This is to certify that the

thesis entitled

Predictive Modeling of Hunter Satisfaction

presented by

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has been accepted towards fulfillment
of the requirements for

Master's degree in Sociology

Craig K. Harris
Major professor

Date January 9, 1992

PREDICTIVE MODELING OF HUNTER SATISFACTION

By

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A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF ARTS

Department of Sociology

1992

ABSTRACT

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By

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Measurement of hunter satisfaction has been used by wildlife managers to assist in evaluating management programs and policies. The purpose of the model presented in this paper is to better understand the factors associated with hunter satisfaction using by general information found in many agency hunter questionnaires. This model is composed of variables associated with the species being hunted, hunter demographics, and hunter behavior.

The model was demonstrated using survey data from a controlled Black Bear hunt. The predictive model after testing consisted of hunting method being predicted by hunter's age and hunting experience, success predicted by age, hunting experience, and hunting method, and satisfaction being solely predicted by success. The importance of success in predicting satisfaction in this model was partially caused by the special circumstances of the hunt (limited number of hunters, five closed hunting seasons).

ACKNOWLEDGEMENTS

I would like to acknowledge the assistance I received from the Michigan Department of Natural Resources. Carl Bennett provided me with the data and was always willing to take the time to answer my questions. I would also like to thank Larry Visser for his help in answering my questions about the bear hunt and the Drummond Island.

I would like to thank my advisor, Craig Harris for his assistance and suggestions. I would also like to thank my husband, Rick Rusz, for his support and encouragement along the way.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Wildlife managers are concerned with determining the effectiveness of management practices to meet specific goals defined by user desires and resource needs. Hunter satisfaction is assumed to measure the fulfillment of those goals that pertain to the wants and needs of the hunters.

Satisfaction is "the degree to which one is presently content or pleased with his/her experiences and situations. This positive feeling of contentment results from the satisfaction of felt or unfelt needs of the individual" (Beard and Ragheb, 1979). The level and direction of satisfaction is related to the difference between the expected (though not necessarily the ideal) experience and the actual one.

Traditionally, the successful harvest of an animal was the only factor considered in evaluating benefits to hunters. Leopold (1948) defined game management as "the art of making land produce sustained annual crops of wild game for recreational use." The principal objective of wildlife management was to maintain high animal populations to provide the highest probability of harvesting an animal.

The loss of quality wildlife habitat in succeeding years, due to development and agricultural practices, and the increased hunting pressure on remaining hunting areas caused a reduction in the likelihood of success for some species, such as the ring-necked pheasant. The emphasis placed on success as an indicator of fulfilling hunter desires assumed that all hunting desires were met through harvesting an animal and that unsuccessful hunters received no satisfaction from hunting. Factors affecting satisfaction

needed to be appraised to determine changes in management goals and practices crucial to preserving a reasonable likelihood of meeting hunter desires for these species.

Though success was still considered important, days afield replaced success as the main indicator of goal fulfillment used by resource managers (Crissey, 1971). Days afield measured the total hunter-days, the number of days spent hunting by all hunters. The days afield method assumed the more days spent hunting, the higher the benefit to the hunter and therefore higher satisfaction. Ragheb (1980) found a strong correlation between hunter participation and satisfaction, but assumed that higher satisfaction led to higher participation in that activity.

Weaknesses exist in the use of days afield as a measurement of satisfaction. The precision of days afield as an indicator of satisfaction is affected by the other factors. Days afield does not consider other factors that may affect satisfaction, some of which may have more effect on hunter satisfaction than days afield. The days afield method also assumes that benefit does not vary regardless of success or hunt quality (Hendee, 1972). Factors such as social carrying capacity, esthetics, and weather may also have an effect on hunter satisfaction.

Number of days afield may have an indirect negative relationship with satisfaction for an individual hunter. In big game hunts, the majority of animals are often taken within the first few days. Therefore, a high percentage of those who are successful have spent few days afield. Since success has a positive effect on satisfaction, there might be a negative relationship between days afield and satisfaction.

Hunters' plans to return to the area for hunting are also used to measure satisfaction (Stankey et al., 1973). This method does not consider any reasons, other

than low satisfaction, that may affect the hunter's likelihood to hunt the area again. The area also may be the only one available to the hunter who will, therefore return to the area regardless of her/his satisfaction with the previous hunt.

Hendee (1974) recommended a change from the success model or days afield model to a multiple satisfaction model. This holistic model recognizes satisfaction from all sources including success and number of days afield. Numerous studies have evaluated variables, such as love of nature, success, hunting equipment, and hunting skill that affect hunter satisfaction (Table 1).

Some of the satisfaction components in Table 1 are measured as a simple variable, but many are measured with multiple questions and transformed into indices. Below is a brief definition of each component and examples of how it has been measured.

Enjoying nature contains all questions involved with the natural environment that are not related to the species being hunted. It is measured with such items as "being close to nature", "at least seeing some wildlife", and "being where things are natural" (Brown et al., 1977; Hautaluoma and Brown, 1979).

Challenge is the mental skills involved with the hunting of an animal. It involves knowledge of animal behavior and the hunting area. It has been measured as "suspense and challenge of seeking deer" and "challenge with the animal" (Kennedy, 1970; Schole et al., 1973).

Companionship is the psychological benefit received by hunting with one or more other hunters. Companionship is measured either as a single component or split into two categories: companionship with family and companionship with friends. These have been measured using "companionship with fellow sportsmen", "companionship with son

Table 1: Some Components of Hunter Satisfaction

Satisfaction Components	References
Enjoy Nature	More (1973), Hendee et al. (1974), Brown et al. (1977), Hawes (1978), Hautaluoma and Brown (1979), Decker et al. (1980), Jackson and Norton (1980), McCullough and Carmen (1982), Jackson and Anderson (1985), Hazel et al. (1990)
Challenge	Kennedy (1970), More (1973), Schole et al. (1973), Hendee et al. (1974), Hawes (1978), Hautaluoma and Brown (1979), Langenau and Mellon (1980), Vaske et al. (1986)
Companionship	Kennedy (1970), More (1973), Schole et al. (1973), Hendee et al. (1974), Hawes (1978), Decker et al. (1980), Jackson and Anderson (1985), Vaske et al. (1986),Hazel et al. (1990)
Escapism	Kennedy (1970), More (1973), Schole et al. (1973), Hendee et al. (1974), Hawes (1978), Hautaluoma and Brown (1979), (1982), Jackson and Anderson (1985), Vaske et al. (1986), Hazel et al. (1990)
Getting Outdoors	Kennedy (1970), Schole et al. (1973), Hendee et al. (1974), Brown et al. (1977), Hautaluoma and Brown (1979), Decker et al. (1980), Langenau and Mellon (1980), Vaske et al. (1986)
Skills	More (1973), Hendee et al. (1974), Hawes (1978), Hautaluoma and Brown (1979), Decker et al. (1980), Jackson and Norton (1980), Jackson and Anderson (1985), Vaske et al. (1986), Hazel et al. (1990)
Success	Kennedy (1970), More (1973), Schole et al. (1973), Brown et al. (1977), Hautaluoma and Brown (1979), Jackson and Norton (1980), Langenau and Mellon (1980), McCullough and Carmen (1982), Hazel et al. (1990)

Table 1: (Cont.)

Satisfaction Components	References
Game Related, Other than Kill	Hendee et al. (1974), Hautaluoma and Brown (1979), Decker et al. (1980), Jackson and Norton (1980), Langenau and Mel lon (1980), McCullough and Carmen (1982), Vaske et al. (1986), Hazel et al. (1990)
Getting a Trophy	More (1973), Schole et al. (1973), Hendee et al. (1974), Hautaluoma and Brown (1979), Decker et al. (1980), Jackson and Norton (1980), Jackson and Anderson (1985)
Hunter Density Interference	Hendee et al. (1974), Brown et al. (1977), Hautaluoma and Brown (1979), Decker et al. (1980), McCullough and Carmen (1982), Vaske et al. (1986)
Competition	Hendee et al. (1974), Brown et al. (1977), Hawes (1978), Hautaluoma and Brown (1979), Jackson and Anderson (1985)
Equipment	Hendee et al (1974), Brown et al. (1977), Hautaluoma and Brown (1979), Decker et al. (1980), Vaske et al. (1986), Hazel et al. (1990)
Physical	Schole et al. (1973), Brown et al (1977), Hawes (1978), Hautaluoma and Brown (1979), Jackson and Anderson (1985)
Solitude	More (1973), Brown et al. (1977), Hawes (1978), Jackson and Norton (1980), Jackson and Anderson (1985)
Display Game or Trophy	Hendee et al. (1974), Brown et al. (1977), Hautaluoma and Brown (1979), Decker et al. (1980), Hazel et al. (1990)
Outgroup Hunters	Hendee et al. (1974), Brown et al. (1977), Hautaluoma and Brown (1979), Vaske et al. (1986), Hazel et al. (1990)

or another child", and "getting out with friends" (More, 1973; Schole et al., 1973).

Escapism involves getting away from aspects of daily life. These aspects of daily life include "getting away from the city", "getting away from civilization", and "getting away from every day problems" (More, 1973; Hautaluoma and Brown, 1979).

Getting outdoors refers to any questions that stated something about being outdoor without mentioning any nature related topic. Examples are "getting outdoors", "love of outdoors", and "just being outdoors" (Schole et al., 1973; Hautaluoma and Brown, 1979; Langenau and Mellon, 1980).

Skills are those skills associated with hunting in general. Hunting skills have been measured using "stalking game", "practicing woodsmanship skills", and "making a difficult shot" (More, 1973, Hautaluoma and Brown, 1979).

Success is normally measured simply as the successful harvest of an animal, but other variables are sometimes added to form an index. Other variables are measured as "amount of bag limit", "bring game home", and "getting my bag limit" (Hautaluoma and Brown, 1979). These would more likely be used when dealing with daily bag limits, such as with small game and waterfowl.

Game related, other than kill refers to activities involved with the hunt itself, but separate from the actual harvest. This category is sometimes combined with skills. This component has been measured using "getting shots at game", "seeing game or game sign", and "tracking and stalking game" (More, 1973; Decker et al., 1980).

Getting a trophy contains the harvesting of an animal that allows the saving of some portion of the animal as a trophy or the harvesting of an animal that is unusual or above the norm in size. Trophy has been measured by "passing up small animals for

even a remote chance for a larger one", "trophy display", and "bagging a very large animal or bird" (More, 1973; Hautaluoma and Brown, 1979; Decker et al., 1980)

Hunter density and interference refers to any variable measuring the number of hunters perceived to be in the area and any interference encountered. This category should be split when actually measuring because perceived hunter density does not predispose interference. This component has been measure with "seeing very few other hunters while hunting", "hearing other hunters", "seeing other hunters", and "too much competition from other hunters today" (Hautaluoma and Brown, 1979; Decker et al., 1980; Vaske et al., 1986)

Competition includes all competition between hunters for bag limit or trophy, both within hunter's own hunting group and outside hunter's group. Competition has been measure by "chance to compete", "bagging as much game as my hunting companions", and "bagging more game than hunters in other parties" (Hautaluoma and Brown, 1979; Hawes, 1979).

Equipment contains the care for, display, and use of hunting equipment. This component has been measured using "having the best of hunting equipment", "comparing my equipment with other hunters", "cleaning and maintaining my hunting equipment", and "use of equipment" (Hautaluoma and Brown, 1979; Decker, 1980).

Physical refers to all physical exercise and exertion related to the hunt. This component has been measured with "exercise", " getting physically tired", "physical challenge", and "keeps me healthy" (More, 1973; Schole et al., 1973; Hautaluoma and Brown, 1979; Hawes, 1979).

Solitude includes everything involved with being alone. This has been measured

using "alone with my thoughts", and "alone in a quiet place" (Hawes, 1979).

Display game or trophy refers to the displaying of harvested game or of a trophy acquired during a hunt. This component has been measured by "trophy display" and "showing game I have bagged to family and friends" (Hautaluoma and Brown, 1979; Decker et al., 1980).

Outgroup hunters refers to contact with hunters from other groups. This component does not look at perceived hunter density or interference, but the benefits gained from interaction with other hunters outside of ones hunting group. This has been measured with "talking with hunters from other parties" and "meet new people"(Hautaluoma and Brown, 1979; Hawes, 1979).

Satisfaction components have been used to create hunter types and predict hunter characteristics, such as age and hunting experience (Hendee, 1974; Hautaluoma and Brown, 1979). Hunter types have been predicted using number of days hunted, age at first hunt, number of years hunting, adult residence, childhood residence, sex, education, income, and satisfaction. These hunter types vary in their ranking of importance of satisfaction components.

Predicting hunter types with hunter characteristics may be a method than can be used to predict and understand satisfaction. Studies measuring motivations and attitudes are often not practical for standard use by government agencies for predicting satisfaction among hunter groups. These studies are often long and expensive. Therefore, the identification of predictor variables will permit a better understanding of the sources of satisfaction without the expense of an annual attitude study. This is not to imply that these variables cause success or satisfaction, though some may. Some of these variables

are only indicators of latent factors, such as motivation and attitudes. The study variables are easier to measure and there is less concern about bias and ambiguity than may be found with attitudinal and motivational questions.

MODEL THEORY

Development of any model must begin with a theoretical base. Hunter satisfaction is affected by the characteristics and habitat of the species hunted, region of the country hunted, and hunter characteristics, behavior, beliefs, and attitudes. A comprehensive model to predict satisfaction must contain all of these.

Below is a general model for hunting satisfaction (Figure 1). For the most part, beliefs and attitudes have been considered latent. Included is an explanation of the variables, when needed, and their theoretical bases for incorporation into this model. This model includes all variables which appear to be pertinent, but some may have been missed or their importance not determined.

EXOGENOUS VARIABLES

Exogenous variables are those variables in the model that are not dependent variables anywhere in the model, but only an independent variable. The exogenous variables in this model are hunter's age, hunter's gender, and hunter's present residence. These variables are assumed not to be caused by another variable.

Gender

Women have different needs fulfilled through hunting than men. In Hawes (1979), women rated the extent to which different activities fulfilled needs with hunting and fishing one category. Women evaluated the fulfillment of the listed needs as lower or the same as men did, except "physical challenge", "develop stronger family ties", "bring happy memories", and "interesting experiences" which they rated as higher than their male counterparts (Table 2).

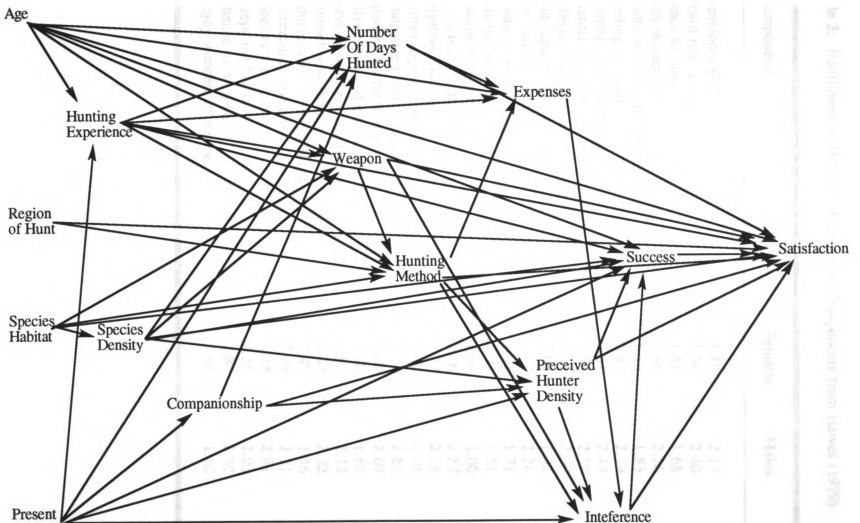

Figure 1: Theoritical Causal Model

Table 2: Fulfillment of Different Satisfaction Components from Hawes (1979)

Components	Females	Males
Develop a skill	2.17	2.17
Learn new things	2.54	2.40
Peace of mind	1.67	1.68
Can respect myself	2.46	2.26
Alone with my thoughts	1.83	1.83
Feeling of mastery	2.45	2.19
Control over the outcome	2.61	2.43
Mental challenge	2.52	2.58
Independence and self-reliance	2.34	2.00
Old familiar activity	2.04	1.82
See and do new things	2.42	2.26
Alone in a quiet place	1.91	1.71
Get the most out of life	1.95	1.81
Escape from pressure	1.68	2.00
Experiment with style of life	2.76	2.57
Physical challenge	1.77	2.18
Brings happy memories	1.77	1.95
Understand myself better	2.73	2.65
Interesting experiences	1.89	2.07
Adventures and excitement	1.80	1.65
Develop stronger family ties	1.68	2.12
Contact with friends	2.40	2.32
Educational for my children	2.47	2.46
Uncertainty involved	2.49	2.21
Meet new people	2.88	2.81
Keeps me healthy	2.35	2.03
Chance to compete	2.88	2.52
Enjoy wonders of nature	1.68	1.65

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Enjoy wonders of nature	1.68	1.65

Ragheb and Beard (1980) isolated six subscales of satisfaction: psychological, educational, social, relaxational, physiological, and aesthetic. They found women differed from men only on the relaxation satisfaction subscale.

Due to the small proportion of women in the hunter population and the few studies on gender differences, it is difficult to use gender as a predictive variable. Because of this, gender has been excluded from consideration in this paper.

The number of women who are interested in hunting appears to be increasing (Snepenger and Ditton, 1985). If women continue to be excluded, gender may begin to add unexplained variance to predictive models. It is important that further research be done in regards to this variable.

Hunted Species' Habitat

The concept of habitat in this model consists of both type and quality. Type of habitat pertains to plant ecosystem classification, such as white cedar swamps, bottomland hardwoods, and post oak savannah. The quality of the habitat is defined within the bounds of the specific type. Each type has its own gradient and criterion of quality.

When considering species habitat in regards to humans, accessibility due to cover density also be must be taken into account. Lack of or reduced human access to an area is an important component of habitat in terms of its use in this model.

Residence

Childhood residence has been shown to affect many of the variables discussed in this paper. Unfortunately, the data used in this study came from a questionnaire which was not written for this study. Childhood resident community is generally not asked on

an annual hunter questionnaire. Because of this, childhood residence was not included in the questionnaire. Thus, adult residence will be used for this study.

ENDOGENOUS VARIABLES

Endogenous variables are dependent variables within the model. This does not restrict them from being independent variables of variables further in the model. The endogenous variables in this model are years of hunting experience, companionship, weapon choice, hunting method used, number of days hunted, perceived hunter density, hunting expenses, hunter interference, success, and hunter satisfaction.

Years of Hunting Experience

Years of hunting experience may be predicted by hunter's age and present residence. Hunters generally start hunting within the same age range. Schole et al. (1973) found that 90% of the hunters interviewed started hunting by age 15 and by age 25 98% had begun hunting. O'Leary et al. (1987) found almost 70% of the respondents had started hunting by 15, and over 83% by 19 years old. Therefore, a relationship between hunter's age and number of years hunting exists. This relationship may be very strong and the possibility that only one of these variables should be used needs to be checked for each model.

The age hunters begin to hunt varies by the species hunted (Wright et al., 1979). Hunters may initially begin one form of hunting, but not begin another form until they are older. This will not normally be a concern because most studies evaluate hunters of one species or grouped species (small game) at a time.

Childhood residence also plays a part in age hunting was initiated. Those growing up in rural areas generally start hunting at an earlier age (Kennedy, 1973).

Those from rural areas would generally have more years of hunting experience than those from an urban area holding age constant.

Present residence may affect years of hunting experience through increased difficulties of an urban resident to get to hunting areas. Individuals may be unable to hunt some years because of this.

Companionship

Companionship may be predicted by present residence. Rural area residents are more likely to hunt with companions than those living in urban areas (Klessig, 1970). Hunters from rural areas are able to be more spontaneous in planning for a hunting trip because of their proximity to hunting areas.

Companionship differs in importance by type of hunter. Wright et al. (1979) found that general hunters (hunter who did not specialize) and furbearer hunters (hunters who seriously hunt fox, coyote, raccoon) rated companionship in the field as important. Jackson (1980) found that 64% of the duck hunters hunted alone or with a partner, but 82% of the deer hunters hunted with 3 or more hunters. In some models, it may be unnecessary to include companionship.

Species Density

Beyond biological limitations of the species itself, the density of the species population is restricted by the quality of the habitat. High quality habitat has the potential for higher species density, than areas of poorer quality. The population is not always reached due to factors other than biological and habitat.

Weapon

Weapon choice may be affected by species habitat, species density, hunting experience, and hunter's age. Species habitat affects weapon choice in several ways. Cover thickness affects the opportunity for a good shot. Thick cover can prevent an arrow or shot from getting to the animal. Cover can also affect the length of time from the time the animal is in range. In a situation with only a short period of time, a firearm may be more appropriate. The amount of cover to camouflage the hunter can also have an affect. In areas, such as parts of the western states, that lack much cover, the use of long range rifles is conventional because of the distance between the hunter and the game.

Species density influences weapon selection in terms of the probability of seeing game. If the probability of seeing game or getting an opportunity is low, a weapon may be chosen that will give the hunter a better probability of success. Bow hunting, in general, has a lower probability of success than does firearm hunting. Therefore, it a situation of low species density, it would be expected that bow hunters would be less prevalent.

Jackson and Norton (1980) discovered hunting stages based on the number of years of hunting. The more hunting experience, the more likely a hunter is to handicap himself in some way. For example, choosing a weapon that requires more skill, making the hunt more challenging.

Age affects physical capabilities. As hunters become older and less physically able, the ability to do specific activities associated with a weapon may be reduced. For example, a recurved bow may have to be replaced with a compound bow.

Hunting Method

Hunting method may be affected by region of the hunt, habitat, species density, weapon choice, years of hunting experience, and hunter's age. Due to tradition and general habitat of a region, certain hunting methods are common to that area that may not be used in other areas. The use of dogs in deer hunting is an accepted method in the South, but is outlawed in many states in the North.

The specific habitat of an area can affect the choice of methods, possibly to the point of restricting the choice. The denseness of the cover determines the ability to move through it and the ability to see game in it. In heavy cover, "pushing" game by walking through the area may not be feasible, but bait hunting may be.

Weapon choice affects hunting method used in at least two ways. First, some weapons lend themselves to some methods of hunting better then others. A bow is easier to use when still hunting, such as using a stand or over bait, than in a situation where a bow may be drawn quickly in an area that is not necessarily open for a good shot. Second, legal restrictions control the combinations of weapon and hunting methods. For example, in Michigan, it is illegal to hunt with a gun from a tree stand.

Years of hunting experience may also affect the hunting method chosen. Hunting experience is generally associated with skill. Certain hunting methods require more skill than others. Calling ducks in over decoys requires knowledge in duck behavior and skill in calling ducks. Whether or not you are hunting by yourself or with others, may also affect your selection of a hunting method. It is much more difficult to drive deer as an individual, because the deer can easily slip by the hunter or be totally missed.

Age may affect hunting method in several areas. Some hunting methods are also

more expensive then others. Hunting with dogs can be much more expensive than hunting over bait because of the cost of dogs, their upkeep, and their training. For this reason, age is possibly associated with hunting method because of the increase in income as one gets older. Age may also affect physical ability and certain methods require more physical exertion. It is easier to sit in a stand or over bait, than to drive deer through thick cover. Age may also be related because of the relationship between hunting experience and age.

Number of Days Hunted

The number of days hunted may be predicted by hunter's age, hunting experience, species density, companionship, and residence. Hunter's age is negatively related to the number of days hunted (Peterle, 1967). This may be due to the number of other responsibilities that older individuals have which restricts their amount of leisure time that can be given to hunting. This relationship is probably not completely linear due to the increased leisure time available after retirement.

The relationship between hunting experience and number of days hunted maybe negative. A hunter with more experience should need less time to harvest an animal because of increased skill.

Those from a rural area are more likely to hunt longer (Peterle, 1967). This may be because of the importance of hunting and amount of hunting experience those in rural areas get compared to those in urban-suburban settings. There may also still exist a connection to the rural community through friends and family which would offer hunting companions and areas to hunt. Because of the amount of movement in our society, it can not be assumed that childhood residence and present residence are the same. Therefore

present residency may not have a significant effect on number of days hunted.

Species density may have a negative relationship with number of days hunted. The more animals in an area, the more likely the hunter will have contact with game. The increased opportunity of seeing game may reduce the number of days needed to harvest an animal. This relationship is probably more apparent with game species having small bag limits, such as deer or turkey.

Companionship has a positive effect on the number of days hunted (Peterle, 1967). Those who hunt with the same companions each year are more likely to hunt longer. This could be due to the hunt being more of a social event and therefore the hunters would plan on a longer stay. Also, a group of hunters may hunt until the entire party has finished hunting or reached a mandated limit.

Perceived Hunter Density

There are two types of hunter density: physical and perceived. Physical hunter density is the number of hunters per a specified area. This can depend on the proportion of area closed to hunting, amount of private property, horizontal sighting distance, habitat quality, and ease of access to hunting areas. Physical hunter densities should not be compared using absolute values, but with the social carrying capacity for that area. The hunter social carrying capacity is the upper limit of the number of hunters that is acceptable to the majority of hunters who hunt the area.

A better predictor of satisfaction is perceived hunter density. Perceived hunter density is the number of hunters a hunter believes to be in the area. Physical hunter density and perceived hunting density may not be strongly related (Cue and Langenau, 1979). Perceived hunter density can be affected by number of hunters seen, hunt

expectation, number of deer seen, geography, length of hunt, day of season, accessibility, and habitat cover (Brown et al., 1977; Schreyer and Roggenbuck, 1978; Cue and Langenau, 1979). Perceived hunter density may be related to residence, species density, companionship, and hunting method used.

Present residence affects perceived hunter density by influencing the tolerance levels towards other hunters. Hunters from urban areas or those who hunt in high hunter density areas may not perceive the hunter density as high as someone from a rural area or a low hunter density area.

Habitat quality affects perceived hunter density by the level of clear visibility the hunter has. Visibility can be broken into two parts: the ability of the hunter to see game and the ability of the hunter to see other hunters. If cover is too thick for hunters to see game, it creates the false perception that there is little game and this can increase the perceived hunter density. The reduce ability to see other hunters can allow an area to carry more hunters then it would normally be able to and thus reduce the perceived hunter density.

Species density may have an negative effect with perceived hunter density. The less animals in the area to hunt, the more hunters may be aware of each other during hunting.

Companionship also affects the tolerance level of hunters. Hunters who have companions with them may not feel there are too many hunters in an area while a solitary hunter may.

Hunting method may affect the perception of the number of hunters in the area. Deer hunters who drive deer may not be as aware of the high number of hunters

compared to deer hunters who still or stand hunt.

Expenses

Hunting expenses are defined as all costs associated with the actual hunt. This does not include preparatory and overhead expenses, such as weapons, clothing, other equipment, and maintenance of hunting dogs. The amount of expenses may be affected by hunter age, hunting experience, hunting method used, and number of days hunted.

The age of a hunter affects the amount of income available to spend on hunting. As an individual gets older their disposable income increases at least until they retire. Therefore, older hunters would be more likely to spend more money on a hunting trip.

Hunters with more years of hunting experience may be more likely to go on more exotic or difficult hunting trips. These types of trips would generally be more expensive than hunting in the local area.

Certain types of hunting methods are more expensive than others. Baiting is more expensive than stalking or still hunting without bait. Hunting with dogs can also add more expense to a trip.

The number of days hunted positively affects the amount of money spent on lodging, food, bait, guide, travel to the hunting area, and miscellaneous expenses associated with the actual hunt. This relationship may not be completely linear because some expenses do not increase at a constant daily rate, such as bait cost.

Interference

Hunter interference is any action or presence of a hunter that hinders or prevents another hunter from having an expected type of hunt. Interference is not a concrete variable and the determination of what is considered interference varies among hunters

and can be very subjective. The determination of whether or not an incident is interference may be affected by perceived hunter density, present residence, weapon choice, hunting method used, and expenses.

Perceived hunter density may play a major role in determining if presence of other hunters is viewed as interference. There are both advantages and disadvantages to high perceived hunter density. High physical hunter density has the advantage of moving deer around which could increase success and give more opportunity to see deer (Kennedy, 1974b; Heberlein et al., 1982). Negative effects of high hunter numbers are game scared away, safety concerns, competition for hunting spots, and someone shooting your game (Kennedy, 1974b; Heberlein et al., 1982). High perceived hunter density leads to interference when the disadvantages outweigh the advantages. Distinct hunter types react differently to high perceived hunter density (Cue and Langenau, 1979), so interference may not be needed in all models.

Other factors may also affect the impact of interference. Hunters from urban-suburban areas or adjusted to hunting areas of high hunter density may not be as affected by it as someone from rural areas or adjusted to an area of lower hunter density. Gun hunters and bow hunters look for different satisfactions in a hunt and what might be considered detrimental for a bow hunter may not be so to a gun hunter. For example, animals skiddish from the number of hunters may make it more difficult for a bow hunter to get a close, clean shot. Hunters who use a method that requires a group of people or use a method that sees high hunter density as an advantage may not judge a situation as being interference compared to someone who uses a different method. Someone who has spent a great deal of money for a hunt and is not successful, may blame the lack of

success on contact with or the presence of other hunters.

Success

The successful harvest of an animal may be affected by hunters age, present residence, hunting experience, species habitat, species density, weapon choice, hunting method used, number of days hunted, companionship, perceived hunter density, and interference. The final model could never effectively handle this many variables and only the more important or significant variables would be included.

The relationship between age and success has been found to be negative or nonexistent. Peterle (1967) found a negative relationship between age and success controlling for marital status, occupation, income, education, age at first hunt, and species hunted. The decreasing number of days available to hunt with increased age and the decreased physical capability that occurs in later years may explain the relationship. A study of 12- to 18 year olds demonstrated no relationship between age and success (Langenau and Mellon, 1980). This may be because of the relative constant availability of time and lack of physical difficulties associated with that age group.

Those from a rural upbringing are more likely to be successful hunting than those from an urban area (Peterle, 1967). Langenau and Mellon (1980) found for 12- to 18-year olds there was no difference by residence. The distinction between rural and urban-suburban areas is blurring because of the migration of individuals from one area to the other and the proximity of urban-suburban areas to rural areas in much of this country. This may be the cause of the lack of relationship between childhood residence and other variables.

Hunting experience has been shown to be positively related to success (Langenau

and Mellon, 1980). This is expected because knowledge and skill increase with practice. This may not always be the case. Langenau (1980) found no measure of hunter demographics, including hunting experience, that predicted success in harvesting deer for any given year. It appears that experience does not help on a yearly basis, but this does not apply to the life time records of hunters. Actual skill levels were not measured. It was stated that this may not apply to species that are more actively hunted, such as rabbits.

A relationship may exist between species habitat and success. Cover can restrict access of the hunter to an area and protect the game from being detected by the hunter.

A positive relationship would be expected between hunter density and success. As species density increases, the opportunity for contact with an animal increases and therefore, increases the likelihood of harvesting an animal.

In a Michigan study, bow hunters were less likely to harvest a deer than those using a shotgun (Langenau, 1986). Bow hunters were more likely to see deer, but were less likely to shoot.

Different hunting methods may have different probabilities of success. Certain methods handicap the hunter, while others may make the hunt easier. These would affect the ability of being successful.

The number of days that a hunter is able to hunt positively affects the amount of effort that a hunter can put into harvesting an animal. A path may flow in the opposite direction for species that restrict the number of animals taken by an annual bag limit, such as deer and turkey. A successful hunter can no longer hunt. Also, the majority of animals are taken in the first few days of a season. This can create a negative

relationship between days hunted and success.

Companionship may have a negative effect on success rates. Peterle (1967) found hunters who hunted together each year were less likely to be successful than those who hunted alone. Those hunting in groups may be willing to accept lower success rates as long as they can hunt in a group (Kennedy, 1974a).

Hunter density may have a positive relationship with success. Deer are pushed more in areas with high hunter density. This creates the opportunity for more deer sightings and more shots, increasing the possibility of harvesting an animal. This is probably more important in big game hunting.

Interference of other hunters could reduce or prevent the opportunity to harvest an animal. Another hunter could interfere with the ability to get a safe and accurate shot or could scare game from the area.

The relationship between interference and success may not be unidirectional. There may be a feedback loop between interference and success. An unsuccessful hunter may determine that interference has occurred after hunting and therefore may be using success as a variable in determining interference.

Satisfaction

Satisfaction may be affected by hunter's age, region of hunt, species density, weapon choice, method used, companionship, number of days hunted, perceived hunter density, interference, and success. As with all of the dependent variables in the model, some independent variables will be more important than others and some will have no effect once all variables are entered into the equation. Only those independent variables with a significant relationship will remain in the model.

Potter et al. (1973) found no differences in hunter characteristics when it came to satisfaction components. When the sample was grouped by species hunted, satisfaction components differed by species hunted. Satisfaction, in general, also varies by species hunted (Vaske et al., 1982; Jackson and Anderson, 1985).

Of the six satisfaction subgroups that Ragheb and Beard (1980) created. Five of the satisfaction subscales (psychological, educational, social, physiological, aesthetic) varied between age groups, though not linearally. The sixth subscale, relaxation, showed no relationship. The importance of a satisfaction subscale for a specific model would determine if the path from age need be included.

The region of the country where the hunt took place affects the level of satisfaction. Bennett (pers. con.) found that, generally, satisfaction levels are low in the East, variable in the Midwest, and high in the West. The high level of satisfaction in the West is interesting in that they generally have a lower probability of success.

Species density has a positive relationship with satisfaction. Increased species density presumably leads to increased sightings of game. Seeing game has been shown to affect satisfaction levels in several studies (Jackson and Norton, 1980, Vaske et al., 1980, McCullough and Carmen, 1982, Langenau, 1986). This factor may be more relevant for bow hunters.

Bow hunters have different expectations for a hunt than do firearm hunters and therefore, have a different ranking in importance of satisfaction components (Jackson and Anderson, 1985). In their study, 61% of the bowhunters were interested in seeing deer and only 8% discussed killing a deer. Langenau (1986) found bow hunters more interested getting a shot and firearm hunters more interested in actually getting a deer.

Bow hunters generally have a higher satisfaction rate than firearm hunters even though they have a lower success rate (Langenau, 1986). This applies whether you look at successful or unsuccessful hunters.

Distinct hunting methods, as with weapon choice, may affect the overall hunt satisfaction. For example, a hunter using dogs has a different type of hunt experience than someone hunting over bait. Those distinct experiences would fulfill different satisfaction needs.

Companionship can be an important factor in why individuals hunt. In a study of Colorado hunters, 12.8% listed companionship with fellow sportsmen and 5.7% listed companionship with son or another child as reasons for hunting (Schole et al., 1973). Kennedy (1974a) found that hunters felt hunting with companions was more important to their enjoyment than the actual hunt.

The number of days hunted should be positively related to hunter satisfaction since it is used to measure recreational benefit to the hunter. If number of days is not related to satisfaction in this manner, than it is questionable how much benefit is obtained by hunting more days. This relationship would not be expected to be apparent with a seasonal bag limit restriction, such as with deer, because success would prevent any further legal hunting.

Hunter density at first appears to have an effect on satisfaction levels, but after controlling for other variables it is only an indirect effect. In a firearm deer study, physical hunter density and satisfaction were found to be positively related (Cue and Langenau, 1979). Perceived hunter density was not significant when controlling for physical hunter density. Heberlein et al. (1982) found physical hunter density also

significant at the zero order correlation, but disappeared when controlling for the number of deer seen. Hunter density may also not be important when the number of hunters and their proximity to each other is controlled because of the lack of variance (Vaske et al., 1986).

Interference is a negative experience during a hunt. Depending on the extent of the interference, it would be assumed that a negative aspect of the hunt would have a negative effect on satisfaction.

Success has long been associated with satisfaction, though its importance compared to other factors is under question. Some studies have even found success to have no significant effect on satisfaction. Vaske et al. (1986) found that the waterfowl hunters in their study were not considering success when determining satisfaction. They assumed this had to do with the lack of good waterfowl hunting weather and that most hunters were returning from the previous year and were aware of the harvest potential of the area. The expectations of the hunters did not include bagging a limit or even one bird.

A general group of Ohio hunters were asked if they would be satisfied without getting any game (Peterle, 1961). Nearly half of the respondents said that they would be. The problem with this question is that hunters are being asked about behavior in the future and this has been shown to be a poor indicator of actual behavior.

Most studies have shown at least a small significant relationship between success and satisfaction (Stankey et al., 1973; Langenau and Mellon, 1980; Heberlein et al., 1982; Vaske et al., 1982). Though success is found to have an effect it is still ranked below other factors in many studies (Langenau and Mellon, 1980). The ranking of

success among satisfaction components may be somewhat affected by the fact that killing of animals is not seen as being as socially acceptable as it was at one time. Hunters may not want to place too high an emphasis on harvesting so as not to look like a blood-thirsty animal killer.

It has been suggested that there is a minimum level of probability of success below which satisfaction is greatly affected (Stankey et al., 1973). Vaske et al. (1982) studied satisfaction levels of consumptive and nonconsumptive users of natural resources. Nonconsumptive users in general have a higher level of satisfaction than consumptive users regardless of success. Successful consumptive users did have a higher satisfaction rate than unsuccessful users. The researchers believed the difference in the satisfaction level between successful and unsuccessful consumptive users was success which could only be substituted for up to a point.

METHODS

Survey data collected by the Michigan Department of Natural Resources (MDNR) of hunters of the Drummond Island special bear hunt was used to demonstrate the application of the model. Data was collected for the 1988 and 1989 bear hunting season. This questionnaire was not designed to be used as a test of this model, so wording of some questions is not necessarily appropriate for this model.

ISLAND DESCRIPTION

Drummond Island, situated in the eastern end of Chippewa County, Michigan, is 1.6 km off of the eastern tip of MIchigan's Upper Peninsula. The island is 337 km^2 in size and is inhabited by approximately 800 permanent residents and 3000 seasonal residents (Hirsch, 1990). The island habitat is a mixture of hardwoods, conifers, wetlands, and openings with more than 96% of the island being undeveloped. Over 50% of the island is managed by MDNR.

Accessibility to most parts of the island is dirt roads and foot paths. Many of the roads to the more isolated parts of the island allow only one vehicle at a time. The island itself can be reached by a year round ferry service and small aircraft.

BEAR

Descriptive

The only indigenous species of bear in Michigan is the black bear (*Ursus americanus Pallus*). The male is typically larger than the female with typical total body lengths of 1,370 to 1,800 mm and 1,200 to 1,500 mm respectively (Baker, 1983). Male and female typical weight ranges of 113 to 227 kg and 102 to 204 kg respectively. A bear more than 600 kg is unusual.

Range and Habitat

The black bear can be found almost through out the continental United States and parts of Canada, Mexico, and Alaska (Baker, 1983). In Michigan, it can be found in the upper half of the Lower Peninsula and the entire Upper Peninsula.

Bear habitat in Michigan consists of upland forests of hardwood and conifers, marshes, swamps, and thickets (Baker, 1983). Quality habitat should contain a mixture of these ecosystems.

Population Density

The bear population density on the island was approximately 26 bears/100 km^2 (Hirsh, 1990). The bear population was not evenly distributed around the island. Density near the open public dump was higher than average especially among male bears. The dump and surrounding area was closed to bear hunting during the two special hunting seasons used in this study.

Behavior

Black bears are a relatively solitary species, though they will associate with each other during breeding and at large food sources, such as garbage dumps and berry patches (Baker, 1983). Bears are predominately active at twilight, though this can be affected by weather and food preference.

Home ranges vary between male and females with average home ranges of 75.64 km^2 and 48.14 km^2 respectively found on Drummond Island (Hirsch, 1990). The home ranges had extensive overlap. Home range and the amount of overlap of home ranges is affected by habitat quality and food supply. Home ranges increase and the level of overlap that is acceptable to the bears decreases during periods of reduced foods or poor

habitat.

Winter dormancy among black bears can begin as early as the middle of October and normally ends approximately mid April in the Upper Peninsula (Baker). The beginning and ending period of dormancy is affected by weather.

Food Habits

Black bears are omnivorous and eat a variety of plant and animal matter, with plant matter making up the majority of mass (Baker, 1983). Plant matter is predominately made up of fruits, bud, nuts, and tubers.

Bears will eat any animal matter that they are able to get from ants to elk calves and deer, and carrion. Livestock may be part of the diet during times of insufficient natural foods.

Bears under most conditions avoid human contact in search of food, unless there is a lack of natural food sources. Dumps are an exception to this rule with some bears becoming habituated.

HUNT INFORMATION

The bear hunting season on the island was closed from 1985 until the 1988 hunting season due to concerns about the decrease of the bear population. A controlled black bear hunt was established on the island in 1988. The hunt is controlled by the MDNR by limiting the number of hunting permits issued, enforced quota, and through preregistration and enforcing established regulations.

A quota was established for the number of bear that could be harvested. The quota was determined utilizing the desired bear population size and the anticipated annual natural bear mortality. Hunters were required to check in every morning to see if the

quota had been reached. Once the quota was reached, the season was closed for the year. In 1988, there were two one week hunting seasons. In 1989, there was only one season.

DATA COLLECTION

For the first two years of the new bear hunting season, 1988 and 1989, a hunter questionnaire was mailed to gain information about the hunt and its procedures. The results from the 1988 and 1989 hunt surveys are combined for this study.

Due to the small size of the Drummond Island bear hunt applicant and permittee populations, a single mailing of a questionnaire was sent to all Drummond Island bear hunt permit applicants for each year. Three hundred ninety-eight questionnaires were mailed for the 1988 hunt and 209 were mailed for the 1989 hunt. There was no follow-up mailing to nonrespondents. The questionnaire response rate was 60% (234) for 1988 and 66% (138) for 1989. Those who actually hunted had a higher response rate than those who did not with 70% responding in 1988 and 83% responding in 1989. Only those who hunted were included in this study with 39 cases for 1988 and 23 cases for 1989.

DATA ANALYSIS

The structural equation model was evaluated using path analysis. Discrete variables were transformed into dummy variables. Linear regression was used when the dependent variable was at least interval. Logistic regression was used when this was not the case.

Due to the effect of the small sample size on tests of significance, $\alpha \leq .2$ was felt to be acceptable for the margin of error for this demonstration. Variables with an

$\alpha \leq .2$ were retained for the model.

STUDY MODEL (Figure 2)

The general model is not normally feasible and a preliminary model should be created. Variables should be selected on the basis of their relevance to the specific hunter population and the feasibility of collecting the necessary information for that variable.

Once the preliminary model has been created, it must be tested and nonsignificant paths dropped. The final model should be as simple as possible without losing important information. When testing the model, multiple years of data should be used to reduce the effect of an unusual year on the predictive model. The theoretical reasons for the paths chosen has already been discussed. Below are descriptions of the questionnaire variables that have been chosen to represent the hunter characteristics and behaviors. The variables dealing with habitat and the species being hunted were dropped from the model because they were relatively constant in this study.

Age

Age was self reported on the questionnaire. Ages of hunters ranged from 13 to 95 years old with a mean of 38 years old and a median of 37 years old (Table 3).

Resident Community

Respondent's mailing address was considered the resident community. The population size from the 1990 United States Census was used as the measurement. The community population sizes ranged from 369 to 189,126 people with a mean of 20038 and a median of 4232 (Table 4). The distribution of population sizes was heavily skewed to the left, i.e. to small sizes. The population values were transformed by squaring to

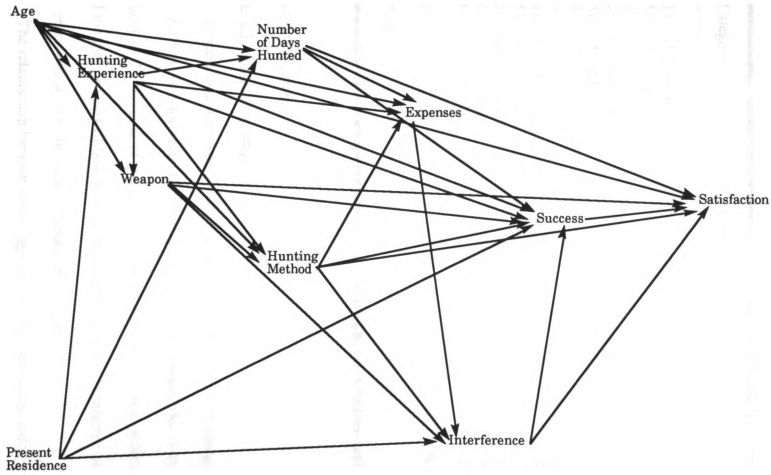

Figure 2: Hypothetical Casual Model

Table 3: Frequency Distribution of Hunter's Age

Category	Frequency	Percent	Cum. Percent
13 - 15 years old	1	1.6	1.6
16 - 20 years old	2	3.3	4.9
21 - 25 years old	4	6.6	11.5
26 - 30 years old	13	21.3	32.8
31 - 35 years old	8	13.1	45.9
36 - 40 years old	16	26.2	72.1
41 - 45 years old	6	9.8	82.0
46 - 50 years old	4	6.6	88.5
51 - 55 years old	1	1.6	90.2
56 - 60 years old	1	1.6	91.8
61 - 65 years old	2	3.3	95.1
66 - 70 years old	1	1.6	96.7
71 - 75 years old	1	1.6	98.4
over 75 years old	1	1.6	100.0
Total	61	100.0	

correct this problem.

Years of Hunting Experience

Respondents were asked how long they had hunted bear in Michigan. It was this value that was used for years of hunting experience. All respondents were residents of Michigan so the wording of the question was assumed not to have much effect on the actual number of years of bear hunting in general. Years of experience ranged from 0 to 25 years with a mean of 4 and a median of 0 (Table 5).

The relationship between hunter age and hunting experience was not linear, so a natural logarithm transformation of the data was necessary. This was possibly due to two

Table 4: Frequency Distribution of Resident Community Size

Category	Frequency	Percent	Cum. Percent
up to 1,000	13	25.0	25.0
1,001 - 2,000	10	19.2	44.2
3,001 - 4,000	1	1.9	48.1
4,001 - 5,000	4	7.7	55.8
5,001 - 6,000	3	5.7	61.5
7,001 - 8,000	2	3.9	65.4
8,001 - 9,000	1	1.9	67.3
10,001 - 20,000	6	11.5	78.8
30,001 - 40,000	4	7.7	86.5
40,001 - 50,000	2	3.9	90.4
60,001 - 70,000	2	3.9	94.3
over 100,000	3	5.7	100.0
Total	52	100.0	

Table 5: Frequency Distribution of Years of Hunting Experience

Category	Frequency	Percent	Cum. Percent
0 years	31	51.7	51.7
1 - 5 years	13	21.7	73.3
6 - 10 years	6	10.0	83.3
11 - 15 years	6	10.0	93.3
16 - 20 years	3	5.0	98.3
21 - 25 years	1	1.7	100.0
Total	60	100.0	

factors. The age hunters generally begin hunting is a continuum of several years, as noted above. Another problem is the rounding of the number of years hunted after 15 years. The natural logarithm of hunter age was taken and used in place of hunter age to improve the linearity of the relationship.

Weapon

Hunters were asked in separate questions if they had hunted with a bow or a gun. The gun was definitely the weapon of choice in most cases (Table 6). The operationalized variable was whether or not the bow was used at all, regardless of whether or not a gun was used.

Table 6: Frequency Distribution of Weapon Choice

Category	Frequency	Percent	Cum. Percent
Used a gun	50	82.0	N/A
Used a bow	13	21.3	N/A

Frequencies can not be accumulated because some hunters used both weapons during the hunt.

Hunting Method

Hunters were asked what methods they had used during the hunt in four separate questions: dogs, dogs started on bait, bait, or still hunted or stalked. Hunting over bait was the method used by the vast majority of hunters (Table 7). The variable used was whether or not dogs were used. It was assumed that the other forms of hunting (stalked, still hunted, and bait) were more like each other and would show little variance among

Table 7: Frequency Distribution of Hunting Methods Used

Category	Frequency	Percent	Cum. Percent
Hunted with dogs not started over bait	5	8.2	N/A
Hunted with dogs started over bait	9	14.8	N/A
Hunted over bait	53	86.9	N/A
Still hunted or stalked	18	29.0	N/A

Frequencies can not be accumulated because hunters may have used more than one method during the hunt.

themselves.

Number of Days Hunted

The number of days spent hunting was self reported. It ranged from 1 to 8 days with a mean and median of 3 (Table 8).

Companionship

This variable was excluded from the study model because the hunt was by individual permits only. It was unlikely that a group of hunters all received a permit, though hunters were allowed to have other people assist with the hunt, such as keeping track of dogs, as long as they had valid bear hunting licenses. This created a situation where hunting without a companion was not necessarily by choice.

Expenses

Expenses were calculated by summing travelling expenses, lodging expenses, on-island expenses, and bait cost. Expenses associated with the harvesting of a bear were

Table 8: Frequency Distribution of Number of Days Hunted

Category	Frequency	Percent	Cum. Percent
1	15	24.6	24.6
2	15	24.6	49.2
3	13	21.3	70.5
4	6	9.8	80.3
5	8	13.1	93.4
6	3	4.9	98.4
8	1	1.6	100.0
Total	61	100.0	

not considered because of the possible effect of success on satisfaction that might occur. Expenses ranged from $0 to $670 with a mean of $238.52 and a median of $200 (Table 9).

Perceived Hunter Density

Perceived hunter density was dropped from this model because the number of hunters in the hunt was controlled.

Interference

Interference was measured by asking hunters if they had been bothered by any other hunters while hunting. The majority of hunters did not feel they had been interfered with (Table 10).

Success

The successful harvest of a bear was self-reported. Over half of the hunters who

Table 9: Frequency Distribution of Hunting Expenses

Category	Frequency	Percent	Cum. Percent
Up - $50	4	16.0	16.0
$51 - $100	3	12.0	28.0
$101 - $150	4	16.0	44.0
$151 - $200	2	8.0	52.0
$201 - $250	2	8.0	60.0
$251 - $300	2	8.0	68.0
$301 - $350	2	8.0	76.0
$351 - $400	3	12.0	88.0
More than $400	3	12.0	100.0
Total	25	100.0	

Table 10: Frequency Distribution of Hunter Interference

Category	Frequency	Percent	Cum. Percent
No hunter interference	52	83.9	83.9
Had hunter interference	10	16.1	100.0
Total	62	100.0	

answered the questionnaire successfully harvested a bear (Table 11).

Table 11: Frequency Distribution of Success

Category	Frequency	Percent	Cum. Percent
No	27	48.2	48.2
Yes	29	51.8	100.0
Total	56	100.0	

Satisfaction

Satisfaction was measured using a five point scale from very poor to very good. The majority of hunters were satisfied with their hunt and over half were at least satisfied with the hunt (Table 12).

Table 12: Frequency Distribution of Hunter Satisfaction

Category	Frequency	Percent	Cum. Percent
Very poor	3	4.9	4.9
Poor	4	6.6	11.5
Neutral	11	18.0	29.5
Good	17	27.9	57.4
Very good	26	42.6	100.0
Total	61	100.0	

RESULTS

The model (Figure 2) was tested and simplified, reducing it to five variables and seven paths (Figure 3). Many of the expected relationships appeared in the zero order correlations, but disappeared when controls were added (Table 13). The relationships between age and success, and hunting method and success were masked in the zero-order correlations.

The zero order correlation between age and hunting experience was highly significant. The relationships were both positive which was predicted.

Both the zero-order relationships with weapon were in the opposite direction than predicted. Hunting experience was significant, but age was not.

All of the zero order correlations with hunting method were significant. Hunting experience and weapon used were in the predicted direction, but age was not.

All but one of the zero-order correlations with number of days hunted was significant. Age was not significant. The relationships with age and hunting experience were not in the predicted direction. Age's zero-order correlation was very small. The relationships between weapon and number of days, and hunting method and number of days hunted were not predicted.

Only hunting experience had a zero-order correlations with expenses that was significant. Age, weapon use, hunting method and number of days hunted were not significantly related. Age and hunting experience were positively related as was predicted, while the relationships hunting method and number of days hunted were in the opposite direction than predicted. Both zero-order correlations were small. There was no prediction about any relationship between hunting experience and weapon used.

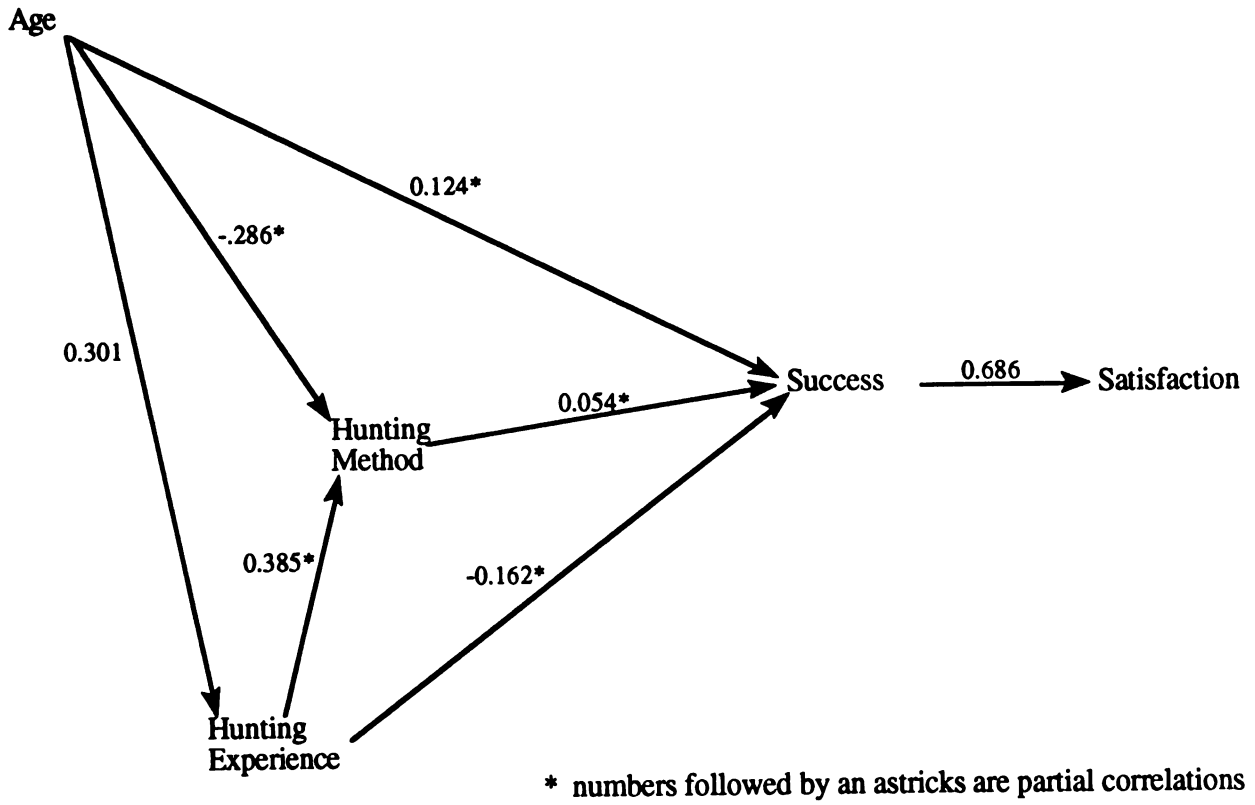

Figure 3: Final Causal Model

Table 13: Zero-order Correlations for Study Variables

	Age	Exper.	Weapon	Method
Age	1.000			
Exper.	.301 ***	1.000		
Weapon	.100	-.183 **	1.000	
Method	-.174 **	.365 ***	-.230 ***	1.000
Days	.073	.515 ***	-.222 ***	.202 **
Expenses	.147	.309 **	.159	-.070
Interf.	-.024	-.165 *	.310 ***	-.192 **
Success	.093	-.202 **	.107	.088
Satis.	.015	.165 *	.029	.206 ***

	Days	Expenses	Interf.	Success
Expenses	-.098			
Interf.	-.149 **	.255 ***		
Success	-.245 ***	.143	.033	
Satisf.	-.241 ***	-.038	.013	.686 ***

* - $\alpha \leq .2$
** - $\alpha \leq .1$
*** - $\alpha \leq .05$

Underlined values are those showing predicted relationships

The only zero-order correlation with interference that was not significant was that with age. Weapon used, hunting method, and expenses all had relationships in the predicted direction with interference. Hunting experience was not in the predicted direction. The relationship with age and number of days hunted was not predicted.

The only the zero-order correlation with success that was significant was that of number of days hunted. Age, hunting experience, weapon used, hunting method, expenses, and interference were not significant. Number of days hunted was also the only variable with a relationship in the predicted direction. Age, hunting experience, weapon used, and interference were all in the opposite direction than anticipated. The zero-order correlations of age and interference with success were very small. A relationship between success and hunting method was expected, but a specific direction was not predicted. No relationship was predicted with expenses.

Hunting experience, hunting method, number of days hunted and success had significant zero-order correlations with satisfaction. Age, weapon chosen, expenses, and interference did not have significant zero-order correlations. Hunting experience, number of days hunted, and success all had relationships with satisfaction in the predicted direction. Interference had a relationship in the opposite direction than satisfaction. The zero-order correlation was very small. The relationships of age, hunting method, and weapon with satisfaction were expected, but not predicted in any direction. The zero-order correlations of age and weapon were very small. There was no relationship predicted for expenses and satisfaction.

Least squares linear regression can not be used for calculating ß's when using success and hunting method as dependent variables due to being dichotomous variables.

Because of this, the path coefficients for these paths are not standardized regression coefficients, but partial correlations calculated using logistic regression. They are not true path coefficients, but they are being used here to assist in the analysis. Decomposition of the effects was not possible because of the use of partial correlations. They will be identified as R^* in the paper to distinguish them from ß. Logistic regression also does not calculate a multiple R for the equation.

Hunting experience was significantly related to hunter age with ß=.310 (Table 14). Age only explained 9% of the variance of hunting experience. Resident community

Table 14: Regression Analysis Results

Dependent Variable	Independent Variable(s)	Beta	Sign.	R	Sign
Experience	Age	.331	.021	.331	.021
Method[1]	Age	*	*	-.295	.010
	Experience	*	*	.389	.012
Success[1]	Age	*	*	.130	.071
	Experience	*	*	-.167	.043
	Method	*	*	.076	.119
Satisfaction	Success	.686	.000	.686	.000

* Analysis was done using logistic regression. This procedure does not calculate standardized regression coefficients or multiple R's, only partial coefficients which are in place of R.

was not significant in predicting hunting experience.

Weapon choice was significantly predicted by age and hunting experience. Weapon choice was dropped from the model because it was not significantly related to satisfaction, either directly or indirectly.

Both hunter's age and hunting experience were related to hunting method used. Age was negatively related with R^1=-.286. Hunting experience was a stronger predictor than age of hunter with R^1=.385.

Number of days was significantly related to resident community, hunter's age, and hunting experience. Number of days hunted was dropped because it was not significantly related to satisfaction.

Hunting expenses were positively related to hunting experience. Expenses was dropped due to lack of significance in relations to satisfaction.

Successful harvest of a bear was predicted by age of hunter, hunting experience, and hunting method. Hunting experience had the most effect with R^1=-.162. Hunting method had a R^1=.054 and age of hunter had a R^1=-.124.

Success was the only variable that had a significant direct effect on satisfaction. Success had a ß=.686 and predicted 47% of the variance in satisfaction. Age of hunter, hunting experience, and hunting method had only indirect effects on satisfaction.

Interference was dropped from the model because it did not predict success or satisfaction. The only variable that significantly predicted interference was expenses which was positively related. Though the results were not significant, bow hunters were more affected by interference than those using firearms.

DISCUSSION

The size of the sample prevents any robust test of the model. A test of this model with a large multiple-year sample is necessary before it can be considered useful and reliable. Although the results of this study are not considered significant at $\alpha=.05$, the results are still informative.

The relationship between age and hunting experience was positive as expected. The direction of the relationships of age and hunting experience with the dependent variables and the fact the correlation was not extremely high between age and hunting experience demonstrates that the two variables can be used at least sometimes together without adverse effects.

The operationalized variable for hunting method was whether or not a hunter used dogs. Dog hunting is very expensive because of the cost of the dogs, their training, and equipment. Hunting with dogs is often done with a group of hunters and can be very physically demanding for the hunter(s) who keep up with the dogs. The physical exertion may explain why the use of dogs is negatively related to age. The level of experience and the time and effort involved with dog use is probably the reason for the strong positive relationship between hunting experience and using dogs.

Not all of the significant independent variables for success behaved as expected. Age has been previously found to have a negative or nonexistent relationship with success, though a relatively strong positive relationship was found in this study. Also, the relationship between hunting experience and success was expected to be positive due to increased skill and it was negative in this study. The hunter phases reported by Jackson and Norton (1980) may explain the relationship with hunting experience.

Hunters with more experience are more likely to handicap themselves while hunting which reduces the possibility of success. The importance of harvesting an animal in relation to other aspects of the hunt diminishes with increased hunting experience.

An explanation for the importance of success in predicting satisfaction for the Drummond Island bear hunt is the hunters' high expectations for the hunt. The bear season on the island had been closed for several years and hunters expected trophy-sized bears that were not adjusted to being hunted. In 1989, the bears had been hunted for one year and hunters may not have had as high of expectations about the bears' wariness towards hunters, but there was probably still an expectation for trophy bears. Also, the number of hunters was restricted for both the 1988 and 1989 hunting season.

These factors combined to create high expectations for harvesting a large bear. The relationship between success and satisfaction may have been higher if there had not be a harvest quota which forced hunters to shoot the first bear they had an opportunity for, instead of waiting for a trophy-sized bear. The quota may also have affected satisfaction for some of the successful hunters because of this.

Typically, an bear over 300 pounds is considered trophy size, but determination of what is trophy sized can be very subjective. Depending upon the hunting experiences of the hunt and the number and size of bear previously harvested, what an individual hunt will consider a trophy. A first time hunter may consider anything over 250 pounds as being a trophy, while a veteran of many hunts may not consider anything less than 400 pounds as a trophy.

Present residency of hunters was a poor predictor of satisfaction for both direct and indirect effects. Residency was used in the model in two forms: the squared 1990

United States Census population size and communities defined as rural or urban-suburban. Population size may not have worked because community size does not automatically define rural or urban. Specifying areas as rural or urban-suburban did not work either. This is possibly because of the level of migration that exists within our society has obscured the distinction between these areas for at least most of the country. The ability to use childhood residence will probably deteriorate in the future for this reason.

Weapon choice was dropped from the model due to the lack of significant direct or indirect effect on satisfaction. A significant number of hunters of the 1988 hunting season stated that they had planned on only using a bow and not a firearm, but did switch from a bow to a firearm just prior to or during the hunt. This may have to do with the quota system and the pressure to get a bear as quickly as possible. Bow hunting, in general, has a lower success rate than does a firearm hunting and the importance of success for this hunt may have caused a change in weapon use. This relationship was not apparent in the 1989 data.

Bow hunters also have different satisfaction needs than firearm hunters, and those needs may not have been evaluated by this method. The addition of variables for number of bear seen during the hunt or if the hunter shot at a bear may improve the model.

The regression of number of days hunted with its independent variables had interesting results. Age was negatively related to number of days hunted as was predicted. Community size was also negatively related to number of days hunted. This was the direction that was expected if using childhood residency. The relationship between hunting experience and number of days hunted is opposite of that predicted.

This is quite possibly due to the hunter phases discussed by Jackson and Norton (1980). As a hunter's experience increases, the importance of success decreases compared to other satisfaction components. Therefore, even though skill increases, the experienced hunter's desire to shoot the first animal that appears may not be as strong as someone with less hunting experience.

Hunt expenses were dropped from the model due to lack of any significant paths to satisfaction. The lack of significance may be because actual expenses do not show the importance placed on the amount of money to the individual. A better measure may be the percentage of a month's wages spent on the hunt.

Interference may not have been significant for two reasons. The number of hunters was greatly restricted and therefore there may not have been as much potential for contact with other hunters. The other reason is that a distinction was not made between hunters by weapon type. Bow hunters are more likely to complain of interference.

The zero order correlation between number of days hunted and success was -.245 and between number of days hunted and satisfaction was -.241. These results demonstrate that days afield is not a good method for predicting satisfaction in cases of big game seasons, especially those with high expectations of success. This may not be the case with small game hunting that has daily bag limits. The variable is still useful in determining the level of use the resources are receiving, but should not be used in evaluating the satisfaction of those hunters.

There 1988 and 1989 Drummond Island bear hunt was unique compared to Michigan's annual bear hunting season. This was due to several factors: harvest quota,

restricted number of hunters, level of regulation enforcement by the MDNR, and the closure of the 1982-1987 bear hunting season. The quota system placed an increased level of importance on harvesting a bear. This had two possible effects on the hunt. It forced at least some of the hunters to harvest the first possible bear instead of waiting for a trophy bear. The importance of harvesting a bear may also have been a partial cause of success being so central to hunt satisfaction.

The restriction of the number of hunters in the area reduced the level of interaction of the hunters during hunting and reduced the opportunity for interference. Because of the decreased hunter to bear ratio, the low number of hunters in the area normally would have reduced the level of competitiveness had the quota system not been in place.

Hunters were required to check in prior to the beginning of the hunt and before hunting each morning. They were also required notify the MDNR of all bait piles, of which they were restricted to two. Conservation officers of the MDNR also actively patrolled the areas hunted. The level of enforcement and the established rules possibly reduced the opportunity for incidents of unacceptable contact between hunters.

Due to the bear hunting season being closed on the island for five years, many of those who applied envisioned nonwary trophy sized bears. This expectation would not be anticipated in a general bear hunt because previously unhunted sections are rarely if ever opened up to hunting. The importance of success in predicting satisfaction would be expected to be lower in areas of normal bear hunting.

If this model was used on a survey of general bear hunters, some changes in the final model would be expected. The sample size would be larger possibly allowing

certain predicted relationships to be empirically significant that the small sample size of this study did not. For example, the relationship between weapon used and interference would be expected to be significant for two reasons. First, there would be more bow hunters in the sample and therefore it would be more likely that the results would be significant if a relationship actually exists. Also, without restricting the number of hunters, there is more opportunity for interaction among hunters, both positive and negative.

In general then, the importance of success would be expected to be decreased for the regular bear hunting season because the hunting season has not been recently closed, the number of hunters would not restricted, and the quota system has not been employed. This would allow some variables predicted to be related to satisfaction to become more evident.

Interference may be more of a factor with increased hunter density and the reduction of regulation enforcement. Hunters come in contact more often with one another while hunting and the probability of illegal activity being prevented or arrested would be lower. Therefore, the number of undesirable contacts between hunters would increase.

In a general model, hunter density would have to be included because it would vary by hunting area. Present residence may also function properly in a larger sample, and an appropriate method of measurement or transformation may be developed. Many of the variables may become significant with a larger sample, such as weapon used and number of days hunted.

CONCLUSIONS

This model can assist in evaluating the effects of management projects on hunter satisfaction and understanding the effects on specific characteristics of hunters, such as rural residence or bow hunters. Knowledge of the attitudes, beliefs, and values associated with these characteristics is important in understanding why those characteristics were affected.

This model is not a substitute for program evaluation. This model only looks at hunter satisfaction in terms of the actual hunt. This model is only useful in evaluations in which maintaining or improving hunter satisfaction is a goal.

Satisfaction is only a small part of what is necessary in evaluation a project or program. Caution should be used when using satisfaction to measure goal achievement. Satisfaction can measure the actual fulfillment of needs and wants (true satisfaction), but it can also measure the belief that the situation will not improve (resignation) (Ölander, 1979). A hunter who hunts in a poor quality area, but has no access to a better area may accept the situation and state that he/she is relatively satisfied. Though, if the hunter had unrestricted access to better hunting areas, he/she would find the hunting in the present area total dissatisfying.

Many management projects are not design solely to maintain or improve hunter satisfaction. Most projects have multiple dimensions; many of which affect more than just hunters during the hunt, such as increasing the size of the deer herd. The increased visibility of deer benefits many user groups. Also, hunters gain satisfaction from management projects other than those that are measured in this model.

There are a few policy implications from this study. The quota system as it was

used here needs to be used with caution due to the effect it has on increasing the level of importance of success. The effect of interference on bowhunters found in this study may indicate that bowhunters need more areas where hunters are limited and there is less opportunity for outgroup contact.

The relationships and non-relationships found in this study need to be retested with a larger sample and investigated. Further studies need to be done on how hunter characteristics and activities relate to satisfaction and what other variables may explain the variance, such as number of game seen.

Satisfaction needs of bow hunters need to be further studied, because there appears to be a difference in the needs of bowhunters from that of firearm hunters. If this is the case, it must be determined if present management practices meet the needs of bowhunters.

The word "success" needs to be replaced in wildlife management if we are to reduce the emphasis placed on harvesting an animal. The opposite of success is unsuccessful which sounds like failure. It would be interesting to study the effects of the word success and the ramifications of using the word harvest or another word instead.

Further study needs to be done in several areas. The effects of expectations on satisfaction and the implications of the results need to be considered and researched. Inappropriate expectations can have a negative effect on satisfaction. Expectations are something that can be somewhat controlled through the use of the media and public contact with the resource managers.

Little research appears to have been done on female hunters. The interest and concerns of female hunters needs to be investigated. Though needs fulfilled by hunting

for women appear to be different than for men, further research needs to be done.

The growing anti-hunting movement is making it less socially acceptable to hunt. This may have some effect on the willingness of hunters to rank success as an important aspect of their hunt. Research needs to be done on the effect of the anti-hunting movement on both public and private hunter attitudes and on the sport of hunting in general.

BIBLIOGRAPHY

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Baker, Rollin H.
1983 Michigan Mammals. Detroit, MI: Wayne State University Press.

Beard, and Ragheb
1980 "Measuring leisure satisfaction." Journal of Leisure Research 12(1):20-33.

Bennett, Carl
1991 Personal communication.

Brown, Perry J., Jacob E. Hautaluoma, and S. Morton McPhail
1977 "Colorado deer hunting experiences." Transactions of the North American Wildlife and Natural Resources Conference 42:216-225.

Cue, David C., and Edward E. Langenau, Jr.
1979 Satisfaction and Deer Hunter Density. Michigan Department of Natural Resources Wildlife Division Report No. 2848. Lansing, MI.

Crissey, Walter
1971 "Some thoughts on wildlife research and management objectives." Wildlife Society News.

Decker, Daniel J., Tommy L. Brown, and R. J. Gutierrez
1980 "Further insights into the multiple-satisfaction approach for hunter management." Wildlife Society Bulletin 8:323-331.

Hautaluoma, Jacob, and Perry J. Brown
1979 "Attributes of the deer hunting experience: a cluster-analytic study." Journal of Leisure Research 10(4):271-287.

Hawes, Douglass K.
1978 "Satisfactions derived from leisure-time pursuits: an exploratory nationwide survey" Journal of Leisure Research 10(4):247-264.

Hazel, Kelly L., Edward E. Langenau, Jr., and Ralph L. Levine
1990 "Dimensions of hunting satisfaction: multiple-satisfactions of wild turkey hunting" Leisure Sciences 12:383-393.

Heberlein, Thomas A., John N. Trent, and Robert M. Baumgartner
1982 "The influence of hunter density on firearm deer hunters' satisfaction: a field experiment." Transactions of the North American Wildlife and Natural Resources Conference 47:665-676.

Hendee, John C.
1972 "Management of wildlife for human benefits." Transaction of the Annual Conference of the Western Association of State Game and Fish Commissioners 52:175-181.

Hendee, John C.
1974 "A multiple-satisfaction approach to game management." Wildlife Society Bulletin 2:104-113.

Hirsch, James Glenn
1990 "Black bear habitat utilization and habitat model validation in Michigan." Master's Thesis. East Lansing, MI.

Jackson, Robert
1980 "Models and influences shaping hunter attitudes and behaviors" Presented at the 42nd Midwest Fish and Wildlife Conference.

Jackson, Robert and Ray Anderson
1985 "The deer hunting experience: its satisfaction and expectations" Deer and Deer Hunting. April.

Jackson, Robert and Robert Norton
1980 "Phases: the personal evolution of the sport hunter." Wisconsin Sportsman 9(6):17-20.

Kennedy, James Joseph III
1970 "A consumer analysis approach to recreational decisions: deer hunters as a case study." Phd Dissertation. Blacksburg, VA.

Kennedy, James J.
1973 "Some effects of urbanization on big and small game management." Pp. 90-97 in John C. Hendee and Clay Schoenfeld (eds.), Human Dimensions in Wildlife Programs. Washington, D.C.: The Wildlife Management Institute.

Kennedy, James J.
1974a "Motivations and rewards of hunting in a group versus alone." Wildlife Society Bulletin 2:3-7.

Kennedy, James J.
1974b "Attitudes and behavior of deer hunters in a Maryland forest." Journal of Wildlife Management 38:1-8.

Klessig, L. L.
1970 Hunting in Wisconsin: initiation, desertion activity patterns and attitudes as influenced by social class and residence. M.S. Thesis University of Wisconsin, Madison. 152 pp. Cited in Bernhard J. Schole. 1973. A Literature Review on Characteristics of Hunters. Special Report Number 33. Colorado Division of Wildlife. 15 pp.

Langenau, Edward E., Jr.
1980 "Deer hunting success: skill or luck?" Michigan Department of Natural Resources Wildlife Division Report No. 2873.

Langenau, Edward E., Jr., and Phyllis M. Mellon
1980 "Characteristics and behaviors of Michigan 12- to 18-year-old hunters." Journal of Wildlife Management 44:69-77.

Langenau, Edward E., Jr.
1986 "Factors associated with hunter retrieval of deer hit by arrows and shotgun slugs." Leisure Sciences 8:417-438.

Leopold, Aldo
1948 Game Management. New York, NY: Charles Scribner's Sons.

McCullough, Dale R., and William J. Carmen
1982 "Management goals for deer hunter satisfaction." Wildlife Society Bulletin 10:49-52.

More, Thomas A.
1973 "Attitudes of Massachusetts hunters." Transactions of the North American Wildlife and Natural Resources Conference 38:230-234.

O'Leary, Joseph T., Jean Behrens-Tepper, Francis A. McGuire, and F. Dominic Dottavio
1987 "Age of first hunting experience: results from a nationwide recreation survey." Leisure Sciences 9:225-233.

Ölander, Folke
1977 "Can consumer dissatisfaction and complaints guide public consumer policy?" Journal of Consumer Policy 1(2):124-137.

Peterle, Tony J.
1961 "The hunter-who is he?" Transactions of the North American Wildlife and Natural Resources Conference 26:254-266.

Peterle, Tony J.
1967 "Characteristics of some Ohio hunters." Journal of Wildlife Management 31:375-389.

Potter, Dale R., John C. Hendee, and Roger N. Clark
1973 "Hunting satisfaction: game, guns or nature?" Transactions of the North American Wildlife and Natural Resources Conference 38:220-229.

Ragheb, Mounir G.
1980 "Interrelationships among leisure participation leisure satisfaction and leisure attitudes." Journal of Leisure Research 12(2):138-149.

Ragheb, Mounir G., and Jacob G. Beard
1980 "Leisure satisfaction: concept, theory, and measurement." Pp. 329-353 in Seppo E. Iso-Ahola (ed.) Social Psychological Perspectives on Leisure and Recreation. Springfield, IL: Charles C. Thomas.

Schole, Bernhard J., Fred A. Glover, Douglas D. Sjorgen, and Eugene Decker
1973 "Colorado hunter behavior, attitudes, and philosophies." Transactions of North American Wildlife and Natural Resources Conference 38:242-248.

Snepenger, David J., and Robert B. Ditton
1985 "A longitudinal analysis of nationwide hunting and fishing indicators: 1955-1980." Leisure Sciences 7(3):297-319.

Stankey, George H., Robert C. Lucas, and Robert R. Ream
1973 "Relationships between hunting success and satisfaction." Transactions of the North American Wildlife and Natural Resources Conference 38:235-242.

Vaske, Jerry J., Maureen P. Donnelly, Thomas A. Heberlein, and Bo Shelby
1982 "Differences in reported satisfaction ratings by consumptive and nonconsumptive recreationists." Journal of Leisure Research 14:195-206.

Vaske, Jerry J., Anthony J. Fedler, and Alan R. Graefe
1986 "Multiple determinants of satisfaction from a specific waterfowl hunting trip." Leisure Sciences 8(2):149-166.

Wright, Vernon L., Thomas A. Bubolz, Alice Wywialowski, and Robert B. Dahlgren
1979 "Characteristics of individuals involved in different types of hunting." Transactions of the North American Wildlife and Natural Resources Conference 42:207-215.