sharing behaviors, they are honest but forgetful (Nolin, 2010). If Nolin's (2010) findings are accurate, sharing behaviors in my study may be under-reported rather than over-reported. Furthermore, because sharing behaviors are partially dependent on harvesting a deer, just because a hunter did not share this year does not mean that have not shared in previous years or will not share in the future. A one-year measurement of sharing behaviors may underestimate the total number of hunters who share venison because the availability of venison varies year-to-year. A better way to measure variability in sharing behaviors would be to identify sharing behaviors over a longer period of time or to categorize hunters based upon the frequency of their sharing behaviors when they have venison (e.g., never, sometimes, always).

Venison Receivers

Michigan deer hunters who shared, provided venison to an average of approximately 6 people over a 12 month period of time. This finding illustrates the role of sharing in the amplification of ecosystem services provided by hunting to a larger portion of the population. However, as discussed previously, this estimate might be low. For deer hunters, the act of sharing venison is relatively habitual, and thus they are less likely to remember each occurrence (Nolin, 2010; Tourangeau et al., 2000). Another factor that may influence the number of people a hunter reported sharing with, or if they reported sharing at all, is their own definition of sharing. Although study questions provided a definition of sharing and response categories, some hunters may not define providing venison to the household as sharing. Also, in question piloting and

through antidotal conversations, hunters often use sharing to refer to giving away packages of raw meat, not having friends over for dinner. Thus, although sharing was defined as including raw and cooked venison meals, it is possible that some hunters referred only to providing packages of raw meat in their estimates. Additionally, the estimate a hunter provided for the number of people they shared their venison with did not include people they shared with at large events. It is likely the average number of people a hunter shares with is higher than reported in this study.

Hunters who provided information on their sharing behaviors most often shared within their household. This is expected based on evolutionary theories of kin selection which predict increased food sharing with kin because it increases chances of offspring survival (Kaplan & Gurven, 2005). Relatives were the second most common relation hunters shared venison with, closely followed by friends. Relatives not within the household received venison less frequently than household members, supporting Koster's (2011) theory that sharing is more common between lineal than collateral kin. What is unexpected is that hunters shared venison with friends almost as frequently as with relatives. A small percentage of hunters reported sharing venison at a community game dinner or providing venison to donation programs, yet these events can generate more recipients than providing venison at the individual level. My results suggest that frequency of hunter sharing behaviors decreases with increased social distance from the hunter. Social proximity appears to be a key factor influencing sharing behaviors among hunters. The frequency with which hunters share outside of their household suggests that socialization to hunting through WHM venison may occur. The number of non-hunters with whom hunters shared, however, cannot be estimated from my results.

Maximum Edible Venison Yield for 2013

Often the value of WHM is measured in economic terms, or the price per pound of a roughly equivalent product (Wilcox, 1976). Prices for farm-raised venison available in stores and online vary considerably and lack market research. For example prices at Elk USA range from $9.95 per pound for ground venison up to $39.95 per pound for tenderloin, while ground venison from Michigan Venison has a similar price but tenderloin costs only $24.00 per pound. However, ground venison in Lansing, Michigan grocery stores from Butcher Boy Food Products costs approximately $13.00 per pound. Extensive market research is conducted on national beef prices by the USDA Economic Research Service (ERS). Thus, although venison is superior to beef in many ways, using the price of high quality lean beef is the best option for an economic assessment of the value of wild harvested venison. From June 2013-June 2015 the average price per pound for USDA choice boneless sirloin steak was $7.61 (Hahn, 2015). Based on this information the economic value of the venison harvested by Michigan deer hunters in 2013 was between $197 and $247 million US dollars. It is likely that this estimate is low because farm raised venison prices seem to be much higher. Besides being healthy, the venison hunters' harvest represents a large economic value, providing hunters with a return for their investment in hunting and potentially savings on their grocery bill. The economic value of wild harvested venison is another example of the provisional ecosystem services WHM can provide.

The amount of venison produced each year by Michigan deer hunters provides an average of approximately 3 pounds of venison - or twelve 4-ounce servings - for every person in Michigan. The U.S. Department of Agriculture (USDA) and U.S. Department of Health and Human Services (HHS) recommend 26 oz per week of meat, poultry, or eggs for a healthy diet (USDA & HHS, 2010). The venison harvested by Michigan deer hunters in 2013 represents the

yearly meat protein requirement for 307-385 thousand adults, or 3-4% of the Michigan population. Although venison harvested cannot be used as the sole meat protein source for a vast majority of people, enough venison is harvested each year that some families may rely on venison as a substantial source of protein.

In addition to protein, venison has 16-23% less fat and higher percentages of monounsaturated fats and omega 3 fatty acids compared to domestic meat (O'Keefe & Cordain, 2004). WHM is free of most antibiotics, hormone supplements, and other additives. Substituting domestic meat with venison can have positive health effects (Larsen, 2003). The sheer amount of venison harvested by hunters in Michigan each year clearly demonstrates the provisional ecosystem services that WHM can provide in terms of protein and access to nutrition, and these benefits are valuable and sought after regardless of the frequency of consumption.

It is important to interpret the estimates produced here as a maximum possible yield of edible venison because researchers reporting meat yield did so from animals mostly taken under controlled conditions. For instance, Hamerstrom & Camburn (1950) state that their results are likely not representative of the edible venison yield from recreational hunting due to the scientific nature of the harvest (e.g. neck shots to maximize meat yield) and processing. All of the studies used in the formulation of my calculations for edible venison yield per deer, used either professional or highly trained butchers to conduct their processing. Furthermore, hunters may be choosier with what meat they keep for consumption. Accuracy of the shot, care and speed in dressing and bleeding, butchering ability, and differences in deer size and weight all influence the amount of edible venison a deer yields (Cowan et al., 1968; Hamerstrom & Camburn, 1950; Hamilton, 1947; Marchello et al., 1983; Severinghaus, 1949). Also, the type of hunting equipment used and the deer's physical condition at time of kill influence how much

edible venison is produced (Jenkins & Bartlett, 1959). Additional studies that more accurately estimate the range of edible venison yields from wild harvested deer would provide a more accurate estimate of edible venison yield from recreational deer hunting.

Although no standardized method has been established to calculate the amount of edible venison produced from a deer, most estimates are based upon the average size of the deer harvested (Cowan et al., 1968; Hamerstrom & Camburn, 1950; Hamilton, 1947; Marchello et al., 1983; Severinghaus, 1949). To use these equations, assumptions were made about the average size of a deer harvested in Michigan. Weights of white-tailed deer vary based on subspecies, region, season, age and habitat quality (Sauer, 1984). Michigan hunters typically harvest deer younger than five years, which likely increases variability in live weights of harvested Michigan deer (Ozoga et al., 1993). Although this study's calculations attempted to control for these variations, some error is unavoidable when estimating edible venison yield using the average size of a live deer. Furthermore, as the amount of deer harvested varies from year to year, the amount of edible venison produced from one hunting season to the next may be quite variable

The equations used to estimate edible venison yield also varied considerably, likely due differences in methodologies and for the reasons described above. However, these equations provide the best available method for estimating maximum edible venison yield from the 2013 Michigan deer harvest. Further information on venison consumption rates and sharing amounts could help identify how the resource is being used and the specifics of the provisional ecosystem services it provides.

CHAPTER 3

The Extent of Venison Sharing and Consumption: Receivers

Major societal transformations are changing the way humans interact with and think about nature and wildlife (Heberlein & Ericsson, 2005; Manfredo et al., 2009; Manfredo et al., 2003; Robinson & Ridenour, 2012; Whittaker et al., 2006; Zinn et al., 2002). In 1820, 5% of the U.S. population lived in cities (Organ et al., 2010); in 2010, 80% of the U.S. population inhabited urbanized environments (U.S. Census, 2010). Living in a man-made urban environment decreases the frequency of direct experience with wildlife, and more broadly nature, increasing the geographical and social distance between human and natural systems (Dizard, 2003; Heberlein & Ericsson, 2005; Manfredo et al., 2009; Manfredo & Zinn, 1996; Robinson & Ridenour, 2012). Furthermore, fewer ties to rural environments and utilitarian values expressed by people who live in urbanized environments may mean decreasing support for traditional natural resource users, such as hunters (Heberlein & Ericsson, 2005; Manfredo et al., 2009). Weakening links between human and natural systems are identified as a threat to environmental conservation and human well-being (MEA, 2005). Identification and understanding of current links between human and natural systems, how these links are being used and can continue to be used in order to maintain and reinforce connections between human and natural systems can have implications for wildlife management, conservation policy, public health and the preservation of traditional natural resource use cultures.

Hunting, and the sharing and consumption of the wild harvested meat (WHM) it produces, are important sociocultural, economic, ecological and nutritional activities around the

world (Fischer et al., 2013). WHM, the meat of wildlife – animals that maintain their wild state and survive with minimal human intervention – procured through hunting is an important and valuable natural resource. Sharing and consuming WHM has been identified as a potentially significant coupler of human and natural systems (Freeze, 1997; M. N. Peterson et al., 2010). The framework of Coupled Human and Natural Systems (CHANS) proposed by Liu et al. (2007) aids in understanding the importance of WHM to society by identifying the provisional and cultural ecosystem services associated with WHM sharing and consumption.

Provisional ecosystem services are the tangible benefits people receive from nature (Liu et al., 2007; MEA, 2005), such as the nutritional value of WHM. WHM is local free-range lean protein, high in energy content and essential macronutrients that is also antibiotic, hormone, and additive free, and is not subject to engineered genetic modifications (Larsen, 2003; O'Keefe & Cordain, 2004). Cultural ecosystem services are the non-tangible benefits people derive from natural systems (Liu et al., 2007; MEA, 2005). Culture and nature are inevitably linked, providing humans with cultural ecosystem services such as spiritual and religious associations with nature, recreational opportunities, aesthetic or inspirational enjoyment, creating a sense of place and cultural heritage, enforcing social relations, and offing educational opportunities (Hernandez-Morcillo et al., 2013; MEA, 2005). Potential cultural ecosystem services provided by the sharing and consumption of WHM include: establishing and maintaining social relations, social recognition of a successful hunter, a reminder of the hunting experience, and a direct connection to nature and the source of our food (Fletcher, 2011; Heffelfinger, 2014; Jiménez et al, 2011; Omura, 2013; M. N. Peterson et al., 2010).

Sharing WHM is not only an important element of the hunting experience, but also amplifies provisional and cultural ecosystem services WHM provides to a larger portion of

society. In the US, where the sale of WHM is illegal in almost all instances, sharing through social networks is the only way WHM is moved through society. Heberlein (1991) proposed that participation in social activities where WHM is shared may develop acceptance of the activity among non-hunters by strengthening or developing shared beliefs. Sharing WHM at meals, or in other ways, is thought to be one readily available and effective means of enhancing positive social interaction among non-hunters and hunters or of socializing non-hunters to hunting via food and stories about hunting (Stedman and Decker, 1996). In Sweden Ljung et al., (2012) reported that WHM consumption positively influenced attitudes toward hunting. Effects of sharing WHM were found to be similar in rural and urban settings in Sweden, although availability – and thus frequency of consumption– are markedly different in these two environments (Ljung et al., 2014). The societal impacts WHM provides are created by an individuals perceived benefits or costs when interacting with WHM. Creating opportunities to share WHM may help society recognize these impacts and the important role WHM plays in coupling human and natural systems.

To analyze the role of WHM as a coupler of human and natural systems, it is necessary to first explore the extent of WHM sharing and consumption and the mechanisms for WMH transfer. Sharing involves two different actions, providing and receiving, each with their own motivations and effects. Chapter 2 focused on the providers (hunters) of WHM. This chapter focuses on receivers of WHM – people who were provided (or received) WHM, either from another individual or from their own harvest. I measured the extent and mechanism of WHM movement through society by identifying: 1) the social and physical pathways by which WHM is transferred to a receiver; 2) opportunities and barriers to WHM reception; 3) number and attributes of receivers; 4) and frequency of WHM consumption by receivers. Results from this

study will help identify potential ecosystem services provided by WHM, the beneficiaries these ecosystem services, and populations who may not receive these benefits.

Methods

Study Area and Population

Michigan (56,539 mi^2) is located in the northcentral US, bounded by Lake Superior to the north, Lake Michigan and Wisconsin to the west, Indiana and Ohio to the south and Lakes Huron and Erie and the Canadian province of Ontario to the east. Traveling south to north along Michigan's landscape human density and intensity of land use typically decrease (MDEQ, 2014; MDTMB CSS, 2011). Approximately 75% of Michigan's population lives in urban areas (U.S. Census, 2010). In 2010, Michigan's population was estimated to be 9,883,706, comprised of 76.6% white non-Hispanic or non-Latino, 49.1% male, with a median age of 38.9 years (U.S. Census, 2010). From 2003-2005 an average of 790,000 people purchased a Michigan hunting license each year with an average age of 41 years, 92% of who were male (Frawley, 2006). Deer hunting (90%), small game (37%), and turkey (14%) were the three most popular licenses purchased during this time frame (Frawley, 2006).

Deer hunting has maintained its popularity in the state. During the 2013 hunting season 712,404 people purchased a deer hunting license a majority of whom were male (89%) with an average age of 42 years. While-tailed deer hunting has a long history and heritage in Michigan (Langenau, 1994; Rudolph, 2005). Because deer are widely distributed (Geist, 1998) and readily used and valued by humans (Roth & Merz, 1996), focusing on the sharing of venison increases the generalizability of this study. The popularity of deer and deer hunting in the US (Aiken &

Harris, 2011; USFWS, 2011) and the large amount of venison produced by a single deer likely increase the frequency of sharing behaviors (Gurven, 2004b; Stransky, 1984), ensuring a wide range of experiences with venison and the ability to conduct research across large populations.

Sampling Design

Questions were included in the Michigan State University (MSU) Institute for Public Policy and Social Research's (IPPSR) Office for Survey Research (OSR) 68th State of the State Survey (SOSS); a longstanding quarterly telephone survey with standardized protocol. A full report on methodologies including questions and raw data can be found on the IPPSR website (http://ippsr.msu.edu/soss/). SOSS methods were reviewed and approved by the MSU Human Research Protection Program (HRPP) Social Science / Behavioral / Education Institutional Review Board (SIRB) to ensure the protection of human subjects (IRB #x95-499e).

The target population for this study was Michigan residents $\geq$ 18. However, as data were collected via telephone interviews, the study population was further limited to English-speaking individuals that either lived in a household with a landline or possessed a cellphone and could effectively communicate over the phone.

The sampling frame was divided into three separate segments: re-contacted, new landline, and new cell phone. The re-contacted segment was comprised of all respondents who completed the interview two rounds earlier (66th SOSS) and who agreed to be recontacted. Respondents can only be recontacted for one additional survey, ensuring that these individuals only responded to the 66th and 68th SOSS. According to the IPPSR OSR, with adjustments for non-response, this recontact sample still represents a representative random sample of the target population. IPPSR OSR contracted Survey Sampling, INC. (SSI) to provide samples of landlines

and cellphone numbers within the state of Michigan for the new landline and cellphone segments.

The new landline sample was created using a list-assisted random-digit-dial (RDD) sampling procedure (Casady & Lepkowski, 1993). SSI selected known working Michigan area code and phone number exchanges from a continuously updated countrywide database of all known working area code and phone number exchange combinations. The sample was stratified by county and the total number of possible 10 digit phone numbers per county was calculated. Phone numbers within each county were randomly selected and allocated proportionally based upon a county's contribution to the total number of possible phone numbers for the state. Additionally, Disproportionate Stratified Sampling (DDS) was used to improve efficiency (Center for Disease Control, 2013). The sample was divided into two strata – listed and unlisted numbers – and was sampled in a ratio of 1.5:1 listed to unlisted. SSI also removed known numbers associated with businesses and institutions and screened the sample for disconnected numbers.

The new cellphone segment was also derived using RDD. SSI created a database of all known number exchanges allotted to wireless numbers derived from the monthly updated Telcordia Terminating Point Master Data File. SSI compared this database to its list-assisted RDD database and removed listed numbers to avoid dual sampling frames. SSI also screened the final sample and divided it into categories based on level of billing activity; IPPSR OSR only contacts cellphone numbers with recent billing activity.

Potential respondents within each of these three segments were contacted differently. All numbers within the re-contact segment were used. Numbers from the new landline and cellphone segments were selected randomly in blocks of 50 from their respective SSI samples.

Once pulled from the SSI sample all numbers were contacted, regardless of if the total number of respondents was reached. Subsamples were pulled in this manner so that an accurate response rate could be calculated from all attempted numbers. IPPSR OSR attempted to contact an equal number of landline and cellphone users, however more cellphones numbers were pulled from the SSI sample because the working number rate and completion rate for cellphone is less than that of landlines.

Data Collection

The 68th SOSS telephone interviews were conducted April 11 to June 24, 2014 during all times of the day and week. Numbers selected to be contacted, and for which an address was available, were sent a notification approximately one week in advance of being contacted (Appendix J).

A minimum of nine call attempts were made per number, after which the call schedule for that phone number was reviewed by a SOSS supervisor to determine if more contact attempts should be made at different times or on different days. Supervisors reviewed the time of day and days of the week the nine calls were made to ensure equal representation. If contact was established, but no interview conducted, 12 attempts to conduct the interview were made or until the individual refused the interview.

Respondents within each of the three segments (recontact, landline, and cellphone) were selected differently. Interviews conducted within the recontact segment were done with the individual who originally responded to 66th SOSS survey questions. When contacting a new landline number the interviewer established that the phone line was associated with a residence, and that the person who answered the phone was over the age of 18. The Troldahl-Carter

technique then was used to select a respondent using probability sampling. The Troldahl-Carter technique asks the respondent how many adults over the age of 18 live in the household including themselves and how many of those adults are male (Troldahl & Carter, 1964). Four matrices are used to randomly select a respondent based on the number of adults in the household, their sex and age (Troldahl & Carter, 1964). Cell phone numbers were assumed to belong to one individual and no selection process was used, however, cell phone respondents had to be the owner of cell phone, 18 years or older and a resident of Michigan to be eligible for the study.

Interviewers were trained by SOSS supervisors and provided the rigorously developed OSR telephone interviewing training package, in addition to specific instructions on the 68th SOSS instrument and question objectives. Interviews were conducted using Computer Assisted Telephone Interviewing (CATI) implemented with the Computer Assisted Survey Extension System software (CASES version 5.5). This program presents the interviewer with the scripted interview in sequential order as programed by the IPPSR OSR and assists the interviewer in recording responses to closed-ended and open-ended questions. By guiding the interviewer through the interview script the CASES program improves data quality by minimizing human error in questionnaire administration and data collection, reduces variability across interviewers through standardized protocols and monitoring, and results in a more streamlined interview process increasing the efficiency of questionnaire administration and data collection (Shanks, 1983; Tourangeau et al., 2000).

Survey Instrument

ISSPR OSR uses well-established basic demographic questions on the SOSS. These demographic questions were used to determine a respondent's sex, age, education level, ethnicity, race, religious affiliation, political party identity, political ideology, household income, community type and Michigan county of residence.

Study specific questions were piloted through focus groups with upper level MSU Department of Fisheries and Wildlife undergraduates, an Amazon Mechanical Turk survey, two rounds of phone interviews conducted with non-hunters and hunters by a undergraduate intern, and pilot interviews conducted by ISSPR OSR-trained interviewers. Open-ended and closed-ended questions were used to determine personal hunting experience, relationships with hunters, overall WHM consumption activities and venison specific behaviors. (Note: Interview questions used the term 'game meat' -see Appendix E for full question wording). WHM was defined as derived from hunting in Michigan and that it did not include meat that was bought at a store or farm, or was eaten in a restaurant. Additionally, the phrase 'whether you were the hunter or were given the meat by a hunter' was used to establish that the individual did not have to be a hunter to have eaten WHM. Venison was defined as deer meat to ensure respondent understanding.

Respondents were first asked if they had ever eaten WHM. Respondents who identified as having eaten WHM were asked a open-ended question about what types of WHM from hunting in Michigan they had consumed. Respondents who identified as having not eaten WHM were asked an open-ended question to determine if there was any particular reason why not. Open-ended questions were used here to elicit a full list of possible answers and avoid influencing potential answers with response options (Tourangeau et al., 2000; Vaske, 2008). Additionally, researchers had very little information from which to formulate appropriate

response options. If a respondent answered as having eaten venison they were asked specific questions about frequency of venison consumption over the past 12 months (not at all, once or twice, 3 to 10 times, more than 10 times), from whom it was provided (self, member of household, family not within household, friends, neighbors or coworker, community game dinner or event, other open ended), and in what form the venison was provided (uncooked or raw, cooked or prepared, and other open ended). All questions about venison were limited to reference period of 12 months to assist respondent recall about specific behaviors (Dillman et al., 2009; Vaske, 2008). All respondents were asked about their relationships with hunters (member of household, family not within household, friends, neighbors or coworker, and other open ended) and their level of hunting experience. Partially close-ended response options were used to ensure all possible response options were recorded. (A complete interview transcript can be found in Appendix E).

Variable Construction

Dependent variables. Wild harvest meat consumption was a binary variable reporting whether or not an individual has ever consumed WHM.

Frequency of venison consumption was a mutually exclusive ordinal categorical variable that is treated as a continuous variable in analysis. It measures a respondents frequency of venison consumption from 0-4 where: 0 = never consumed venison; 1 = consumed venison at least once during their lifetime; 2 = consumed venison 1-2 times in the past 12 months; 3 = consumed venison between 3 and 10 times in the past 12 months; and 4 = consumed venison more than 10 times in the past 12 months. If a respondent had reported consuming WHM, but

not venison they were excluded from this variable, rather than coded as never having consumed venison.

Covariates. Hunter in household was a binary variable reporting whether or not the respondent lived with a hunter at the time of the interview.

Relative(s) hunt(s) was a binary variable reporting whether or not the respondent has family that does not live within their household that hunt.

Friend(s) hunt(s) was a binary variable reporting whether or not the respondent has friends, neighbors or coworkers who hunt.

Knew hunter growing up was a binary variable reporting whether or not anyone close to the respondent hunted while they were growing up.

Social Network was a mutually exclusive ordinal categorical variable that is treated as a continuous variable in analysis. It measures the number and strength of relationships a respondent has with hunters. It is created out of the four binary variables hunter in household, relative(s) hunt(s). friend(s) hunt(s) and knew hunter growing up. The variable is coded as follows: 0= knows zero hunters; 1=only knew a hunter growing up; 2=only has friends that are hunters; 3= Knew a hunter growing up and has friends that are hunters; 4= Has relatives that are hunters, or has relatives and friends that are hunters, or has relatives that are hunters and knew a hunter growing up; 5= Has relatives and friends that are hunters and knew a hunter growing up; and 6= Has a hunter in their household and may have other relationships with hunters. Most respondents in category 6 not only had a hunter in their household, but also had relatives and friends who hunt and knew a hunter growing up.

Community type was a categorical variable describing the level of urbanization of a respondent's community where 1=rural; 2=between rural and urban; and 3=urban.

Sex was a binary variable where 0=male and 1=female.

Age was continuous variable describing the respondent's age in years at the time of the interview.

Race was a binary variable where 0=white and 1=not white.

Income was a mutually exclusive ordinal categorical variable that is treated as a continuous variable in analysis. It measures a respondent's annual household income from 1-11 where: 1= Less than 10,000; 2=10,000-19,999; 3=20,000-29,999; 4=30,000-39,999; 5=40,000-49,999; 6=50,000-59,999; 7=60,000-69,999; 8= 70,000-89,999; 9=90,000-99,999; 10=100,000-150,000 and 11=More than 150,000.

Education level was a mutually exclusive ordinal categorical variable that is treated as a continuous variable in analysis. It measures the high level of education a respond has achieved at the time of the interview where: 0-11 = 0-11th grades respectively; 12=high school graduate or GED holder; 13 = 1st year of college; 14= 2nd year of college; 15=technical/junior college graduate; 16=3rd year college; 17= 4 year college graduate; 18=some post graduate; 19=graduate degree.

Coding open-ended questions. All open-ended responses were field coded by the interviewer to assist in coding of open-ended responses. The researchers provided the interviewer with a list of likely responses to open-ended question (see Appendix E for a complete list of field coding options per question). The interviewer was instructed to only code responses that exactly matched the response options; otherwise they transcribed the respondent's complete answer to be coded later by the researcher based on thematic similarities (Babbie, 1990). A complete description of how all opened questions were coded can be found in Appendix I.

Analysis

Weighting. The IPPSR OSR uses a complex weighting scheme for SOSS called design weighting and iterative proportional fitting (also called raking weighting) (CDC, 2013). Design weighting takes into account a respondent's probabilities of selection and iterative proportional fitting adjusts the data to match demographic characteristics of the target population. For a complete detailed description of how the weighting factor was created see pages 7-9 in the 68th SOSS Methodological Report (http://ippsr.msu.edu/soss/).

The landline and cellphone segments of the data were weighted to correct for unequal probabilities of selection. The recontact segment was combined into either the landline or cellphone segment accordingly. IPPSR OSR assumes that because the recontact segment was originally selected using the same methodologies, they do not differ from the new sample in terms of selection probability. The landline segment was adjusted to represent the number of unlisted versus listed numbers. Listed numbers were adjusted to represent only 65% of all data records in accordance with National Center for Health Statistic estimates for the time the sample was taken (Piekarski, 2013). The landline segment was then weighted by the reciprocal of the number of separate phone lines the household had and by the inverse of the number of adults in the household and then adjusted so that the total number of cases matched the actual number of completed interviews for the landline segment. The cellphone segment respondents were weighted by the reciprocal of the combined total number of separate landlines and cellphone numbers the respondent had and then adjusted so that the total number of cases matched the actual number of completed interviews for the cellphone segment.

The landline and cellphone segments were then merged and adjusted so that the proportion of respondents who only owned a cellphone matched the estimated proportion of

Michigan residents in 2012 that only owned a cellphone according to the most recent National Health Interview Survey estimates.

Adjustments for non-response were made using the 2008-2012 American Community Survey (ACS) to match statewide proportions for race (white, black, other racial group) and sex (male or female) by age group in years (18-29, 30-29, 40-49, 50-59, 60-69, 70-79, and 80 or older). The weighted data were then adjusted to ensure that the number of cases for each region was the same as the actual number of interviews completed. Respondents from the Detroit area were deflated to proportionally represent Detroit within the southeast region of Michigan. The data were then weighted so that the proportion of cases from each region matched the 2008-2012 ACS for total adult population per region. The final weighted data set was compared against the 2008-2012 ACS distributions for race, sex, age and region. A final weighting was done to bring all distributions within 1.10% of the actual values according to the ACS. The final weighting factor was defined as STATEWT2.

Design-based analysis. All analysis was conducted using Stata version 13 (StataCorp, 2013a). The complex sampling design of the SOSS violates the assumption that observations are independently and identically distributed and thus requires a design-based analysis using sample weights. When analyzing data derived from a complex survey, design-based analysis results in increased accuracy in the calculation of point estimates and standard error (StataCorp, 2013b).

Using the svy command Stata reports the F-statistic in the form of an adjusted Wald test statistic (F_w) (Aneshensel, 2012). The design-based equivalent to the Pearson chi-square test statistic is a second order design-adjusted Rao-Scott F-test statistic ($F_{S\text{-}R\ Pearson}$) (Heeringa, West & Berglund, 2010).

A design-based logistic regression model was used to identify the determinants of the binary variable WHM consumption. This design-based approach uses pseudo maximum likelihood estimation to calculate odds ratios (Archer & Lemeshow, 2006; Heerengia et al., 2010). Sample variance is computed using the Taylor series linearization (TSL) method (Heeringa et al., 2010). While data derived from complex survey designs can lead to inferential errors due to larger standard errors, the TSL method adjusts the standard error to the complexities of the survey design (Aneshensel, 2012). In nonsurvey data TSL is often referred to as a robust variance estimator (StataCorp, 2013b). Model fit was assessed using the Archer – Lemeshow F-adjusted mean residual goodness-of-fit test, which is interpreted the same as a Hosmer-Lemeshow goodness-of-fit test, where a p-value >0.05 suggests the model is correctly specified (Archer & Lemeshow, 2006, Heerengia et al., 2010).

A design-based linear regression was used to identify the determinants of the continuous variable frequency of venison consumption. (Note: A design-based ordinal logistic regression was also used for this model and reported identical results. The simpler linear regression model was used here for ease of reporting and interpretation.) This "aggregated" design based approach uses weighted least squares estimation to calculate regression coefficients (Heerengia et al., 2010). As in design-based logistic regression, sample variance is computed using TSL. Additionally, the R^2 value is weighted ($R^2_{weighted}$) by applying the observations sample weights to the squared differences used to calculate the sum of squares (Aneshensel, 2012). Heeringa et al. (2010) suggested this $R^2_{weighted}$ should be interpreted as "the fraction of explained variance in *y* attributable to the regression on *x*" (p. 194).

Reporting. All summary statistics (except for the response rates and missing data section) are reported as weighted percentages. Total number of respondents per response and un-

weighted percentages for all questions for all respondents and the subgroups non-hunters and frequent hunters can be found in Appendix F, Appendix G & Appendix H, respectively. For purposes of some analyses non-hunters and frequent hunters were separated from the sample. Non-hunters were defined as individuals who had never gone hunting. Frequent hunters were defined as respondents who reported hunting nearly every year. Results are reported for all respondents, non-hunters and frequent hunters separately, and each section is specifically identified. Additionally, to identify the determinants of WHM consumption and frequency of venison consumption for non-hunters an additional design-based logistic regression model and design-based linear regression were created for this subpopulation.

Results

Summary Statistics

Response rates and missing data. A total of 997 telephone interviews were completed: 289 recontact interviews (53% landline, 47% cellphone) and 708 new interviews (48% landline, 52% cellphone). Fourteen observations were dropped from analysis because a response was not given to the initial question about ever consuming WHM. My resulting effective sample size was thus 983 respondents. For all analyses involving the dependent variable "frequency of venison consumption" an additional five observations were dropped due to non-response and 28 observations were dropped because they reported consuming WHM but not venison. For all analyses involving the demographic variables, 22 observations were dropped due to non-response for race. Age (23 missing), education (seven missing) and income (96 missing) were imputed using regression with all demographic variables. The variable "community type" had 7

missing values, which were imputed using the respondent's reported zip code compared to information on urban areas and clusters from the U.S. Census, satellite imagery, and road density.

Average interview length was 20.4 minutes (σ=5.0) and the mean number of calls required to complete an interview was 4.38. The overall margin of sampling error was ± 3.9%. The final disposition of cases and response, cooperation, refusal and contact rates were calculated using American Association for Public Opinion Research (AAPOR) standard definitions and formulas for complex sampling designs (AAPOR, 2011). The adjusted response rate 4 (RR4) was 22.3%. The adjusted cooperation rate 4 (COOP4) was 60.3%. The adjusted refusal rate 2 (REF2) was 14.7%. The adjusted contact rate 3 (CON3) was 76.5%.

Respondent characteristics.

All respondents. Respondents were 52% male, 74% white and the mean age was 55 years. Twenty percent of respondents had graduated high school or held a GED, an additional 22% graduated from a four-year college, and 15% acquired a graduate degree. Approximately 42% of respondents indicated their annual household income was > $50,000.00, and another 29% indicated their annual household income was $50,000- $99,999. Twenty-five percent of all respondents lived in a rural community 33% in a community between urban and rural and 42% in an urban community.

Respondents had a variety of relationships with hunters: 77% knew a friend, neighbor, or coworker who hunted; 68% knew a hunter when they were growing up; 60% had a family member who didn't live within their household who hunted, and 24% lived with a hunter. A majority of respondents had never gone hunting (57%). Fourteen percent of respondents went

hunting nearly every year, 6% had gone hunting in the last five years, and 23% had gone hunting at least once but not within the last 5 years. Only 10% of all respondents did not know a hunter as a member of their household, relative, friend, neighbor, coworker or growing up.

Non-hunters. Non-hunters, individuals who had never gone hunting, comprised 57% of the sample. Non-hunters were 68% female, 65% white and the mean age was 48 years. Nineteen percent of non-hunters had graduated high school or held a GED, an additional 24% had graduated from a four year college, and 16 % had acquired a graduate degree. Approximately 44% of non-hunters indicated their annual household income was less than $50,000.00, and another 25% indicated their annual household income was $50,000- $99,999. Seventeen percent of non-hunters lived in a rural community 35% in a community between urban and rural and 48% in an urban community.

Non-hunters also had a variety of relationships with hunters: 67% knew a friend, neighbor, or coworker who hunted; 50% knew a hunter when they were growing up; 45% had a family member who didn't live within their household who hunted, and 15% lived with a hunter. Approximately 18% of non-hunters did not know a hunter as a member of their household, relative, friend, neighbor, coworker or growing up.

In comparison to all respondents, a greater proportion of non-hunters were female and nonwhite. Non-hunters were younger, slightly better educated and had slightly a lower annual household income compared to all respondents. Fewer non-hunters had identifiable relationships with hunters compared to all respondents.

Frequent hunters. Frequent hunters, individuals who reported going hunting nearly every year, comprised 14% of the sample. Frequent hunters were 79% male, 82% white and the mean age was 46 years. Twenty-seven percent of frequent hunters had graduated high school or

held a GED, an additional 17% had graduated from a four year college, and 11% had acquired a graduate degree. Approximately 45% of frequent hunters indicated their annual household income was less than $50,000.00, and another 35% indicated their annual household income was between $50,000.00 and $99,999.00. Forty-one percent of frequent hunters stated they lived in a rural community, 32% in a community between urban and rural, and 26% in an urban community.

The social network of frequent hunters included many relationships with hunters: 98% knew a friend, neighbor, or coworker who hunted; 95% knew a hunter when they were growing up; 88% had a family member who didn't live within their household who hunted, and 57% lived with another hunter.

In comparison to all respondents and the non-hunter subgroup, a greater proportion of frequent hunters were male and white. Frequent hunters were younger, slightly less educated and had a slightly lower annual household income compared to all respondents and the non-hunter subgroup. As anticipated, frequent hunters had more relationships with other hunters than all respondents and the non-hunter subgroup.

Wild harvest meat consumption.

All respondents. A majority of respondents (75%) reported having consumed WHM derived from hunting in Michigan. When asked what types of WHM they had consumed, venison was the most common response: 96% of individuals who reported consuming WHM had consumed venison (Table 3.1). Fish (29%), rabbit/hare (28%), pheasant (20%), turkey (20%), squirrel (18%), duck (13%) and bear (12%) were also popular species to eat. In total all respondents identified 32 different wildlife species that had been used for consumption, 29 of

which were species than can be hunted in Michigan. Only 3% of respondents reported consuming non-Michigan game species.

Approximately 25% of respondents reported having never eaten WHM derived from hunting in Michigan (Table 3.2). The most common reason why an individual had not consumed WHM was "never having the opportunity" (21%), followed by "diet/lifestyle" (16%), "taste and smell" (15%), "don't know any hunters" (12%), "don't know" (11%) and "don't hunt" (10%). Compared with all respondents who had consumed WHM, those who reported having never eaten WHM indicated they had less hunting experience and knew fewer hunters (Table 3.3). Respondents who had never consumed WHM were more likely to be female, non-white, and live in an urban area. The number and strength of a respondent's relationships with hunters was correlated with WHM consumption ($F_{S\text{-}R\ Pearson} = 34.41$; $p < 0.001$) (Table 3.4).

Non-hunters. A majority of non-hunters (59%) reported having consumed WHM derived from hunting in Michigan. When asked what types of WHM they had consumed, venison was the most common response: 96% of non-hunters who reported consuming WHM had consumed venison. Fish (21%), rabbit/hare (16%), turkey (13%), pheasant (12%) were also popular species to eat among non-hunters. In total, non-hunters identified 21 different wildlife species that had been consumed, 19 of which were species than can be hunted in Michigan. Only 1% of non-hunters reported consuming non-Michigan game species.

Approximately 41% of non-hunters reported having never eaten WHM derived from hunting in Michigan. The most common reasons why a non-hunter had not consumed WHM was "never having the opportunity" (22%), followed in frequency by "diet/lifestyle" (16%), "taste and smell" (14%), "don't know any hunters" (13%), "don't hunt" (11%), "don't know" (10%)

(Table 3.1). The number and strength of non-hunters relationships with hunters was correlated with WHM consumption ($F_{S\text{-}R\ Pearson}$ =14.29; p<0.001).

Frequent hunters. Ninety-nine percent of frequent hunters reported having consumed WHM derived from hunting in Michigan. When asked what types of WHM they had consumed, venison was the most common response: 97% of frequent hunters who reported consuming WHM had consumed venison. Rabbit/hare (48%), fish and turkey (39%), squirrel (38%), bear (28%), pheasant (25%), duck (19%), goose and grouse (17%) and elk (16%) were also popular species to eat among frequent hunters. In total frequent hunters identified 31 different wildlife species that had been used for consumption, 29 of which were species than can be hunted in Michigan. Only 3% of non-hunters reported consuming non-Michigan game species.

Venison consumption.

All respondents. Seventy-two percent of all respondents (n=983) reported consuming venison. Of all respondents who reported consuming venison (n=735), 31% had not consumed venison in the past 12 months, 28% had consumed venison once or twice in the past 12 months, 21% had consumed venison between 3-10 times in the past 12 months, and 20% reported consuming venison more than 10 times in the past 12 months (Table 3.5). Of respondents who reported consuming venison in the past 12 months (48%), 56% reported receiving venison from family members who did not live within their household, followed in frequency by friends, neighbors or coworkers (54%), and members of their household (26%). Approximately 19% of respondents reported providing venison for themselves and only 7% received it from a community event or game dinner. Venison was provided to an equal percentage of respondents in uncooked and cooked forms (approximately 65% each). The frequency of venison

Table 3.1: Types of wild harvested meat consumed by all respondents (n=983), all non-hunters (n=510), and all frequent hunters (148) reported in weighted percentages out of the total population and those who reported consuming wild harvested meat for each group from the 68th SOSS.

Responses	All Respondents		Non-Hunters		Frequent Hunters	
	All (n=983)	Reported consuming WHM (n=763)	All (n=510)	Reported consuming WHM (n=321)	All (n=148)	Reported consuming WHM (n=145)
Venison/deer	72%	96%	57%	96%	94%	97%
Rabbit/hare	21%	28%	9%	16%	47%	48%
Fish	22%	29%	13%	21%	37%	39%
Pheasant	15%	20%	7%	12%	24%	25%
Squirrel	13%	18%	5%	8%	37%	38%
Turkey	15%	20%	7%	13%	38%	39%
Duck	9%	13%	5%	8%	19%	19%
Bear	9%	12%	3%	5%	28%	28%
Grouse	4%	6%	1%	1%	17%	17%
Goose	5%	7%	2%	4%	17%	17%
Elk	5%	6%	1%	2%	15%	16%
Raccoon	2%	3%	1%	1%	9%	9%
Turtle	3%	4%	1%	2%	7%	16%
Quail	2%	2%	0%	1%	7%	7%
Woodcock	1%	2%	0%	0%	8%	8%
Beaver	1%	1%	0%	0%	4%	4%
Feral Swine	2%	2%	2%	3%	4%	4%
Muskrat	1%	2%	1%	0%	4%	4%
Other- Species not specified	1%	1%	0%	0%	3%	3%
Moose	1%	1%	0%	1%	2%	2%
Bison	1%	1%	0%	0%	1%	1%
Woodchuck	1%	1%	0%	0%	3%	3%
Farmed Species	1%	1%	1%	2%	1%	1%
Do not know	1%	0%	2%	0%	0%	0%
Opossum	0%	1%	0%	0%	3%	3%
Frog	0%	1%	0%	0%	3%	3%
Porcupine	0%	0%	0%	0%	0%	0%

Table 3.1 (cont'd):

Dove	0%	0%	0%	0%	1%	2%
Snake	0%	0%	0%	0%	1%	2%
Alligator/ Crocodile	0%	0%	0%	0%	0%	0%
Fox	0%	0%	0%	0%	2%	2%
Pigeon	0%	0%	0%	0%	1%	1%
Skunk	0%	0%	0%	0%	1%	1%
Crawfish	0%	0%	0%	0%	0%	0%
Sparrow	0%	0%	0%	0%	0%	0%

Table 3.2: Reasons for not consuming wild harvested meat for all respondents (n=220) and non-hunters (n=189) who reported never consuming wild harvested meat reported in weighted percentages from the 68th SOSS.

Responses	All Respondents (n=220)	Non-Hunters (n=189)
	Weighted %	**Weighted %**
Never had opportunity	21%	22%
Taste and smell	15%	14%
Diet/lifestyle	16%	16%
Don't know any hunters	12%	13%
Don't hunt	10%	11%
Don't like	8%	9%
Do not know	11%	10%
No reason	9%	8%
Against hunting	5%	5%
Moral or ethical concerns	2%	0%
Don't know where to get	2%	3%
Don't trust source	1%	1%

Table 3.3: Comparison between wild harvested meat consumers (n=763) and non-consumers (n=220) reported in weighted percentages from the 68th SOSS.

Variables	Consumers (n=763)	Non consumers (n=220)
Level of Hunting Experience		
Never Hunted	45%	91%
Hunted at least once but not in the past 5 yrs	28%	9%
Hunted in the past five years	27%	1%
Social Network		
Hunter in household	30%	7%
Relative(s) hunt(s)	72%	26%
Friend(s) hunt(s)	87%	50%
Knew hunter growing up	80%	33%
Knows zero hunters	2%	33%
Community Type		
Rural	29%	12%
Between Rural and Urban	32%	37%
Urban	39%	51%
Sex		
Male	52%	36%
Female	48%	65%
Age (mean)	50%	48%
Race		
White	82%	53%
Not White	16%	44%
Income (mean)	50,000 - 59,999	50,000 - 59,999
Education (mean)	Technical/Junior College Graduate	Technical/Junior College Graduate

Table 3.4: Social network by wild harvested meat consumption for all respondents, non-hunters and frequent hunters in weighted percentages from the 68th SOSS.

Social Network (increasing in number and strength of relationships)	WHM consumption								
	All Respondents (n=983)			Non-hunters (n=510)			Frequent Hunters (n=147)		
	Never consumed WHM	Consumed WHM at least once	Total	Never consumed WHM	Consumed WHM at least once	Total	Never consumed WHM	Consumed WHM at least once	Total
None	8%	2%	10%	14%	3%	17%	0%	0%	0%
Only knew a hunter growing up	2%	2%	5%	3%	3%	6%	0%	0%	0%
Only has a friend that is a hunter	5%	6%	11%	8%	8%	16%	0%	0%	0%
Knew a hunter growing up and has friends that are hunters	3%	8%	11%	4%	7%	11%	0%	6%	6%
Has relatives that are hunters, or has relatives and friends that are hunters, or relatives that are hunters and knew a hunter growing up	4%	8%	11%	6%	7%	13%	0%	3%	3%
Has relatives and friends that are hunters and knew a hunter growing up	2%	26%	28%	3%	18%	20%	0%	35%	35%
Has a hunter in their household plus other relationships with hunters	2%	23%	24%	3%	13%	16%	0%	55%	56%
Total	25%	75%	100%	41%	59%	100%	1%	99%	100%
	$F_{S\text{-}R\ Pearson}$ =34.4107 p<0.001			$F_{S\text{-}R\ Pearson}$ =14.2927 p<0.001			$F_{S\text{-}R\ Pearson}$ =0.7490 p=0.5480		

consumption was correlated with the level of urbanization of all respondents community type ($F_{S\text{-}R\ Pearson}$ =7.51; p<0.001). About 67% of all respondents who lived in a rural community had consumed venison in the past 12 months compared to 37% living in an urban area.

Non-hunters. Fifty-seven percent of all non-hunters (n=510) reported consuming venison. Of the non-hunters who reported consuming venison (n=307), 40% had not consumed venison in the past 12 months, 33% had consumed venison once or twice in the past 12 months, 19% had consumed venison between 3-10 times in the past 12 months, and 8% reported consuming venison more than 10 times in the past 12 months. Ninety-two percent of respondents who had never consumed venison were non-hunters, whereas only 20% of respondents who had consumed venison >10 times in the past 12 months were non-hunters (Table 3.6). Non-hunters who reported consuming venison in the past 12 months (34% of all non-hunters) received their venison most often from friends, neighbors or coworkers (61%), followed by family members who did not live within their household (59%), and members of their household (20%). Approximately 5% of non-hunters reported receiving venison from a community event or game dinner. Venison was more often provided to non-hunters in a cooked (71%) than uncooked form (54%). Frequency of venison consumption was weakly correlated with the level of urbanization in a non-hunters community type ($F_{S\text{-}R\ Pearson}$ =3.64; p<0.001). Approximately 54% of non-hunters who lived in a rural community had consumed venison in the past 12 months compared to 26% living in an urban area.

Frequent hunters. Ninety-four percent of all frequent hunters (n=148) reported consuming venison. Of the frequent hunters who reported consuming venison (n=141), 7% had not consumed venison in the past 12 months, 9% had consumed venison once or twice in the past 12 months, 27% had consumed venison between 3-10 times in the past 12 months, and 57%

reported consuming venison > 10 times in the past 12 months. Frequent hunters who reported consuming venison in the past 12 months (93% of all frequent hunters) received their venison most often from themselves (71%), followed in frequency by friends, neighbors or coworkers (49%), family members who did not live within their household (43%), and members of their household (37%). Approximately 9% of frequent hunters reported receiving venison from a community event or game dinner. This percentage is a greater percentage than that of all respondents (7%) and the subgroup non-hunters (5%). Venison was more often provided to frequent hunters in an uncooked form (70%) compared to a cooked form (66%).

Modeling Wild Harvested Meat and Frequency of Venison Consumption

The variables age, education, and income were not statistically associated with either dependent variable, WHM consumption or frequency of venison consumption. Removing these demographic variables from the model did not affect overall model significance. However, it did influence coefficients for other variables, particularly race. Age, education and income were included in the final model as control variables.

Determinants of wild harvest meat consumption.

All respondents. Level of hunting experience, social network and race were the only significant predictors of WHM consumption (Table 3.7). Level of hunting experience and social network were both positive predictors of WHM consumption ($p<0.001$). Being of a race other than white was inversely related to WHM consumption ($p<0.01$). The odds of consuming WHM for someone who hunted at least once but not in the past five years is 3.57 times the odds of someone has never gone hunting consuming WHM, adjusting for the other covariates. This

Table 3.5: Frequency of venison consumption by level of urbanization reported in weighted percentages for all respondents, non-hunters and frequent hunters from the 68th SOSS.

Frequency of Venison Consumption	**Level of Urbanization**											
	All respondents (n=950)				Non-hunters (n=510)				Frequent hunters (n=143)			
	Rural	Between Rural and Urban	Urban	Total	Rural	Between Rural and Urban	Urban	Total	Rural	Between Rural and Urban	Urban	Total
Never	3%	10%	14%	27%	4%	16%	21%	42%	0%	0%	0%	1%
Consumed, but not within the past 12 months	5%	7%	11%	23%	4%	7%	12%	24%	2%	3%	2%	7%
1-2 Times in the past 12 months	6%	6%	8%	20%	4%	6%	9%	19%	7%	1%	2%	9%
3-10 times in the past 12 months	4%	6%	6%	16%	3%	5%	3%	11%	6%	10%	11%	27%
10+ times in the past 12 months	7%	5%	2%	14%	2%	1%	1%	5%	28%	20%	9%	56%
Total	25%	34%	41%	100%	18%	35%	47%	100%	42%	34%	24%	100%
	$F_{S\text{-}R\ Pearson} = 7.51\ p<0.001$				$F_{S\text{-}R\ Pearson} = 3.6365\ p<0.001$				$F_{S\text{-}R\ Pearson} = 2.0198\ p=0.0238$			

Table 3.6: Frequency of venison consumption by level of hunting experience: reported in weighted percentages out of total (n=950) from the 68th SOSS (FS-R Pearson=35.39 p<0.001).

Frequency of Venison Consumption	**Level of Hunting Experience**			
	Never Hunted	Has hunted at least once but not within the past 5 years	Hunted within last 5 years	Total
Never	24%	2%	0%	26%
Consumed, but not within the past 12 months	13%	8%	2%	23%
1-2 Times in the past 12 months	11%	7%	3%	21%
3-10 times in the past 12 months	6%	4%	5%	15%
10+ times in the past 12 months	3%	3%	9%	15%
Total	57%	23%	20%	100%

effect is even greater for someone who has hunted in the past five years. The linearized standard error and confidence interval for hunted in the last five years are high because in the weighted data set only 1.4 observations had hunted in the past five years but never consumed WHM. However, the confidence interval does not include zero, indicating that although there is high error in this prediction, hunting within the past five years is a significant predictor of WHM consumption. Nonetheless, the precise size of this effect is unknown. For every one unit increase in the social network variable, the odds ratio of consuming WHM increases by 63%, adjusting for other covariates. As level of hunting experience and number and strength of relationships with hunters increase, the likelihood of consuming WHM also increases. The opposite is true for the race variable. Someone being of a race other than white is 52% less likely to have consumed WHM than a white person, adjusting for other covariates.

Non-hunters. A non-hunter's social network was a positive predictor of frequency of venison consumption ($p<0.001$ level; Table 3.8). For every one-unit increase in a non-hunters social network the odds ratio of consuming WHM increases by 57%, adjusting for other covariates. A non-hunter of a race other than white was a negative predictor of WHM consumption ($p<0.05$). A non-hunter of a race other than white is 46% less likely to have consumed WHM than a white person, adjusting for other covariates.

Determinants of frequency of venison consumption.

All respondents. Level of hunting experience, social network, and living in an urban community were the only reliable predictors of frequency of venison consumption for this model (Table 3.9). Level of hunting experience and social network were both positive predictors ($p<0.001$). Living in an urban community was a negative predictor of frequency of venison

consumption ($p<0.01$). The predicted frequency of venison consumption is 0.422 times greater for someone who hunted at least once but not in the past five years compared to someone who never hunted, holding all other predictors constant. The predicted frequency of venison consumption is 1.31 times greater for someone who has gone hunting in the past five years compared to someone who has never gone hunting, holding all other predictors constant. Frequency of venison consumption increased by 0.268 for every one-unit increase in social network, holding all other predictors constant. There was no observed difference in frequency of venison consumption between respondents living in a community between rural and urban and living in a rural community. The predicted frequency of venison consumption for someone from an urban community is -0.342 less than someone from a rural community, holding all other predictors constant.

Non-hunters. A non-hunter's social network was a positive predictor of frequency of venison consumption ($p<0.001$ level; Table 3.10). Living in an urban community and living in a community between rural and urban were negative predictors of a non-hunter's frequency of venison consumption ($p<0.01$ and $p<0.05$, respectively). Frequency of venison consumption increased by 0.252 times for every one-unit increase in a non-hunter's social network, holding all other predictors constant. The predicted frequency of venison consumption for a non-hunter from community between rural and urban is -0.361 less than a non-hunter from a rural community, holding all other predictors constant. The predicted frequency of venison consumption for a non-hunter from an urban community is -0.490 less than a non-hunter from a rural community, holding all other predictors constant.

Table 3.7: Design-based logistic regression of wild harvested meat consumption for all respondents on level of hunting experience, social network, community type, sex, age, race, income and education level. Results reported in terms of odds ratios.

Predictor	Estimated odds ratio	Linearized SE	t-Statistic	p-Value	95% CI		DEFF
Level of Hunting Experience							
Never Hunted*							
Hunted at least once but not in the past 5 years	3.570	0.978	4.64	0.000	2.085	6.111	1.126
Hunted in the past five years	24.151	19.062	4.03	0.000	5.132	113.666	0.811
Social Network	1.631	0.103	7.75	0.000	1.441	1.846	1.470
Community Type							
Rural*							
Between Rural and Urban	0.689	0.225	-1.14	0.254	0.363	1.307	1.410
Urban	0.728	0.241	-0.96	0.336	0.380	1.392	1.417
Sex	0.677	0.166	-1.59	0.113	0.418	1.097	1.361
Age	0.997	0.007	-0.38	0.705	0.985	1.011	1.470
Race (not white)	0.484	0.134	-2.63	0.009	0.282	0.833	1.596
Income	1.067	0.049	1.40	0.160	0.975	1.167	1.385
Education	0.950	0.040	-1.20	0.230	0.874	1.033	1.501
Intercept	0.411	0.332	-1.10	0.271	0.084	2.005	1.330
n=961	F_W (10 , 951) = 16.54, p< 0.0000			F_{A-L}(9 , 952) = 0.598, p= 0.799			

* Denotes reference category

Table 3.8: Design-based logistic regression of wild harvested meat consumption for non-hunters on social network, community type, sex, age, race, income and education level. Results reported in terms of odds ratios.

Predictor	Estimated odds ratio	Linearized SE	t-Statistic	p-Value	95% CI		DEFF
Social Network	1.566	0.102	6.91	0.000	1.379	1.779	1.370
Community Type							
Rural*							
Between Rural and Urban	0.606	0.227	-1.34	0.181	0.291	1.263	1.339
Urban	0.656	0.250	-1.11	0.269	0.310	1.387	1.353
Sex	0.624	0.171	-1.72	0.086	0.364	1.069	1.290
Age	1.003	0.007	0.44	0.657	0.989	1.017	1.363
Race (not white)	0.536	0.161	-2.08	0.038	0.298	0.966	1.499
Income	1.084	0.056	1.57	0.117	0.980	1.199	1.341
Education	0.945	0.045	-1.19	0.236	0.860	1.038	1.460
Intercept	0.320	0.283	-1.29	0.198	0.057	1.815	1.263
n=497 $F_w(8 , 489) = 7.79 , p< 0.0000$ $F_{A-L}(9 , 488) = 1.168, p= 0.313$							

* Denotes reference category

Table 3.9: Design-based linear regression of frequency of venison consumption for all respondents on level of hunting experience, social network, community type, sex, age, race, income and education level.

Predictor	Parameter Estimate	Linearized SE	t-Statistic	p-Value	95% CI		DEFF
Level of Hunting Experience							
Never Hunted*							
Hunted at least once but not in the past 5 years	0.422	0.114	3.71	0.000	0.199	0.645	1.363
Hunted in the past five years	1.308	0.136	9.60	0.000	1.041	1.576	1.390
Social Network	0.268	0.025	10.92	0.000	0.220	0.316	1.465
Community Type							
Rural*							
Between Rural and Urban	-0.197	0.113	-1.74	0.082	-0.418	0.025	1.357
Urban	-0.342	0.114	-3.00	0.003	-0.565	-0.119	1.394
Sex	0.036	0.087	0.42	0.678	-0.134	0.206	1.343
Age	-0.003	0.003	-1.35	0.178	-0.008	0.002	1.487
Race (not white)	-0.161	0.109	-1.48	0.140	-0.375	0.053	1.637
Income	0.006	0.016	0.40	0.690	-0.025	0.038	1.320
Education	-0.004	0.015	-0.25	0.806	-0.032	0.025	1.369
Intercept	0.596	0.302	1.97	0.049	0.004	1.188	1.321
n=928 $R^2_{weighted}$ = 0.4542 $F_w(10 , 918) = 75.03 , p< 0.0000$							

* Denotes reference category

Table 3.10: Design-based linear regression of frequency of venison consumption for non-hunters on social network, community type, sex, age, race, income and education level.

Predictor	Parameter Estimate	Linearized SE	t-Statistic	p-Value	95% CI		DEFF
Social Network	0.252	0.027	9.33	0.000	0.199	0.306	1.306
Community Type							
Rural*							
Between Rural and Urban	-0.361	0.183	-1.97	0.050	-0.721	0.000	1.336
Urban	-0.490	0.175	-2.8	0.005	-0.834	-0.146	1.346
Sex	-0.106	0.107	-0.99	0.324	-0.317	0.105	1.184
Age	0.002	0.003	0.53	0.596	-0.005	0.008	1.399
Race (not white)	-0.171	0.130	-1.31	0.191	-0.426	0.085	1.476
Income	0.028	0.023	1.23	0.219	-0.017	0.073	1.267
Education	0.005	0.020	0.24	0.812	-0.034	0.043	1.290
Intercept	0.250	0.406	0.62	0.538	-0.548	1.048	1.155
n=482 $R^2_{weighted} = 0.2714$ $F_w(8, 474) = 17.52$, $p < 0.0000$							

* Denotes reference category

Discussion

Wild Harvested Meat Consumption

A large majority of all respondents (three-fourths) and nearly two-thirds of all non-hunters reported consuming WHM at least once in their lifetime. Although there are no studies on which to compare results for all respondents, Stedman & Decker (1996) estimated that 61.6% of non-hunters in their New York sample had consumed WHM. The term game meat was used in questions about consumption for their 1996 study, similar to the present study, however the term was not specifically defined in in the study's questionnaire. It is thought provoking that these two studies conducted 18 years apart in different locations produced similar numbers. It seems that the number of non-hunters reporting consuming WHM at least once in their lifetime appears to converge around two thirds.

Generalizing to the entire state of Michigan, this means that a vast majority of the state's residents, including non-hunters, have interacted with hunting/hunters through the consumption of WHM at some point in their life. The extent of WHM consumption derived from hunting in Michigan is vast, and this wide distribution of the state's wildlife resources offers evidence that WHM provides provisional and cultural ecosystem services to society (Ljung et al. 2012). Although game species were the most popular, results suggest that there are other types of WHM that may be desired by individuals in the population. Identifying populations interested in non-traditional game species and monitoring their consumption may be important for wildlife management; however, increasing access to these sources of WHM may also increase the number of people who perceive ecosystem services from WHM.

The variety of wildlife species named by respondents in this study has implications for the definition of WHM or "game meat" and future studies on the topic. First, many non-game species were identified in this study. Using the term "game" may underreport what wildlife species are being consumed. The term "wild-harvested" in lieu of "game" may be a simple solution to this variability in definition. Most formal definitions of the word meat define it as coming from a mammal eliminating fish, birds, reptiles, amphibians, crustaceans etc. as meat. Many respondents in this study did not use such a strict definition, although it is impossible to know how many did. It was particularly unexpected that fish were often identified as a WHM, even though the term hunting was used in the definition. To ensure continuity in the definition of WHM and accuracy in reporting, my results indicate that not only is it important to define the source of the meat (e.g. wildlife from hunting), but also to establish wither or not non-mammalian species are included in this definition (e.g. wild harvested meat, fowl or fish; wild harvested meat and fowl, not including fish). However, in this particular study, every individual who identified fish as a WHM also reported consuming a traditional game species: either fowl, meat or both.

Non-hunters comprised a majority of people who reported they had never consumed WHM. Increasing opportunities for non-hunters to consume WHM may be a simple way to engage, or perhaps socialize, non-hunters to hunting. Furthermore, the taste and smell or a general dislike of WHM were also cited as reasons for not consuming WHM. Considering that these respondents reported not having ever tried WHM, another mechanism to involve non-hunters with hunting may be to dispel myths about WHM tasting gamey or unpleasant. Programs such as Michigan's Gourmet Gone Wild® take this approach by providing participants with WHM dishes prepared by a professional chef. Cookbooks, clinics and other easily accessible

media that describe proper handling of WHM as well as creative recipes may be helpful in lessening perceived barriers to consumption.

Venison Consumption

Venison was unanimously the most popular form of WHM consumed in this study. Nearly all individuals who reported consuming WHM reported consuming venison. This identifies venison as an ideal proxy for studying WHM consumption in Michigan, and perhaps other areas where deer are prevalent and deer hunting a popular form of recreation. Being able to focus on one type of WHM encourages more detailed questioning, reduces concerns about varied definitions of 'game meat' and more broadly meat, and improves respondent recall. However, although using the frequency of venison consumption as a proxy for WHM likely decreases measurement error, this method may under estimate overall frequency of WHM consumption.

Forty-eight percent of all respondents and 34% of non-hunters reported consuming venison in the past 12 months. A national survey of the United States reported that 42% of the population had consumed WHM in the past 12 months (RM & NSSF, 2011). In a study of Swedish residents, Ljung et al. (2012) found that 65% of non-hunters reported consuming WHM at least once per year. In a follow up study of Swedish WHM consumption, it was revealed that 62% of non-hunters from urban Stockholm consumed WHM at least once per year, whereas 81% of non-hunters in rural Northern Sweden reported consuming WHM at least once per year (Ljung et al. 2014). Again, the Swedish equivalent for the term game meat was used in questions about consumption for these studies, but the term was not specifically defined in in the study's questionnaire. The differences in terminology and language may be partially responsible for differences in reported consumption rates. In Sweden, WHM may be more readably available to

non-hunters because meat can be sold directly by hunters and in stores and restaurants, likely increasing the overall WHM consumption rate in Sweden compared to the US.

Results indicate that in the United States, the total number of people who consume WHM is much higher than the percent of the population that actually hunts, which is about six percent (USFWS, 2011). This supplies direct evidence that sharing WHM greatly increases the number of beneficiaries of provisional and cultural ecosystem services WHM provides to society. These estimates are much greater than reported in Chapter 2. Hunters reported sharing venison with approximately 19% of the population. For receivers of venison the event may be unique, and distinctive events are easier to recall than repeated ones (Tourangeau et al., 2000). To estimate the extent of venison sharing, responses from receivers are likely more accurate than those of hunters, because hunters are honest but forgetful when it comes to sharing their harvest (Nolin, 2010).

Frequent hunters were by far the most frequent consumers of venison. A large majority of frequent hunters reported consuming venison, many of whom reported consuming venison more than 10 times in the past 12 months. Hunters not only provided themselves venison, but also received it from many other sources. This higher rate of WHM consumption by frequent hunters identifies the provisional ecosystem services WHM may provide to hunters and their families, but also raises concerns about frequent hunters level of exposure to contaminants in WHM. When questioning hunters about their consumption patterns it is important to keep in mind that they are both providers and receivers of WHM and a different scale with higher frequency of consumption options is likely needed to assess just how often hunters are consuming WHM.

Determinants of Wild Harvested Meat and Frequency of Venison Consumption

A non- hunter's social relationships with hunters increasing in strength and frequency was a positive predictor of WHM consumption, whereas living in an urban community and race (being not white) were negative predictors of WHM consumption. Research from Sweden also reported living in a rural residence and knowing hunters were positive predictors of non-hunter WHM consumption (Ljung et al., 2012 & Ljung et al., 2014). The role of knowing hunters for WHM consumption in the US emphasizes the importance of social networks in the extent of the distribution of WHM, especially to non-hunters, and underscores the potential cultural ecosystem services sharing WHM may provide. Furthermore, hunter densities are lower in urban environments, thus someone living in an urban community is less likely to know a hunter as a function of their community type.

Limited consumption of WHM by races other than white is likely a result of multiple factors. A majority of hunters in Michigan (85%) and the United States (94%) are white (USFWS, 2011), and any racial division probably extends to hunters' social networks. Additionally, the black population of Michigan mainly lives in urban communities, and results indicate that living in an urban community reduces access to WHM (Rastogi, Johnson, Hoeffel, & Drewery, 2011). Furthermore, Burger (2000) reported significant differences in WHM (including fish) consumption patterns for different races. Blacks reported eating more WHM, but very little venison (Burger, 2000). In this study there was no statistically significance difference in consumption patterns for venison based on race. However, cultural variations in consumption patterns should still be considered when making estimates of WHM consumption, even when using venison as a proxy. My small sample size of respondents from a race other than white made comparisons of race across different types of WHM statistically invalid. Additionally,

grouping all races other than white into one category likely eliminates any effect of cultural differences on WHM consumption.

Contrary to Burger's (2002) findings, females were just as likely as males to have consumed WHM when controlling for level of hunting experience. Results from Sweden support this finding. Ljung et al. (2014) found that sex did not predict non-hunter WHM consumption. Thus, although females may not be active hunters, they are equally engaged in hunting when it comes to WHM consumption.

Hunters who share WHM beyond their normal social networks, particularly to groups who are less associated with hunting, can increase the extent of WHM consumption and potentially the number of people connected to hunting. Sharing WHM may be a relatively easy way to introduce and include underrepresented groups in the number and type of ecosystem services produced by hunting.

CHAPTER 4

Management Implications and Future Directions

Management Implications

In the previous chapters, I established that wild harvested meat (WHM) provides provisional and cultural ecosystem services to a considerable proportion of Michigan society. Recognition of these services and their amplification beyond hunters increases the number of people benefiting from and connected to the hunting wildlife management system. Consideration of these services and their beneficiaries could be an important element for making informed decisions in conservation policy and wildlife management in Michigan. The social relevance of hunting will likely only become more important if current declines in hunter numbers continue. The provisional and cultural ecosystem services provided by hunters may be a key component of maintaining the relevancy and importance of these traditional natural resource uses to Michigan society.

I identified access to WHM as the primary factor limiting the extent of WHM consumption into society. Thus, fostering opportunities for sharing and consuming WHM may be a practical and effective strategy to increase participation in hunting and garner acceptance and support for hunters and hunting among Michigan residents, particularly with groups underrepresented in hunting, such as urbanites and racial minorities. Sharing opportunities could be increased through formalized programs like Windsor Dinners, Gourmet Gone Wild®, or the Nebraska Deer Exchange. Less structured approaches that encourage hunters to expand their WHM sharing network also may be an effective and a low cost way of increasing benefits from

hunting. Encouraging hunters to share their meat in social settings where non-hunters are present may be the most readily implemented method to maintain the social relevancy of hunting, encourage positive attitudes toward hunting, and potentially recruit new hunters. Additionally, dispelling myths regarding taste of WHM may increase the inclination of non-hunters to try WHM. Additionally, public support for hunting is strong when hunting is characterized as a method of obtaining food. Identifying how hunters use their WHM, regardless of motivation, and disseminating this information, may be another simple way to positively change attitudes about hunting.

Commercial harvest and sale of WHM are currently under consideration in US wildlife management as a mechanism to control abundant populations of white-tailed deer (*Odocoileus virginanus)*. A structured inquiry into the extent of sharing and consumption of WHM under current practices would help inform the development of such policies. I have found that the lack of a legal market in WHM does not impede the sharing of WHM. A system of sharing and consumption governed by informal institutions appears to have evolved, or perhaps, remained. It is not clear that a regulated market in WHM would increase the number of beneficiaries of the current wildlife management system, and, in fact, could have the opposite effect. Imposing an economic value on WHM in this system could change who benefits and how, and the number of beneficiaries of this system, for better or worse.

I have also identified a considerable social network in which WHM is shared and consumed and my results provide an initial estimate of the extent of this network. This network of sharing and consumption also identifies numerous pathways for exposure to zoonotic disease and chemical contaminants from WHM. Should the need arise to provide public health information to WHM consumers, it is important to recognize that WHM is consumed by many

more people than just hunters and their household members. Educational campaigns geared towards hunters and their families may not reach all consumers.

Future Directions

This thesis has provided basic knowledge on a relatively unstudied system – the sharing and consumption of WHM – but it has also generated more questions about this same system. The extent of WHM sharing and consumption was measured, but little is known about how much WHM is transferred through sharing networks and how it is used as a provisional ecosystem service. Understanding the sociocultural value of this system and the importance of the act of sharing WHM to providers and receivers would further identify the cultural ecosystem services WHM provides. The CHANS model identifies connections between human and natural systems and the feedback loops and reciprocal interactions between the two. My study only looked at one relationship in this system, the ecosystem services WHM (the natural system) provide to humans. More information and analysis of the other interactions that complete this system, such as the effect of WHM sharing and consumption has on attitudes towards and relevancy of hunting, would further our knowledge of WHM as a coupler of human and natural systems. The next step in this inquiry is to further specify the provisional and cultural ecosystem services that WHM sharing and consumption provide through an in-depth inquiry, and to quantify the influence of these services on human well-being, attitudes toward hunting and nature, and conservation policy.

APPENDICES

APPENDIX A

2013 Michigan Deer Harvest Study Questionnaire

Michigan Department of Natural Resources – Wildlife Division
PO Box 30030 Lansing MI 48909-7530

2013 MICHIGAN DEER HARVEST STUDY

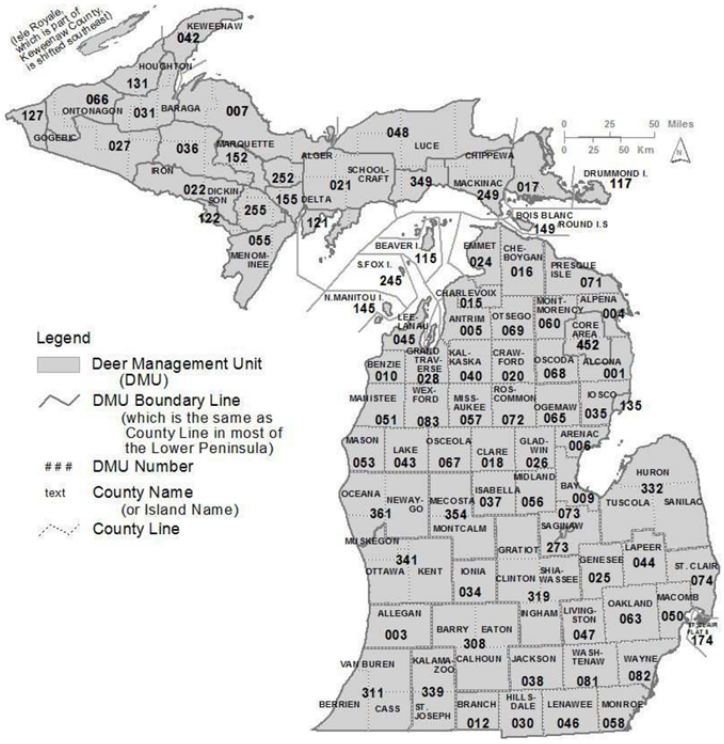
This information is requested under authority of Part 435, 1994 PA 451, M.C.L. 324.43539.

It is important that you return this questionnaire even if you did not hunt or harvest a deer. Please report only your hunting activities, and only report taking a deer if your kill tag was attached to it. If you want to provide your answers via the internet, visit our website at https://secure1.state.mi.us/deersurvey.

1. Did you hunt deer in Michigan during the 2013 seasons?

[1] ☐ Yes.

[2] ☐ No. If you did not hunt deer, skip to Question #11.



Questions continued on next page.

2. In the following table, please report only your hunting activities and the deer that were tagged with your deer license. Report harvest and days hunted in different counties on separate rows. For each deer harvested, indicate the type of deer tagged (antlered buck or antlerless), and whether it was taken on public or private land. Antlered bucks have antlers at least 3 inches in length; antlerless deer include deer without antlers and deer with antlers less than 3 inches in length. Do not report hunting effort and harvest associated with Deer Management Assistance Permits.

SEASON HUNTED (Check box if you hunted during the season.)	LOCATION HUNTED (For each season you hunted, list the management unit and county hunted on separate lines. See map on first page.)		NUMBER OF DAYS HUNTED	NUMBER OF DEER HARVESTED (Record by type of deer and land ownership type where each deer was taken.)			
				Antlered Bucks		Antlerless	
	Deer Management Unit	County		Public Land	Private Land	Public Land	Private Land
0 [X] **Example**	1 041	Kent	12	0	1	0	0
1 [ ] **Archery** Oct 1-Nov 14 and Dec 1-Jan 1 (Statewide)	1						
	2						
	3						
2 [ ] **Regular Firearm** Nov 15-30 (Statewide)	1						
	2						
	3						
3 [ ] **Muzzleloader** Dec 6-15 (UP) Dec 13-22 (NLP) Dec 6-22 (SLP)	1						
	2						
	3						
4 [ ] **Early Firearm** Sept 21-22 (Portions of the Lower Peninsula)	1			Only antlerless deer could be taken on private land during the early firearm season			
	2						
	3						
5 [ ] **Late Firearm** Dec 23-Jan 1 (Portions of the Lower Peninsula)	1			Only antlerless deer could be taken on private land during the late firearm season			
	2						
	3						
6 [ ] **Liberty Hunt** Sept 21-22 (Statewide)	1						
	2						
	3						
7 [ ] **Independence Hunt** Oct 17-20 (Statewide)	1						
	2						
	3						

3. **Did you use a crossbow to hunt deer during the archery season (Oct 1- Nov. 14 and Dec. 1 - Jan. 1)?**

1 ☐ Yes 2 ☐ No.

4. **If you used a crossbow to hunt deer during the archery season, how many deer did you take using the crossbow?**

_____ Report the number of antlerless deer you took with a crossbow.

_____ Report the number of antlered deer (bucks) you took with a crossbow.

5. **The DNR collects biological information such as age and sex from deer that hunters take to DNR check stations. Were any of the deer you harvested in 2013 taken to a DNR check station?** *(Only count deer tagged with one of your kill tags.)*

1 ☐ Yes 2 ☐ No. Skip to question #7.

6. **How many of your deer were taken to a DNR check station?**
(Only count deer tagged with one of your kill tags.)

_____ Report the number of deer taken to a DNR check station.

7. **What is your preferred county to hunt deer in Michigan? Please select one county from the counties you reported hunting during the 2013 seasons in Question #2.**

Please write county name

8. **Please indicate how satisfied or dissatisfied you were with the following for the 2013 deer hunting seasons in your preferred county:**
(Select one choice per item.)

	Very Satisfied	Somewhat Satisfied	Neutral	Somewhat Dissatisfied	Strongly Dissatisfied	Not Applicable
a. Number of deer you saw.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐
b. Number of antlered deer (bucks) you saw.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐
c. Your overall deer hunting experience.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐
d. Number of deer you harvested.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐

9. **Michigan hunters share venison they harvest in a variety of ways. Sharing is defined as offering raw (meat) or prepared (cooked) venison to another person. If you shared venison during the past 12 months, to whom did you provide it?** *(Please select all that apply.)*

1 ☐ I did not share any of my venison
2 ☐ Members of my immediate household
3 ☐ Relatives not in my household
4 ☐ Friends, neighbors, or co-workers
5 ☐ Landowner whose property I hunted
6 ☐ Community group game dinner
7 ☐ Food bank or other donation program
8 ☐ Other: _____

10. **During the past 12 months, to how many people did you directly provide venison?** *Do not include in your estimate large events such as community group game dinners or deer provided to a donation program.*

Total number of people to whom you provided venison: _____

11. Antler point restrictions were adopted in 2008 for taking antlered deer (bucks) in the Upper Peninsula (UP). The regular buck tag of a combination deer license could only be used to tag a buck with at least three antler points on one side. The restricted tag could only be used on a buck with at least four points on one side. Hunters who chose not to purchase the combination tag were restricted to one buck (with no additional point restrictions) in the UP, all seasons combined, even if they purchased an archery and firearms license. How strongly do you support or oppose these restrictions for the UP?

1 ☐ Strongly Support 2 ☐ Support 3 ☐ Oppose 4 ☐ Strongly Oppose 5 ☐ Not Sure

12. Please describe how the antler point restrictions for the Upper Peninsula affected your deer hunting participation, harvest, and satisfaction in 2013. *(Select one choice per item.)*	Increased	No change	Decreased	Not Applicable
a. Number of days you hunted deer in the Upper Peninsula (UP).	1 ☐	2 ☐	3 ☐	4 ☐
b. Number of days you hunted deer in the Lower Peninsula (LP).	1 ☐	2 ☐	3 ☐	4 ☐
c. Number of antlerless deer you harvested in the UP.	1 ☐	2 ☐	3 ☐	4 ☐
d. Number of antlerless deer you harvested in the LP.	1 ☐	2 ☐	3 ☐	4 ☐
e. Total number of deer you harvested in the UP.	1 ☐	2 ☐	3 ☐	4 ☐
f. Total number of deer you harvested in the LP.	1 ☐	2 ☐	3 ☐	4 ☐
g. Overall satisfaction with your deer hunting experience in the UP.	1 ☐	2 ☐	3 ☐	4 ☐
h. Overall satisfaction with your deer hunting experience in the LP.	1 ☐	2 ☐	3 ☐	4 ☐

13. The same antler point restrictions that were adopted in the Upper Peninsula as described above were implemented in DMU 487 in the northeast Lower Peninsula in 2010. In addition, hunters in DMU 487 could use a firearm license or one or both combination license tags for antlerless deer during the firearm or muzzleloader seasons. DMU 487 included Alcona, Alpena, Iosco, Montmorency, Oscoda, and Presque Isle counties. How strongly do you support or oppose these regulations for DMU 487?

1 ☐ Strongly Support 2 ☐ Support 3 ☐ Oppose 4 ☐ Strongly Oppose 5 ☐ Not Sure

14. Please describe how the antler point restrictions for DMU 487 affected your deer hunting participation, harvest, and satisfaction in 2013. *(Select one choice per item.)*	Increased	No change	Decreased	Not Applicable
a. Number of days you hunted deer in DMU 487.	1 ☐	2 ☐	3 ☐	4 ☐
b. Number of days you hunted deer outside DMU 487.	1 ☐	2 ☐	3 ☐	4 ☐
c. Number of antlerless deer you harvested in DMU 487.	1 ☐	2 ☐	3 ☐	4 ☐
d. Number of antlerless deer you harvested outside DMU 487.	1 ☐	2 ☐	3 ☐	4 ☐
e. Overall satisfaction with your deer hunting experience in DMU 487.	1 ☐	2 ☐	3 ☐	4 ☐

Please return questionnaire in the enclosed postage-paid envelope.
Thank you for your help!

www.michigan.gov/dnr

APPENDIX B

2013 Michigan Deer Harvest Survey Questionnaire Cover Letters

STATE OF MICHIGAN
DEPARTMENT OF NATURAL RESOURCES
LANSING

RICK SNYDER
GOVERNOR

KEITH CREAGH
DIRECTOR

January 15, 2014

Dear Hunter:

We need your help in completing our survey of the 2013 Deer Harvest. Our survey provides you with a unique opportunity to directly affect the management of deer in Michigan. Your answers will help us evaluate hunting seasons so we can provide future seasons that you and other hunters enjoy. Harvest reports also are important indicators of population status and deer management.

Please take a few minutes to complete this short questionnaire and return it in the enclosed postage-paid envelope. Alternatively, if you want to provide your answers via the Internet; visit our website at https://secure1.state.mi.us/deersurvey/.

You are an important part of our study. **We need information from you, even if you did not hunt or harvest a deer.** It is also important that you give us only **your** hunting results. Do not combine anyone else's results with yours. When reporting harvest, only report deer that were tagged with **your** kill tag. Please do not report deer taken with crop damage (block), deer management assistance, or disease control permits. Deer taken with these special permits are counted by a separate survey.

Thank you for your participation in this study. The information you provide will assure that Michigan's deer management is based on the best information available. If you have questions regarding the survey, please contact Mr. Brian Frawley, Mail Surveys Specialist, Wildlife Division, P.O. Box 30030, Lansing, MI 48909-7530, or at 5517-284-9453. The results of this survey will posted on our website as soon as they are available (www.michigan.gov/dnr). You also can find Wildlife Division news and results of deer harvest surveys from previous years on our website.

Sincerely,

Russ Mason, Ph.D., Chief
Wildlife Division

Enclosures

STATE OF MICHIGAN
DEPARTMENT OF NATURAL RESOURCES
LANSING

RICK SNYDER
GOVERNOR

KEITH CREAGH
DIRECTOR

February 28, 2014

Dear Hunter:

Your help is needed! We have not received your 2013 Michigan Deer Harvest Survey. If you have already returned your questionnaire, we greatly appreciate your help. If not, please return your questionnaire today. As you can tell from the enclosed questionnaire, we are trying to collect some very basic information about your hunting activities. The information you provide will help us establish hunting seasons that you and other deer hunters enjoy.

You are an important part of our study**. We need information from you, even if you did not hunt or harvest a deer in 2013**, so that our results will give us a good understanding of all license buyers. To properly manage Michigan's deer population, it is important for us to have knowledge of the annual hunting season harvest. Using harvest information, we can construct population estimates and chart important changes.

The information you provide will assure that Michigan's deer management is based on the best information available. Please take a few minutes to complete this short questionnaire and return it in the enclosed postage-paid envelope. Alternatively, if you want to provide your answers via the Internet; visit our website at https://secure1.state.mi.us/deersurvey/. You may also reach this website by selecting links found in the Hunting and the Deer sections of the DNR home page, www.michigan.gov/dnr.

Thank you for your participation in this study. If you have questions about the survey, please contact Mr. Brian Frawley, Mail Surveys Specialist, at Wildlife Division, P.O. Box 30030, Lansing, MI 48909-7530 (Phone: 517-284-9453). The results of this survey will posted on our website as soon as they are available (www.michigan.gov/dnr). You also can find Wildlife Division news and results of deer harvest surveys from previous years on our website.

Sincerely,

Russ Mason, Ph.D., Chief
Wildlife Division

Enclosures

RICK SNYDER
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF NATURAL RESOURCES
LANSING

KEITH CREAGH
DIRECTOR

April 22, 2014

Dear Hunter:

Earlier this year, we sent you a questionnaire asking you to report the results of your 2013 Deer Hunting Season. Unfortunately, we have not received your reply. Without your information, our study results will be less accurate. The information you provide will help us provide hunting seasons that you and other hunters enjoy. Consequently, we have enclosed another questionnaire and ask that you help your fellow deer hunters by completing the enclosed questionnaire.

Hunters are our best source of information about their sport and wildlife populations. Indeed, this information is considered so important that Michigan law requires hunters to report the number, kinds, and location of game harvested when requested by the Department of Natural Resources.

You are an important part of this year's survey. **We need information from you, even if you did not hunt or harvest a deer in 2013**, so that our results will give us an adequate understanding of all license buyers.

The information you provide will assure that Michigan's deer management is based on the best information available. Please take a few minutes to complete this short questionnaire and return it in the enclosed postage-paid envelope. Alternatively, if you want to provide your answers via the Internet; visit our website at https://secure1.state.mi.us/deersurvey/.

Thank you for your participation in this study. If you have questions about the survey, please contact Mr. Brian Frawley, Mail Surveys Specialist, at Wildlife Division, P.O. Box 30030, Lansing, MI 48909-7530 (Phone: 517-284-9453). You also can find Wildlife Division news and results of deer harvest surveys from previous years on our website (www.michigan.gov/dnr).

Sincerely,

Russ Mason, Ph.D., Chief
Wildlife Division

Enclosures

CONSTITUTION HALL • 525 WEST ALLEGAN STREET • P.O. BOX 30028 • LANSING, MICHIGAN 48909-7528
www.michigan.gov/dnr • (517) 284-MDNR(6367)

APPENDIX C

2013 Michigan Deer Harvest Study Questionnaire Incentive

FREE FIREARM OR BOW

As a participant in the 2013 Michigan Deer Harvest Survey you can be eligible to win a

1. **Rifle or**
2. **Compound bow (or crossbow) fitted to your specifications.**

Complete and return the enclosed questionnaire. Only completed questionnaires postmarked before February 20, 2014, will be included in the drawing. Three winners will be selected at random and notified in September 2014.

Prizes donated by

Safari Club International

Michigan Involvement Committee

SCI is the largest hunting club in the world and is dedicated to conserving our wildlife, woods and water and preserving our great American Heritage, "The Right To Hunt." SCI involves itself with **CONSERVATION** for all, **EDUCATION** for proper use of our natural resources, and **LEGISLATION** for the hunter.

For information about the Safari Club International, contact:

SCI, 2852 COLONIAL WAY, BLOOMFIELD HILLS, MICHIGAN 48304

DEPARTMENT OF NATURAL RESOURCES · DNR · MICHIGAN ·

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APPENDIX D

Additional 2013 Michigan Deer Harvest Study Data Tables

Table D.1: To whom Michigan deer hunters provided venison during the past 12 months from the 2013 Michigan Deer Harvest Study. (4,758 hunters did not respond to this question).

Receivers	n	Out of those who shared (n= 9,063)		Out of all respondents to the question (n= 15,223)	
		%	Weighted %	%	Weighted %
I did not share any of my venison	6,160			40%	40%
Members of my household	6,243	69%	69%	41%	41%
Relatives not in my household	4,713	52%	52%	31%	31%
Friends, neighbors or coworkers	4,568	50%	51%	30%	30%
Landowner whose property I hunted	1,165	13%	13%	8%	8%
Community Group game dinner	243	3%	3%	2%	2%
Food bank or other donation program	219	2%	2%	1%	1%
Other Not Specified	75	1%	1%	0%	0%

Table D.2: The number of people Michigan deer hunters shared their venison with over the past 12 months from the 2013 Michigan Deer Harvest Study.

Mean: 5.6 *SEM: 0.047*					
Number of people shared with	**n**	**Out of those who shared (n= 9,051)**		**Out of all respondents to the question (n= 15,952)**	
		%	**Weighted %**	**%**	**Weighted %**
0	6,901			43%	43%
1	594	7%	7%	4%	4%
2	1,380	15%	15%	9%	9%
3	1,258	14%	14%	8%	8%
4	1,502	17%	17%	9%	9%
5	954	11%	11%	6%	6%
6	990	11%	11%	6%	6%
7	354	4%	4%	2%	2%
8	531	6%	6%	3%	3%
9	120	1%	1%	1%	1%
10	596	7%	7%	4%	4%
11	47	1%	0%	0%	0%
12	241	3%	3%	2%	2%
13	25	0%	0%	0%	0%
14	46	1%	1%	0%	0%
15	156	2%	2%	1%	1%
16	23	0%	0%	0%	0%
17	12	0%	0%	0%	0%
18	16	0%	0%	0%	0%
19	3	0%	0%	0%	0%
20	106	1%	1%	1%	1%
21	5	0%	0%	0%	0%
22	7	0%	0%	0%	0%
23	2	0%	0%	0%	0%
24	4	0%	0%	0%	0%
25	19	0%	0%	0%	0%
26	4	0%	0%	0%	0%
28	1	0%	0%	0%	0%
29	1	0%	0%	0%	0%
30	33	0%	0%	0%	0%
31	1	0%	0%	0%	0%
32	1	0%	0%	0%	0%

Table D2 (cont'd):

35	3	0%	0%	0%	0%
37	2	0%	0%	0%	0%
40	5	0%	0%	0%	0%
41	1	0%	0%	0%	0%
42	1	0%	0%	0%	0%
45	2	0%	0%	0%	0%
50	3	0%	0%	0%	0%
55	1	0%	0%	0%	0%
80	1	0%	0%	0%	0%
Missing	4,029				
Total	19,981				

Table D.3: Hunting related characteristics of all respondents (n=19,981) and hunters who did and did not share their venison in the past 12 months (variable venison providers n=17,262) from the 2013 Michigan Deer Harvest Study.

Variable	All respondents (n=19,981)			Venison Providers (n=17,262)					
				Shared venison in past 12 months			Did not share venison in past 12 months		
	n	%	Weighted %	n	%	Weighted %	n	%	Weighted %
Venison Providers				9,475	55%	55%	7,787	45%	45%
Harvested in 2013									
Yes	8,782	44%	44%	7,263	42%	42%	1,274	7%	7%
No	11,199	56%	56%	2,212	13%	13%	6,513	38%	38%
Harvested Antlerless Deer in 2013									
Yes	4,611	23%	23%	3,898	23%	22%	609	4%	3%
No	15,370	77%	77%	5,577	32%	33%	7,178	42%	41%
Harvested Antlered Deer in 2013									
Yes	5,854	29%	29%	4,861	28%	28%	814	5%	5%
No	14,127	71%	71%	4,614	27%	27%	6,973	40%	40%
Total number of Deer Harvested									
0	11,199	56%	56%	2,212	13%	13%	6,513	38%	38%
1	5,997	30%	30%	4,834	28%	28%	983	6%	6%
2	2,044	10%	10%	1,747	10%	10%	247	1%	1%
3	545	3%	3%	507	3%	3%	28	0%	0%
4	136	1%	1%	119	1%	1%	14	0%	0%
5	37	0%	0%	34	0%	0%	2	0%	0%
6	19	0%	0%	18	0%	0%	0	0%	0%
7	4	0%	0%	4	0%	0%	0	0%	0%

Table D3 (cont'd):

Participated in Early and/or Late Antlerless Firearm Season									
Yes	2,258	11%	11%	1,385	8%	8%	681	4%	4%
No	17,705	89%	89%	8,080	47%	47%	7,101	41%	41%
Participated in Archery Season									
Yes	10,195	51%	51%	5,664	33%	33%	3,473	20%	20%
No	9,786	49%	49%	3,811	22%	22%	4,314	25%	25%
Participated in Muzzleloader Season									
Yes	5,451	27%	27%	3,087	18%	18%	1,821	11%	11%
No	14,530	73%	73%	6,388	37%	37%	5,966	35%	37%
Participated in Regular Firearm Season									
Yes	17,771	89%	89%	8,451	49%	49%	6,939	40%	40%
No	2,210	11%	11%	1,024	6%	6%	848	5%	5%
Type of Equipment Used									
Just Bow	1,418	7%	7%	673	4%	4%	559	3%	3%
Just Gun	9,332	48%	48%	3,641	21%	22%	4,141	24%	24%
Bow and Gun	8,772	45%	45%	4,988	29%	30%	2,912	17%	17%

Table D.4: Demographic profiles of all respondents (n=19,981) and hunters who did and did not share their venison in the past 12 months (variable venison providers n=17,262) from the 2013 Michigan Deer Harvest Study.

Variable	All respondents (n = 19,981)*			Venison Providers (n=17,262)**					
				Shared venison in past 12 months			Did not share venison in past 12 months		
	n	%	Weighted %	n	%	Weighted %	n	%	Weighted %
Venison Providers				9,475	55%	55%	7,787	45%	45%
Age									
18-29	2,202	11%	12%	1,120	6%	7%	868	5%	5%
30-39	2,433	12%	13%	1,273	7%	8%	900	5%	6%
40-49	3,806	19%	20%	1,965	11%	12%	1,387	8%	8%
50-59	5,109	26%	27%	2,537	15%	15%	1,868	11%	11%
60-69	4,538	23%	19%	1,902	11%	9%	1,949	11%	10%
70-79	1,583	8%	8%	576	3%	3%	679	4%	4%
80-89	298	1%	1%	97	1%	1%	133	1%	1%
90+	12	0%	0%	5	0%	0%	3	0%	0%
Sex									
Male	18,476	92%	92%	8,754	51%	51%	7,186	42%	41%
Female	1,505	8%	8%	721	4%	4%	601	3%	4%
Ecoregion									
Upper Peninsula	1,753	9%	8%	752	4%	4%	716	4%	4%
Northern Lower Peninsula	4,045	20%	20%	1,931	11%	11%	1,592	9%	9%
Southern Lower Peninsula	14,183	71%	72%	6,792	39%	40%	5,479	32%	32%
Level of Urbanization									
Not Urban	11,277	57%	56%	5,443	32%	31%	4,395	26%	25%
Urban Buffer	6,960	35%	36%	3,224	19%	19%	2,720	16%	16%
Urban	1,692	8%	9%	782	5%	5%	651	4%	4%

* n= 19,929 for variable level of urbanization ** n= 17,215 for variable level of urbanization

APPENDIX E

Study Specific Sections from the 68th SOSS Telephone Interview Transcript

Study Specific Sections from the 68th SOSS Telephone Interview Transcript

This modified version of the interview transcript shows only questions created specifically for this study and demographic questions. A full set of all survey questions and question order is available at http://ippsr.msu.edu/soss/. In the actual interview demographic questions were asked prior to the study specific questions. For the purposes of this thesis I have provided study specific questions first.

Notes for reading the interview transcript:

- R refers to respondent
- Interview questions are in bold.
- Other interview text that was read to the respondent is in quotation marks.
- Notes to the interviewer about specific questions are provided below the question in italics.
- Question response options were not provided to the respondent unless read as part of the question. The response options were provided to the interviewer to field code responses during the interview.

Beginning of Interview Transcript

CONCENT

"Before we begin, let me tell you that this interview is completely voluntary. You may choose not to participate and you may end your participation at any time without penalty. Should we come to any question that makes you feel too uncomfortable or you do not want to answer, just let me know and we can go on to the next question.

Information collected for this study will be kept confidential to the extent allowed by local, state and federal law, and no reference will be made in any oral or written report that would link you individually to this study.

This call may be recorded for quality assurance."

If respondent wanted contact information for the project manager, the principal investigator, or the IRB that information was provided upon request.

STUDY SPECIFC QUESTIONS ABOUT WILD HARVESTED MEAT

"To better inform conservation policy, we are interested in how people use and value natural resources in Michigan. One of those resources is the meat obtained through hunting, also called game meat. The following questions are about the eating and sharing of game meat from Michigan."

Meat1: **Have you ever eaten game meat that came from hunting in Michigan, whether you were the hunter or were given the meat by a hunter? Do NOT include meat that was bought at a store or farm, or was eaten at a restaurant**.

1. YES [*go to meat2a*]
2. NO [*go to meat1a*]
8. DO NOT KNOW [*go to meat13*]
9. REFUSED THIS QUESTION [*go to meat13*]

Meat1a: **Is there any particular reason why you have not eaten game meat?**

Field code response. This means do not read the responses but choose the response that best fits the respondents answer. If a response does not fit, use the other specify to enter the text. Check all that apply.

A. DIET (DON'T EAT MEAT/RED MEAT)
B. TASTE
C. DON'T HUNT
D. NEVER HAD OPPORTUNITY
E. DON'T KNOW ANY HUNTERS
F. DON'T KNOW WHERE TO GET GAME MEAT
G. AGAINST HUNTING/UNCOMFORTABLE WITH HUNTING
X. OTHER
Y. DO NOT KNOW

Once meat 1a is answered go to meat 13.

Meat2a: **What types of game meat that came from hunting in Michigan have you had?**

Field code responses (do not read choices to R). Only select an option if R uses the exact term, otherwise use specify. Check all that apply.

A. VENISON/DEER
B. TURKEY
C. ELK
D. RABBIT OR HARE
E. PHEASANT
F. GOOSE
G. GROUSE
H. SQUIRREL
I. DUCK
J. FISH (ANY/ALL TYPES)
X. OTHER
Y. DO NOT KNOW

Meat2b: **What other types of game meat from hunting in Michigan have you had?**
Field code responses (do not read choices to R). Only select an option if R uses the exact term, otherwise use other specify. Check all that apply.

W. NOTHING ADDITIONAL
A. VENISON/DEER
B. TURKEY
C. ELK
D. RABBIT OR HARE
E. PHEASANT
F. GOOSE
G. GROUSE
H. SQUIRREL
I. DUCK
J. FISH (ANY/ALL TYPES)
X. OTHER
Y. DO NOT KNOW

If respondent answered as having eaten venison (deer meat) they were asked the following question (Meat3). If they had not eaten venison they were asked question Meat 13.

Meat3: **In the past 12 months, approximately how many times have you eaten deer meat (also called venison) that came from hunting in Michigan, whether you were the hunter or were given the meat by a hunter? Not at all, once or twice, three to ten times, or more than ten times.**

1. NOT AT ALL [*go to meat13*]
2. ONCE OR TWICE
3. 3 TO 10 TIMES
4. MORE THAN 10 TIMES
7. ATE IN LAST 12 MONTHS, BUT UNSURE HOW MANY TIMES
8. DO NOT KNOW WHETHER ATE ANY IN LAST 12 MONTHS [*go to meat13*]
9. REFUSED THIS QUESTION [*go to meat13*]

If the respondent identified that they had eaten venison in the last 12 months they were asked the following series of questions (Meat4-12). If they had not eaten venison in the last 12 months they were asked question Meat13.

"The following questions are about where the venison came from that you ate over the past 12 months."

Meat4: **Did you hunt any of the venison yourself?**

1. YES
2. NO
8. DO NOT KNOW
9. REFUSED THIS QUESTION

Meat5: **Did you get any from members of your household?**

1. YES
2. NO
8. DO NOT KNOW
9. REFUSED THIS QUESTION

Meat6: **Did you get any from family that doesn't live with you?**

1. YES
2. NO
8. DO NOT KNOW
9. REFUSED THIS QUESTION

Meat7: **Did you get any from friends, neighbors, or coworkers?**

1. YES
2. NO
8. DO NOT KNOW
9. REFUSED THIS QUESTION

Meat8: **Did you get any from a community game dinner or event?**

1. YES
2. NO
8. DO NOT KNOW
9. REFUSED THIS QUESTION

Meat9: **Did you get any venison from another source?**

1. YES[*specify*]
2. NO
8. DO NOT KNOW
9. REFUSED THIS QUESTION

Meat10: **Thinking about the venison you got from those sources over the past 12 months, was any of it provided to you in an uncooked or raw form?**

Include frozen meat only if it was uncooked or raw

1. YES
2. NO
8. DO NOT KNOW
9. REFUSED THIS QUESTION

Meat11: **Was any of it provided in a cooked or prepared form?**

Include frozen meat only if it was already cooked or prepared.

1. YES
2. NO
8. DO NOT KNOW
9. REFUSED THIS QUESTION

Meat12: **Was any of it provided in another form?**

1. YES[*specify*]
2. NO
8. DO NOT KNOW
9. REFUSED THIS QUESTION

"The following questions are about hunting in general, not just deer hunting, and are not restricted to hunting in Michigan"

Meat13: **Not including you, do any of the members of your household hunt?**

1. YES
2. NO
8. DO NOT KNOW
9. REFUSED THIS QUESTION

Meat14: **Do any other family members that don't live with you hunt?**

1. YES
2. NO
8. DO NOT KNOW
9. REFUSED THIS QUESTION

Meat15: **Do any of your friends, coworkers, or neighbors hunt?**

1. YES
2. NO
8. DO NOT KNOW
9. REFUSED THIS QUESTION

Meat16: **When you were growing up, did anyone you were close to hunt?**

1. YES
2. NO
8. DO NOT KNOW
9. REFUSED THIS QUESTION

Meat17: **Have you ever gone hunting?**

1. YES
2. NO [*go to next section*]
8. DO NOT KNOW
9. REFUSED THIS QUESTION

Meat18: **Do you go hunting nearly every year?**

1. YES
2. NO [*go to next section*]
8. DO NOT KNOW
9. REFUSED THIS QUESTION

Meat19: **Have you gone hunting in the last 5 years?**

1. YES
2. NO
8. DO NOT KNOW
9. REFUSED THIS QUESTION

DEMOGRAPHIC QUESTIONS

"Now, I have some background questions for you."

Sex: **I need to verify that I am speaking with a (male/female) adult?**

1. MALE
2. FEMALE

Age: **In what year were you born?**

19 __ __

Education: **What is the highest level of education you have completed?**

0. DID NOT GO TO SCHOOL
1. 1st GRADE
2. 2nd GRADE
3. 3rd GRADE
4. 4th GRADE
5. 5th GRADE
6. 6th GRADE
7. 7th GRADE

8. 8th GRADE
9. 9th GRADE
10. 10th GRADE
11. 11th GRADE
12. HIGH SCHOOL GRADUATE OR GED HOLDER
13. 1st YEAR COLLEGE
14. 2nd YEAR COLLEGE
20. TECHNICAL/JUNIOR COLLEGE GRADUATE
15. 3rd YEAR COLLEGE
16. COLLEGE GRADUATE (FOUR YEARS)
17. SOME POST GRADUATE
18. GRADUATE DEGREE
98. DO NOT KNOW
99. REFUSED THIS QUESTION

Ethnicity: **Are you of Hispanic, Latino, or Spanish origin?**

1. YES-HISPANIC/LATINO/SPANISH ORIGIN
5. NO-NOT HISPANIC/LATINO/SPANISH ORIGIN
8. DO NOT KNOW
9. REFUSED THIS QUESTION

Race: **What is your race? Would you say white or Caucasian, African American or black, Hawaiian or other Pacific Islander, Asian, or American Indian or Alaska Native?**

Check all that apply.

A. WHITE OR CAUCASIAN
B. AFRICAN AMERICAN OR BLACK
C. HAWAIIAN OR OTHER PACIFIC ISLANDER
D. ASIAN
E. AMERICAN INDIAN OR ALASKA NATIVE
F. OTHER
G. REFUSED

Income: "To get a picture of people's financial situations, we'd like to know the general range of incomes of all households we interview. This is for statistical analysis purposes and your answers will be kept strictly confidential."

Inca: **Now, thinking about your household's total annual income from all sources (including your job), did your household receive $40,000 or more in 2013?**

1. YES [*go to incd*]
5. NO [*go o incb*]
8. DO NOT KNOW
9. REFUSED THIS QUESTION

incb: **Was it less than $20,000?**

1. YES [go to incc]
5. NO [go to incca]
8. DO NOT KNOW
9. REFUSED THIS QUESTION

incca: **What is less than $30,000?**

1. YES
5. NO
8. DO NOT KNOW
9. REFUSED THIS QUESTION

incc: **Was it less than $10,000?**

1. YES
5. NO
8. DO NOT KNOW
9. REFUSED THIS QUESTION

incd: **Was it $60,000 or more?**

1. YES [*go to incg*]
5. NO [*go to incf]*
8. DO NOT KNOW
9. REFUSED THIS QUESTION

incf: **Was it $50,000 or more?**

1. YES
5. NO
8. DO NOT KNOW
9. REFUSED THIS QUESTION

incg: **Was it more than $100,000?**

1. YES [*go to inci*]
5. NO
8. DO NOT KNOW
9. REFUSED THIS QUESTION

inch: **Was it more than $70,000?**

1. YES

5. NO
8. DO NOT KNOW
9. REFUSED THIS QUESTION

incha: **Was it more than $90,000?**

1. YES
5. NO
8. DO NOT KNOW
9. REFUSED THIS QUESTION

inci: **Was it more than $150,000?**

1. YES
5. NO
8. DO NOT KNOW
9. REFUSED THIS QUESTION

Community Type: **Would you say you live in a rural community, a small city or town, a suburb, or an urban community?**

1. RURAL COMMUNITY
2. SMALL CITY OR TOWN, VILLAGE
3. A SUBURB
4. URBAN COMMUNITY
0. SPECIFY:OTHER
8. DO NOT KNOW
9. REFUSED THIS QUESTION

County: **What county do you live in?**

1. Alcona	2. Alger	3. Allegan
4. Alpena	5. Antrim	6. Arenac
7. Baraga	8. Barry	9. Bay
10. Benzie	11. Berrien	12. Branch
13. Calhoun	14. Cass	15. Charlevoix
16. Cheboygan	17. Chippewa	18. Clare
19. Clinton	20. Crawford	21. Delta
22. Dickinson	23. Eaton	24. Emmet
25. Genesee	26. Gladwin	27. Gogebic
28. Grand Traverse	29. Gratiot	30. Hillsdale
31. Houghton	32. Huron	33. Ingham
34. Ionia	35. Iosco	36. Iron
37. Isabella	38. Jackson	39. Kalamazoo
40. Kalkaska	41. Kent	42. Keweenaw
43. Lake	44. Lapeer	45. Leelanau

46. Lenawee
47. Livingston
48. Luce
49. Mackinac
50. Macomb
51. Manistee
52. Marquette
53. Mason
54. Mecosta
55. Menominee
56. Midland
57. Missaukee
58. Monroe
59. Montcalm
60. Montmorency
61. Muskegon
62. Newaygo
63. Oakland
64. Oceana
65. Ogemaw
66. Ontonagon
67. Osceola
68. Oscoda
69. Otsego
70. Ottawa
71. Presque Isle
72. Roscommon
73. Saginaw
74. St. Clair
75. St. Joseph
76. Sanilac
77. Schoolcraft
78. Shiawassee
79. Tuscola
80. Van Buren
81. Washtenaw
82. Wayne
83. Wexford

At the end of the interview respondents were thanked for their participation and asked if they could be recontacted in a couple of moths for another interview.

APPENDIX F

Additional Tables from the 68th SOSS for All Respondents

Table F.1: Wild harvested meat consumption for all respondents (n=997).

Responses	n	%	Weighted %
Yes	763	77%	73%
No	220	22%	25%
Do not know	11	1%	1%
Refused this question	3	0%	0%
Total	997	100%	100%

Table F.2: Reasons for not consuming wild harvested meat for all respondents who reported never consuming wild harvested meat (n=220). *Open ended responses coded*.

Responses	n	Out of total sample (n=983)		Out of those asked (n=220)	
		%	Weighted %	%	Weighted %
Never had opportunity	42	4%	5%	19%	21%
Taste and smell	34	3%	4%	15%	15%
Diet/lifestyle	33	3%	4%	15%	16%
Don't know any hunters	25	3%	3%	11%	12%
Don't hunt	24	2%	3%	11%	10%
Don't like	21	2%	2%	10%	8%
Do not know	20	2%	3%	9%	11%
No Reason	17	2%	2%	8%	9%
Against hunting	14	1%	1%	6%	5%
Moral or ethical concerns	6	1%	1%	3%	2%
Don't know where to get	4	0%	1%	2%	2%
Don't trust source	4	0%	0%	2%	1%

Table F.3: Types of wild harvested meat consumed by all respondents who reported consuming wild harvested meat (n=763). *Open ended responses coded*.

Responses	n	Out of total sample (n=983)		Out of those asked (n=763)	
		%	Weighted %	%	Weighted %
Venison/deer	735	74%	71%	96%	96%
Rabbit/hare	239	24%	21%	31%	28%
Fish	227	23%	22%	30%	29%
Pheasant	169	17%	14%	22%	20%
Squirrel	147	15%	13%	19%	18%
Turkey	143	14%	14%	19%	20%

Table F.3 (cont'd):

Duck	102	10%	9%	13%	13%
Bear	93	9%	8%	13%	12%
Grouse	68	7%	4%	9%	6%
Goose	57	6%	5%	7%	7%
Elk	44	4%	4%	6%	6%
Raccoon	27	3%	2%	4%	3%
Turtle	25	3%	3%	3%	4%
Quail	18	2%	2%	2%	2%
Woodcock	16	2%	0%	2%	2%
Beaver	15	2%	1%	2%	1%
Feral Swine	14	1%	2%	2%	2%
Muskrat	13	1%	1%	2%	2%
Other- Species not specified	13	1%	1%	2%	1%
Moose	11	1%	1%	1%	1%
Do not know	8	1%	1%	1%	2%
Bison	7	1%	1%	1%	1%
Woodchuck	7	1%	1%	1%	1%
Farmed Species	6	1%	1%	1%	1%
Opossum	5	1%	0%	1%	1%
Frog	5	1%	0%	1%	1%
Porcupine	4	0%	0%	1%	0%
Dove	2	0%	0%	0%	0%
Snake	2	0%	0%	0%	0%
Alligator/ Crocodile	2	0%	0%	0%	0%
Fox	2	0%	0%	0%	0%
Don't Know	2	0%	0%	0%	0%
Pigeon	1	0%	0%	0%	0%
Skunk	1	0%	0%	0%	0%
Crawfish	1	0%	0%	0%	0%
Sparrow	1	0%	0%	0%	0%

Table F.4: Types of wild harvested meat consumed by all respondents who reported consuming wild harvested meat (n=763). *Open ended responses coded and combined into categories of similar species.*

Response Categories	**n**	Out of total sample (n=983)		Out of those asked (n=763)	
		%	**Weighted %**	**%**	**Weighted %**
Big game	739	74%	71%	97%	97%
Upland game birds	306	31%	27%	40%	36%
Small game with season	271	27%	24%	36%	33%
Fish	227	23%	22%	30%	29%
Waterfowl	124	12%	11%	16%	16%
Furbearers	46	5%	4%	6%	6%
No limit small game	36	4%	4%	5%	5%
Reptiles and amphibians	30	3%	3%	4%	3%
Non-Michigan game	19	2%	2%	2%	3%
Don't Know	2	0%	0%	0%	0%

Table F.5: Frequency of venison consumption in the past 12 months for all respondents who reported consuming venison (n=735).

Mean =2.26 *SD=1.11* *Min= 1* *Max= 4*					
Response Options	**n**	Out of total sample (n=983)		Out of those asked (n=735)	
		%	**Weighted %**	**%**	**Weighted %**
1. Not at all	239	24%	22%	33%	31%
2. Once or twice	203	20%	20%	28%	28%
3. 3-10 times	150	15%	15%	20%	21%
4. More than 10 times	138	14%	14%	19%	20%
Do not know whether ate any in the last 12 months	2	0%	0%	0%	0%
Refused this question	3	0%	0%	0%	1%
Total	735	74%	71%	100%	100%

Table F.6: Origin of venison consumed over the past 12 months for all respondents who reported consuming venison in the past 12 months (n=491).

Response Categories	Yes	Out of total sample (n=983)		Out of those asked (n=491)		No	Don't know	Refused
		%Yes	Weighted % Yes	%Yes	Weighted % Yes			
Self	97	10%	9%	20%	19%	393	1	0
Members of household	120	12%	13%	24%	26%	371	0	0
Family not within household (Relatives)	275	28%	27%	56%	56%	216	0	0
Friends, neighbors or coworkers	261	27%	26%	53%	54%	230	0	0
Community game dinner or event	39	4%	3%	7%	7%	452	0	0
Other	9	1%	1%	2%	2%	481	1	0
Road kill	3	0%	0%	1%	1%	na	na	na
Donation	3	0%	0%	1%	1%	na	na	na
Restaurant or Store	3	0%	0%	1%	1%	na	na	na

Table F.7: Form of venison provided over the past 12 months for all respondents who reported consuming venison in the past 12 months (n=491).

Response Categories	Yes	Out of total sample (n=983)		Out of those asked (n=491)		No	Don't know	Refused
		%Yes	Weighted % Yes	%Yes	Weighted % Yes			
Uncooked/Raw	306	31%	31%	62%	64%	182	1	2
Cooked/Prepared	314	31%	31%	64%	66%	173	1	3
Other	55	6%	5%	11%	11%	425	8	3

Table F.8: All respondents' relationships with hunters (n=997).

Response Categories	Yes	% Yes	Weighted % Yes	No	Don't know	Refused
Members of household hunt	224	22%	24%	766	4	3
Family members not within household hunt	602	60%	60%	383	11	1
Friends, coworkers, or neighbors hunt	785	79%	77%	170	41	1
Knew hunter growing up	710	71%	68%	277	10	0

Table F.9: Level of hunting experience for all respondents (n=997).

Mean =0.84 SD=1.1 Min= 0 Max= 3			
Response options	**n**	**%**	**Weighted %**
0. Never gone hunting	521	52%	57%
1. Gone hunting at least once but not in the past 5 years	267	27%	23%
2. Gone hunting in the last 5 years but not every year	61	6%	6%
3. Goes hunting nearly every year	148	15%	14%
Total	997	100%	100%

Table F.10: All respondents' sex (n=997).

Sex	n	%	Weighted %
Male	516	52%	47%
Female	481	48%	53%
Total	977	100%	100%

Table F.11: All respondents' age reported in categories (n=997). *Note: in analysis age was used a continuous variable not in categories.*

Mean = 54.91 SD= 17.16 Min= 18 Max=95			
Age	**n**	**%**	**Weighted %**
18-29	100	10%	17%
30-39	103	10%	17%
40-49	127	13%	15%
50-59	227	23%	20%
60-69	217	22%	14%
70-79	134	13%	8%
80+	66	7%	7%
Refused	23	2%	3%
Total	997	100%	100%

Table F.12: All respondents' highest level of education completed (n=997).

Mean =15.04 SD=2.70 Min= 7 Max=19			
Education Level	**n**	**%**	**Weighted %**
0. Did not go to school	0	0%	0%
1. 1st Grade	0	0%	0%
2. 2nd Grade	0	0%	0%
3. 3rd Grade	0	0%	0%
4. 4th Grade	0	0%	0%
5. 5th Grade	0	0%	0%
6. 6th Grade	0	0%	0%
7. 7th Grade	2	0%	0%
8. 8th Grade	7	1%	1%
9. 9th grade	3	0%	0%
10. 10th Grade	5	1%	0%
11. 11th Grade	17	2%	2%
12. High School Graduate or GED Holder	219	22%	20%
13. 1st Year College	92	9%	10%
14. 2nd Year College	151	15%	15%
15. Technical/Junior College Graduate	41	4%	5%
16. 3rd Year College	40	4%	5%
17. College Graduate (Four Years)	219	22%	22%
18. Some Post Graduate	37	4%	3%
19. Graduate Degree	157	16%	15%
Do Not Know	2	0%	0%
Refused This Question	5	1%	1%
Total	997	100%	100%

Table F.13: All respondents' ethnicity (Hispanic. Latino, or Spanish origin) (n=997).

Responses	**n**	**%**	**Weighted %**
No	969	97%	97%
Yes	17	2%	2%
Do Not Know	1	0%	0%
Refused This Question	10	1%	1%
Total	997	100%	100%

Table F.14: All respondents' race (n=997). *Note: categories are not mutually exclusive*.

Race	n	%	Weighted %
White or Caucasian	838	84%	77%
African American or Black	96	10%	14%
Hawaiian or Other Pacific Islander	2	0%	1%
Asian	11	1%	3%
American Indian or Alaskan Native	15	2%	3%
Other	34	3%	3%
Refused	20	2%	2%

Table F.15: All respondents race coded into mutually exclusive categories (n=997).

Race	n	%	Weighted %
White Only	819	82%	74%
Black Only	90	9%	13%
Other Including Multi Race	66	7%	11%
Missing	22	2%	2%
Total	997	100%	100%

Table F.16: All respondents' annual household income in USD (n=997).

Income	n	%	Weighted %
1. Less than 10,000	44	4%	6%
2. 10,000-19,999	101	10%	11%
3. 20,000-29,999	84	8%	8%
4. 30,000-39,999	61	6%	6%
5. 40,000-49,999	110	11%	11%
6. 50,000-59,999	81	8%	7%
7. 60,000-69,999	81	8%	8%
8. 70,000-89,999	116	12%	12%
9. 90,000-99,999	30	3%	3%
10. 100,000-150,000	126	13%	12%
11.More than 150,000	67	7%	6%
Do Not Know	31	3%	4%
Refused	65	7%	6%
Total	997	100%	100%

Table F.17: All respondents' community type (n=997).

Response Options	n	%	Weighted %
Rural Community	279	28%	25%
Small City or Town, Village	337	34%	33%
A Suburb	271	27%	29%
Urban Community	110	11%	13%
Missing	0	0%	0%
Total	997	100%	100%

Table F.18: All respondents' residence by Michigan Department of Natural Resources (MDNR) Ecoregion (n=997). *Note: In statistical analysis the Upper Peninsula and Northern Lower Peninsula Ecoregions were combined because they have similar hunter participation rates and hunter densities compared to the Southern Lower Peninsula*.

MDNR Ecoregion	n	%	Weighted %
Upper Peninsula Ecoregion	59	6%	4%
Northern Lower Peninsula Ecoregion	108	11%	10%
Southern Lower Peninsula Ecoregion	830	83%	87%
Total	997	100%	100%

APPENDIX G

Additional Tables from the 68th SOSS for Non-Hunters

Table G.1: Wild harvested meat consumption for non-hunters (n=521).

Responses	n	%	Weighted %
Yes	321	62%	58%
No	189	36%	40%
Do not know	9	2%	2%
Refused this question	2	0%	1%
Total	521	100%	100%

Table G.2: Reasons for not consuming wild harvested meat for non-hunters who reported never consuming wild harvested meat (n=189). *Open ended responses coded*.

Responses	n	Out of total sample (n=521)		Out of those asked (n=189)	
		%	Weighted %	%	Weighted %
Never had opportunity	37	7%	9%	20%	22%
Diet/lifestyle	29	6%	6%	15%	16%
Taste and smell	27	5%	5%	14%	14%
Don't know any hunters	23	4%	5%	12%	13%
Don't hunt	21	4%	4%	11%	11%
Don't like/no desire to try	20	4%	3%	11%	9%
Against hunting/ uncomfortable with hunting	14	3%	2%	7%	5%
No Reason	14	3%	3%	7%	8%
Do not know	14	3%	4%	7%	10%
Moral or ethical concerns	5	1%	1%	3%	2%
Don't know where to get game meat	4	1%	1%	2%	3%
Don't trust source	3	0%	1%	2%	1%

Table G.3: Types of wild harvested meat consumed by non-hunters who reported consuming wild harvested meat (n=321). *Open ended responses coded*.

Responses	n	Total sample (n=521)		Those asked (n=321)	
		%	**Weighted %**	%	**Weighted %**
Venison/deer	307	59%	55%	96%	96%
Fish	65	12%	12%	20%	21%
Rabbit/hare	55	11%	9%	17%	16%
Turkey	40	8%	7%	12%	13%
Pheasant	39	7%	7%	12%	12%
Duck	26	5%	5%	8%	8%
Squirrel	24	4%	5%	7%	8%
Bear	14	3%	3%	4%	5%
Goose	10	2%	2%	3%	4%
Grouse	8	2%	1%	2%	1%
Turtle	6	1%	1%	2%	2%
Elk	5	1%	1%	2%	1%
Raccoon	5	1%	1%	2%	1%
Feral Swine	5	1%	2%	2%	3%
Farmed Species	4	1%	1%	1%	2%
Beaver	2	0%	0%	1%	0%
Muskrat	2	0%	1%	1%	1%
Moose	2	0%	0%	1%	1%
Woodchuck	1	0%	0%	0%	0%
Quail	1	0%	0%	0%	1%
Alligator/ Crocodile	1	0%	0%	0%	0%
Sparrow	1	0%	0%	0%	0%
Other- Species not specified	1	0%	0%	0%	0%
Do not know	1	0%	0%	0%	0%
Bison	0	0%	0%	0%	0%
Woodcock	0	0%	0%	0%	0%
Porcupine	0	0%	0%	0%	0%
Opossum	0	0%	0%	0%	0%
Frog	0	0%	0%	0%	0%
Pigeon	0	0%	0%	0%	0%
Dove	0	0%	0%	0%	0%
Snake	0	0%	0%	0%	0%
Skunk	0	0%	0%	0%	0%
Fox	0	0%	0%	0%	0%
Crawfish	0	0%	0%	0%	0%

Table G.4: Types of wild harvested meat consumed by non-hunters who reported consuming wild harvested meat (n=321). *Open ended responses coded and combined into categories of similar species.*

Response Categories	n	Out of total sample (n=521)		Out of those asked (n=321)	
		%	Weighted %	%	Weighted %
Big game	307	59%	55%	96%	95%
Upland game birds	71	14%	12%	22%	20%
Fish	65	12%	12%	20%	21%
Small game with season	62	12%	11%	19%	19%
Waterfowl	31	6%	6%	10%	10%
Furbearers	9	2%	2%	3%	3%
No limit small game	8	2%	2%	2%	4%
Reptiles and amphibians	6	1%	1%	2%	2%
Non-Michigan game	2	0%	0%	1%	1%

Table G.5: Frequency of venison consumption in the past 12 months for non-hunters who reported consuming venison (n=307).

Mean =1.94 *SD=0.95* *Min= 1* *Max= 4*					
Response Options	n	Out of total sample (n=521)		Out of those asked (n=307)	
		%	Weighted %	%	Weighted %
1. Not at all	131	25%	22%	43%	40%
2. Once or twice	99	19%	18%	32%	33%
3. 3-10 times	50	10%	10%	16%	19%
4. More than 10 times	26	5%	4%	8%	8%
Do not know whether ate any in the last 12 months	1	0%	0%	0%	0%
Refused this question	0	0%	0%	0%	0%
Total	307	59%	55%	100%	100%

Table G.6: Origin of venison consumed over the past 12 months for non-hunters who reported consuming venison in the past 12 months (n=175).

Response Categories	Yes	Out of total sample (n= 521)		Out of those asked (n=175)		No	Don't know	Refused
		%Yes	Weighted % Yes	%Yes	Weighted % Yes			
Self	1	0%	0%	1%	0%	173	1	0
Members of household	35	7%	7%	20%	20%	140	0	0
Family not within household	104	20%	19%	59%	59%	71	0	0
Friends, neighbors or coworkers	102	20%	20%	58%	61%	73	0	0
Community game dinner or event	9	2%	2%	5%	5%	166	0	0
Other	4	1%	1%	2%	3%	171	0	0
Road kill	0	0%	0%	0%	0%	na	na	na
Donation	1	0%	0%	1%	0%	na	na	na
Restaurant or Store	3	1%	1%	2%	2%	na	na	na

Table G.7: Form of venison provided over the past 12 months for non-hunters who reported consuming venison in the past 12 months (n=175).

Response Categories	Yes	Out of total sample (n=521)		Out of those asked (n=175)		No	Don't know	Refused
		%Yes	Weighted % Yes	% Yes	Weighted % Yes			
Uncooked/raw	93	18%	18%	53%	54%	80	1	1
Cooked/Prepared	122	23%	23%	70%	71%	51	1	1
Other	23	4%	4%	12%	13%	146	1	1

Table: G.8: Non-hunters' relationships with hunters (n=512).

Response Categories	Yes	% Yes	Weighted % Yes	No	Don't know	Refused
Members of household hunt	75	14%	15%	445	3	1
Family members not within household hunt	238	46%	45%	272	10	1
Friends, coworkers, or neighbors hunt	365	68%	67%	136	28	1
Close relationship with hunter growing up	277	53%	50%	236	8	0

Table G.9: Non-hunters' sex (n=521).

Sex	n	%	Weighted %
Male	168	32%	32%
Female	353	68%	68%
Total	521	100%	100%

Table G.10: Non-hunters' age reported in categories (n=521). *Note: in analysis age was used as a continuous variable not in categories*.

Mean =47.65 SD= 18.42 Min= 18 Max=95			
Age	**n**	**%**	**Weighted %**
18-29	70	13%	21%
30-39	55	11%	17%
40-49	65	12%	14%
50-59	97	19%	17%
60-69	110	21%	12%
70-79	66	13%	8%
80+	40	8%	7%
Missing	18	3%	4%
Total	521	100%	100%

Table G.11: Non-hunters' highest level of education completed (n=521).

Mean =15.26 SD=2.69 Min= 7 Max=19			
Education Level	**n**	**%**	**Weighted %**
0. Did not go to school	0	0%	0%
1. 1st Grade	0	0%	0%
2. 2nd Grade	0	0%	0%
3. 3rd Grade	0	0%	0%
4. 4th Grade	0	0%	0%
5. 5th Grade	0	0%	0%
6. 6th Grade	0	0%	0%
7. 7th Grade	1	0%	0%
8. 8th Grade	0	0%	0%
9. 9th grade	3	1%	0%
10. 10th Grade	4	1%	1%
11. 11th Grade	8	2%	2%
12. High School Graduate or GED Holder	110	21%	19%
13. 1st Year College	43	8%	8%
14. 2nd Year College	70	13%	15%
15. Technical/Junior College Graduate	21	4%	5%
16. 3rd Year College Graduate	25	5%	6%
17. College Graduate (Four Years)	122	23%	24%
18. Some Post Graduate	19	4%	4%
19. Graduate Degree	91	17%	16%
Do Not Know	2	0%	0%
Refused This Question	2	0%	0%
Total	521	100%	100%

Table G.12: Non-hunters' ethnicity (Hispanic. Latino, or Spanish origin) (n=521).

Responses	**n**	**%**	**Weighted %**
Yes	14	3%	3%
No	501	96%	95%
Do Not Know	1	0%	0%
Refused This Question	5	1%	1%
Total	521	100%	100%

Table G.13: Non-hunters' race (n=521). *Note: categories are not mutually exclusive*.

Race	n	%	Weighted %
White or Caucasian	403	77%	68%
African American or Black	77	15%	20%
Hawaiian or Other Pacific Islander	2	0%	2%
Asian	9	2%	4%
American Indian or Alaskan Native	7	1%	2%
Other	21	4%	5%
Missing	13	3%	3%

Table G.14: Non-hunter's race coded into three mutually exclusive categories (n=521).

Race	n	%	Weighted %
White Only	393	75%	65%
Black Only	75	14%	19%
Other Including Multi Race	40	8%	14%
Missing	13	3%	3%
Total	521	100%	100%

Table G.15: Non-hunters' annual household income in USD (n=521).

Mean =5.85 SD=3.09 Min= 1 Max= 11			
Income	**n**	**%**	**Weighted %**
1. Less than 10,000	28	5%	6%
2. 10,000-19,999	56	11%	12%
3. 20,000-29,999	41	8%	8%
4. 30,000-39,999	30	6%	7%
5. 40,000-49,999	58	11%	12%
6. 50,000-59,999	41	8%	6%
7. 60,000-69,999	39	7%	6%
8. 70,000-89,999	55	11%	10%
9. 90,000-99,999	17	3%	3%
10. 100,000-150,000	62	12%	13%
11. More than 150,000	33	6%	5%
Don't know	21	4%	5%
Refused	40	8%	7%
Total	521	100%	100%

Table G.16: Non-hunters' community type (n=521).

Response Options	n	%	Weighted %
Rural Community	102	20%	17%
Small City or Town, Village	181	35%	35%
A Suburb	174	33%	33%
Urban Community	64	12%	15%
Missing	0	0%	0%
Total	521	100%	100%

Table G.17: Non-hunters' residence by Michigan Department of Natural Resources (MDNR) Ecoregion (n=521). *Note: In statistical analysis the Upper Peninsula and Northern Lower Peninsula Ecoregions were combined because they have similar hunter participation rates and hunter densities compared to the Southern Lower Peninsula*.

MDNR Ecoregion	n	%	Weighted %
Upper Peninsula Ecoregion	21	4%	2%
Northern Lower Peninsula Ecoregion	29	6%	5%
Southern Lower Peninsula Ecoregion	471	90%	93%
Total	521	100%	100%

APPENDIX H

Additional Tables from the 68th SOSS for Frequent Hunters

Table H.1: Wild harvested meat consumption for frequent hunters (n=148).

Responses	n	%	Weighted %
Yes	145	99%	99%
No	3	1%	1%
Do not know	0	0%	0%
Refused this question	0	0%	0%
Total	148	100	100%

Table H.2: Types of wild harvested meat consumed by frequent hunters who reported consuming wild harvested meat (n=145). *Open ended responses coded*.

Responses	n	Out of total sample (n=148)		Out of those asked (n=145)	
		%	Weighted %	%	Weighted %
Venison/deer	141	95%	94%	97%	97%
Fish	55	37%	37%	38%	39%
Rabbit/hare	72	49%	47%	50%	48%
Turkey	52	35%	38%	36%	39%
Pheasant	43	29%	24%	30%	25%
Duck	30	20%	19%	20%	19%
Squirrel	58	39%	37%	40%	38%
Bear	42	28%	28%	29%	28%
Goose	28	19%	17%	19%	17%
Grouse	34	23%	17%	23%	17%
Turtle	7	5%	7%	5%	7%
Elk	19	13%	15%	14%	16%
Raccoon	13	9%	9%	9%	9%
Feral Swine	5	3%	4%	3%	4%
Farmed Species	1	1%	1%	1%	1%
Beaver	9	6%	4%	6%	4%
Muskrat	5	3%	4%	3%	4%
Moose	2	1%	2%	1%	2%
Woodchuck	4	3%	3%	3%	3%
Quail	9	6%	7%	6%	7%
Alligator/ Crocodile	0	0%	0%	0%	0%
Sparrow	0	0%	0%	0%	0%
Other- Species not specified	6	4%	3%	4%	3%
Do not know	1	1%	0%	1%	0%

Table H.2 (cont'd):

Bison	1	1%	1%	1%	1%
Woodcock	12	8%	8%	8%	8%
Porcupine	1	1%	0%	1%	0%
Opossum	3	2%	3%	2%	3%
Frog	5	3%	3%	3%	3%
Pigeon	1	2%	1%	1%	1%
Dove	2	1%	1%	1%	2%
Snake	2	1%	2%	1%	2%
Skunk	1	1%	1%	1%	1%
Fox	2	1%	2%	1%	2%
Crawfish	1	1%	0%	1%	0%

Table H.3: Types of wild harvested meat consumed by frequent hunters who reported consuming wild harvested meat (n=145). *Open ended responses coded and combined into categories of similar species*.

Response Categories	**n**	Out of total sample (n=148)		Out of those asked (n=145)	
		%	**Weighted %**	**%**	**Weighted %**
Big game	144	97%	95%	99%	98%
Upland game birds	94	64%	60%	65%	62%
Fish	55	37%	37%	38%	39%
Small game with season	83	56%	54%	57%	56%
Waterfowl	39	26%	25%	27%	25%
Furbearers	20	14%	14%	14%	14%
No limit small game	14	9%	11%	10%	11%
Reptiles and amphibians	11	7%	11%	8%	11%
Non-Michigan game	3	2%	3%	2%	3%

Table H.4: Frequency of venison consumption in the past 12 months for frequent hunters who reported consuming venison (n=141).

Mean=3.35 *SD=0.90* *Min=1* *Max=4*					
Response Options	**n**	Out of total sample (n=148)		Out of those asked (n=141)	
		%	**Weighted %**	**%**	**Weighted %**
1. Not at all	10	7%	6%	7%	7%
2. Once or twice	17	11%	9%	12%	9%
3. 3-10 times	43	29%	26%	31%	27%
4. More than 10 times	71	48%	54%	50%	57%
Do not know whether ate any in the last 12 months	0	0%	0%	0%	0%
Refused this question	0	0%	0%	0%	0%
Total	141	100%	100%	100%	100%

Table H.5: Origin of venison consumed over the past 12 months for frequent hunters who reported consuming venison in the past 12 months (n=131).

Response Categories	Yes	Out of total sample (n= 148)		Out of those asked (n=131)		No	Don't know	Refused
		%Yes	Weighted % Yes	%Yes	Weighted % Yes			
Self	93	63%	62%	71%	71%	55	0	0
Members of household	42	28%	33%	32%	37%	89	0	0
Family not within household	54	36%	38%	41%	43%	77	0	0
Friends, neighbors or coworkers	61	41%	43%	47%	49%	70	0	0
Community game dinner or event	13	9%	8%	10%	9%	118	0	0
Other	3	2%	2%	2%	3%	127	1	0
Road kill	2	1%	1%	2%	2%	na	na	na
Donation	1	1%	1%	1%	1%	na	na	na
Restaurant or Store	0	0%	0%	0%	0%	na	na	na

Table H.6: Form of venison provided over the past 12 months for frequent hunters who reported consuming venison in the past 12 months (n=131).

Response Categories	Yes	Out of total sample (n=148)		Out of those asked (n=131)		No	Don't know	Refused
		%Yes	Weighted % Yes	% Yes	Weighted % Yes			
Uncooked/raw	88	59%	62%	67%	70%	43	0	0
Cooked/Prepared	83	56%	58%	63%	66%	48	0	0
Other	14	9%	9%	11%	11%	114	3	0

Table: H.7: Frequent hunters' relationships with other hunters (n=148).

Response Categories	Yes	% Yes	Weighted % Yes	No	Don't know	Refused
Members of household hunt	79	53%	57%	69	0	0
Family members not within household hunt	128	86%	88%	20	0	0
Friends, coworkers, or neighbors hunt	144	97%	98%	3	1	0
Close relationship with hunter growing up	139	94%	95%	9	0	0

Table H.8: Frequent hunters' sex (n=148).

Sex	n	%	Weighted %
Male	126	85%	79%
Female	22	15%	21%
Total	148	100%	100%

Table H.9: Frequent hunters' age reported in categories (n=148). *Note: in analysis age was used as a continuous variable not in categories*.

Mean=46.03 SD=15.90 Min=18 Max=95			
Age	**n**	**%**	**Weighted %**
18-29	11	7%	14%
30-39	23	16%	24%
40-49	30	20%	22%
50-59	39	27%	19%
60-69	26	18%	11%
70-79	14	9%	7%
80+	4	3%	2%
Missing	1	0%	1%
Total	148	101%	100%

Table H.10: Frequent hunters' highest level of education completed (n=148).

Mean =14.50 SD=2.58 Min=8 Max=19			
Education Level	**n**	**%**	**Weighted %**
0. Did not go to school	0	0%	0%
1. 1st Grade	0	0%	0%
2. 2nd Grade	0	0%	0%
3. 3rd Grade	0	0%	0%
4. 4th Grade	0	0%	0%
5. 5th Grade	0	0%	0%
6. 6th Grade	0	0%	0%
7. 7th Grade	0	0%	0%
8. 8th Grade	2	1%	1%
9. 9th grade	0	0%	0%
10. 10th Grade	0	0%	0%
11. 11th Grade	1	1%	1%
12. High School Graduate or GED Holder	41	28%	27%
13. 1st Year College	20	14%	18%
14. 2nd Year College	21	14%	13%
15. Technical/Junior College Graduate	3	2%	1%
16. 3rd Year College Graduate	7	5%	7%
17. College Graduate (Four Years)	29	20%	17%
18. Some Post Graduate	5	3%	2%
19. Graduate Degree	18	12%	11%
Do Not Know	0	0%	0%
Refused This Question	1	1%	1%
Total	148	101%	100%

Table H.11: Frequent hunters' ethnicity (Hispanic. Latino, or Spanish origin) (n=148).

Responses	**n**	**%**	**Weighted %**
Yes	0	0%	0%
No	147	99%	100%
Do Not Know	0	0%	0%
Refused This Question	1	1%	0%
Total	148	100%	100%

Table H.12: Frequent hunters' race (n=148). *Note: categories are not mutually exclusive*.

Race	n	%	Weighted %
White or Caucasian	131	86%	84%
African American or Black	6	4%	8%
Hawaiian or Other Pacific Islander	0	0%	0%
Asian	2	1%	4%
American Indian or Alaskan Native	3	2%	4%
Other	3	2%	1%
Missing	3	2%	2%

Table H.13: Frequent hunter's race coded into three mutually exclusive categories (n=148).

Race	n	%	Weighted %
White Only	129	87	79%
Black Only	5	3	6%
Other Including Multi Race	9	6	10%
Missing	5	3	4%
Total	148	99%	99%

Table H.14: Frequent hunters' annual household income in USD (n=148).

Income	n	%	Weighted %
1. Less than 10,000	3	2%	5%
2. 10,000-19,999	12	8%	11%
3. 20,000-29,999	16	11%	13%
4. 30,000-39,999	13	9%	7%
5. 40,000-49,999	15	10%	9%
6. 50,000-59,999	16	11%	10%
7. 60,000-69,999	13	9%	9%
8. 70,000-89,999	16	11%	13%
9. 90,000-99,999	3	2%	3%
10. 100,000-150,000	20	14%	9%
11. More than 150,000	9	6%	5%
Don't know	1	1%	1%
Refused	11	7%	5%
Total	148	101%	100%

Table H.15: Frequent hunters' community type (n=148).

Response Options	n	%	Weighted %
Rural Community	65	44%	41%
Small City or Town, Village	49	33%	32%
A Suburb	18	12%	13%
Urban Community	16	11%	13%
Missing	0	0%	0%
Total	148	100%	99%

Table H.16: Frequent hunters' residence by Michigan Department of Natural Resources (MDNR) Ecoregion (n=521). *Note: In statistical analysis the Upper Peninsula and Northern Lower Peninsula Ecoregions were combined because they have similar hunter participation rates and hunter densities compared to the Southern Lower Peninsula*.

MDNR Ecoregion	n	%	Weighted %
Upper Peninsula Ecoregion	17	11%	8%
Northern Lower Peninsula Ecoregion	28	19%	19%
Southern Lower Peninsula Ecoregion	103	70%	73%
Total	148	100%	100%

APPENDIX I

Notes on Coding Open-Ended Responses from the 68th SOSS

Notes on Coding Open-Ended Responses from the 68th SOSS

Meat1a: "Is there any particular reason why you have not eaten game meat?"

If the respondent answered that they had not eaten game meat from hunting in Michigan they were asked "Is there any particular reason why you have not eaten game meat?" This question had an open-ended response that was field coded by the interviewer into 9 possible categories. Multiple categories could apply per respondent. The potential response options were (a) diet (don't eat meat/red meat); (b) taste; (c) I don't hunt; (d) never had opportunity; (e) don't know any hunters; (f) don't know where to get game meat; (g) against hunting/uncomfortable with hunting; (x) other; and (y) do not know. Some of the responses recorded in other could easily be coded into the previously specified categories (a-g). Four additional response options emerged from answers to this question: (h) no reason; (i) dislike game meat; (j) don't trust source; and (k) expressed moral or ethical reasons. The variable no reason was created to describe respondents who felt there was no particular reason why that had not consumed game meat. The variable dislike game meat was created to express a respondent's general dislike of game meat or a disinterest in trying game meat due to their dislike. The variable don't trust source was created to express a respondent's concerns about the source of the meat and it's processing. The variable expressed moral or ethical concerns was created to express a respondents moral or ethical issues with killing or eating wildlife. Categories were not exclusive, except no reason. Only one respondent answered no reason and dislike. They were coded as having the response dislike and removed from the response category no reason.

MEAT 2: "What types of game meat from hunting in Michigan have you had? "

This question had an open-ended response that was live coded by the interviewer into 12 possible categories. Multiple categories could apply per respondent. The potential response options were: (a) venison; (b) turkey); (c) elk; (d) rabbit or hare; (e) pheasant; (f) goose); (g) grouse; (h) squirrel; (i) duck; (j) fish; (x) other; and (y) do not know. The other category was later coded into 24 additional response options: (k) bear; (l) partridge; (m) turtle; (n) bison; (o) raccoon; (p) woodcock; (q) beaver; (r) muskrat; (s) feral swine; (t) woodchuck; (u) quail; (v) moose; (w) porcupine; (aa) opossum; (ab) frog; (ac) pigeon; (ad) dove; (ae) snake; (af) skunk; (ag) alligator/crocodile; (ah) fox; (ai) crawfish; (aj) sparrow; (ak) other species not specified; (al) farmed species. Some individuals used different words to describe the same species. Partridge is another term for grouse in Michigan, thus the coded response option partridge (l) was combined with the response option grouse (g). Wild pig, boar, and wild boar were all defined as feral swine. Ground hog and woodchuck were defied as woodchuck.

All of these potential responses where then reduced to 9 categories of similar themed species. Deer, black bear and elk were combined into the category big game. According to the MDNR turkey is considered big game in Michigan, however, technically turkey is an upland game bird. Turkey, quail, woodcock, pheasant and grouse were combined to create the category upland game birds. Duck and goose were combined to create the category waterfowl. Raccoon, beaver, muskrat and fox were combined into the category furbearers. Rabbit/hare and squirrel were combined to create the category small game with season. Technically red squirrels are part of the non-limit season, however the larger squirrel species (grey and fox), which have seasons, are hunted more often and contain more meat. Thus the response squirrel was included in the

small game with season category, although we cannot be sure which squirrel species the respondent was referring to. Opossum, porcupine, woodchuck, feral swine, feral pigeons and house sparrows can be hunted year round with a valid Michigan hunting license and were combined to create the category no-limit small game. Turtle, snake, and frog were combined into the category Reptiles and Amphibians. Bison, moose, dove and alligator were combined into the category non-Michigan game. One respondent answered crayfish, which was combined into the fish category.

Meat 9: "Did you get any venison from another source?"

Some of the responses to this question could easily be coded into the previously specified source categories (self, members of household, relatives, friends, neighbors or coworkers and community dinner or event). Three additional response options emerged from answers to this question: road kill, donation, and restaurant or store. Road kill referred to venison that had been harvested form the side of the road. Donation referred venison that was provided to the individual in the form of a donation, either from another person or at a food bank or other food donation program. Restaurant or store referred to individuals who had purchased their venison from a restaurant or store. This response is contrary to the definition of game meat provided during the survey, however, individuals who responded this way had also received venison from previously specified sources and were not removed from the study.

Meat 12: "Was any of it provided in another form?"

Some of the responses to this question could easily be coded into the previously specified source categories (raw/uncooked and cooked/prepared). Responses such as sausage, jerky, canned, smoked, sticks, salami, and salted were all added to the cooked/prepared response category. Responses that did not indicate a uncooked or cooked form, such as frozen or packaged, remained coded as other.

Community Type: "Would you say you live in a rural community, a small city or town, a suburb, or an urban community?"

If a respondent answered with another category that was not specified, this was recorded as other with their specific response transcribed. The open-ended responses were then coded to best match the original four response options. The responses the country, the boonies, and farming community was coded as rural. The response township was coded as part of a small city or town. The responses between the country and the city and lower middle class suburb were coded as suburban. The responses larger city and Battle Creek were identified as urban. Furthermore, seven additional respondents did not provide an answer to this question; however, these respondents did provide their zip code in response to another question. Using the respondent's zip code compared to information on urban areas and clusters from the U.S. Census, satellite imagery, and road density these additional respondents were assigned a community type based upon the original four response options.

APPENDIX J

Pre-Notification Letter for the 68th SOSS

MICHIGAN STATE
UNIVERSITY

{Date}

{Name}
{Address}
{City}, {State} {Zip}

Dear {Name},

I am writing to ask for your household's assistance with the **State of the State Survey**, a research project conducted by the Institute for Public Policy and Social Research at Michigan State University. **We would like an adult member of your household to participate in a one-time telephone interview**.

The State of the State Survey asks Michigan residents for their opinions on current public policy issues, and results are used to inform elected officials, the media, and the general public. It has been conducted by the Institute for Public Policy and Social Research in collaboration with the Office for Survey Research at Michigan State University since 1994; to date, over 65,000 people have participated in the survey.

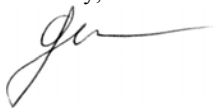
In the next few days, your household will receive a phone call from an interviewer at Michigan State University. You will only be asked for information; we will not try to sell you anything or ask for money. If your household is called at an inconvenient time, the interviewer will work with you to find a date and time for the interview that fits your schedule. **Your time and participation are highly valued and appreciated.**

The interviewer will first ask a few questions to determine which adult in your household we need to interview, and the interview itself will take approximately 20 minutes. Your participation in this research is completely voluntary and confidential. Your answers will never be linked to your household, and we will never share your name or phone number with any other organization.

If you have any questions about this study, please contact me at glpierce@msu.edu or 517-884-0364. You can learn more about the MSU State of the State Survey at http://ippsr.msu.edu/soss/

On behalf of Michigan State University and the Institute for Public Policy and Social Research, I want to thank you for your assistance in this research effort.

Sincerely,



Graham L. Pierce
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