Winter 2000

Impacts of wildlife viewing: A case study of Dixville Notch wildlife viewing area

Judith Kay Anderson Silverberg
University of New Hampshire, Durham

IMPACTS OF WILDIFE VIEWING: A CASE STUDY OF DIXVILLE NOTCH WILDLIFE VIEWING AREA

BY

JUDITH KAY ANDERSON SILVERBERG

B.S. University of Wisconsin-Madison 1974
M.S. University of Wisconsin-Madison 1975

DISSERTATION

Submitted to the University of New Hampshe

in Partial Fulfillment of

the Requirements for the Degree of

Doctor of Philosophy

in

Natural Resources

December, 2000

UMI Number: 9991561

Bell & Howell Information and Learning Company
300 North Zeeb Road
P.O. Box 1346
Ann Arbor, MI 48106-1346

PhD. DISSERTATION

This dissertation has been examined and approved

Dissertation Director, Peter J. Pekins
Associate Professor of Natural Resources

Lawrence C. Hamilton
Professor of Sociology

William W. Mautz
Professor of Natural Resources

Robert A. Robertson
Associate Professor of Resources and Economic Development

James T. Taylor
Professor of Zoology

ACKNOWLEDGEMENTS

A dissertation like this does not happen without a tremendous amount of support from many people. When I first envisioned this project five years ago, it seemed as though as though this time was a long way off. The years have flown and I am grateful for the support of my family, friends and colleagues.

I would like to thank Peter Pekins for being interested an interdisciplinary project and for the hours he spent editing and consulting with me to bring this to completion. I would also like to thank Robert Robertson for a tremendous amount of support. His willingness to see how social scientists and biologists can work together, inspired the original proposal. I appreciate the extra time he took to read drafts of chapters.

I thank my dissertation committee for being willing to listen, and being interested in bringing different disciplines together. Lawrence Hamilton, for really making me think about statistics. William Mautz for being interested in the human dimensions of wildlife and James Taylor for providing insight into statistics and re-awakening my interest in amphibians.

Mike Roth and Kent Gustafson provided assistance with statistics. A special thank you to Mike for the hours you allowed me to share your office figuring out SPSS.

The eight technicians who worked on this project were all a great bunch, Matt Langlais, Tracy Alyward, Rebecca Perkins, Martin Bean, Jason Traylor, Eric Boucher, Lucy LaPlante and Kori Marchowski. This project would not have been done without their hard work and dedication.

I am also grateful for the support of the people who I work with at New Hampshire Fish and Game. I particularly want to thank Judy Stokes Weber for being an understanding division chief and allowing me to pursue one of my dreams. My colleagues John Lanier, John Kanter, Marilyn Wyzga, Pam Riel and Kelle MacKenzie who always showed an interest in what I was doing.

There are several people from the Great North Woods who are in a large part responsible for this project. Don Merski from Mead Paper, made it possible for the Dixville Notch Wildlife Viewing Area to exist. Don believed enough in the project to draft an agreement for the site to be built.

I will be eternally indebted to the BALSAMS for the support they provided this project both monetarily and morally. A special thank you to Steve Barba, for believing in me and recognizing the value of wildlife to his guests. I would be remiss not to mention David Nesmith, who helped the technicians feel comfortable in their setting and who was many times asked to be the message taker. David your enthusiasm is catching.

The funding for this project came from many sources. The University of New Hampshire SURF program, a Partners in Wildlife Grant from the National Fish and Wildlife Foundation, The BALSAMS and the New Hampshire Fish and Game Department.

And last but certainly not least, I would like to thank my family. Thank you to my brother Jim, for saying it is not a question of if, but of when

and to my Mom and my mother-in-law who always asked how was it going and were encouraging. To my husband Rick, how can I ever show you how much it has meant to me to have you in my life. You let me pursue this degree, knowing there would be many sacrifices. To my children Beth and Sarah, I hope in watching me struggle you know how much I treasure the opportunity to learn and grow. I know I can never make up for the dinners you had to cook or the times you had to wait because of my dream.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

IMPACT OF WILDLIFE VIEWING: A CASE STUDY OF DIXVILLE NOTCH WILDLIFE VIEWING AREA

by

Judith Kay Anderson Silverberg

University of New Hampshire, December, 2000

Major objectives of this study were to examine the motivations, knowledge level and attitudes of wildlife viewers as well as the response of moose to observation and other human caused stimuli at a designated wildlife viewing site. Moose and other wildlife are attracted to areas where road salt runoffs and pools in low areas around culverts and ditches creating wildlife viewing opportunities.

This study examined whether moose behaviors such as visitation time and rate of use of the salt lick changed from preconstruction (1996) of a wildlife blind to wildlife viewing establishment (1999). Trailmaster monitors strategically located on trails entering the licks were used to determine that no changes in moose visitation and use patterns occurred. In addition moose responses to a variety of human stimuli including visitors in the viewing blind, visitors walking along the trail, visitors talking, cars stopping on the roadway, trucks passing and humans out of cars approaching moose were recorded during 42 observation periods conducted summers of 1997-1999 Moose showed no response to wildlife viewers using the viewing blind or walking along the trail, however, their behavior patterns changed when cars stopped along the road and trucks passed.

A segment of the study involved interviewing 439 viewers at the site during 1997-1998 and then follow by a mail survey. Mail surveys were used to determine motivations, level of wildlife knowledge, satisfaction and attitudes toward wildlife management. The 209 completed surveys indicated viewers had a variety of motivations for watching wildlife and most were satisfied with their experiences in Dixville Notch. There were changes in knowledge level from the interview to the mail survey. In addition attitudes about managing wildlife viewing sites were provided including the willingness for more regulations, not wanting to have artificially created experiences and a willingness to forgo options which would increase the number of animals at the site.

Results of this research provide recommendations for designing and planning wildlife viewing areas to maximize viewing and learning opportunities. A traditional multi-disciplinary and an interdisciplinary planning approach to using sociological and biological research results are discussed.

INTRODUCTION

The purpose of this study was to use multiple disciplines to integrate sociological and biological data related to wildlife viewing, wildlife viewers, and viewed wildlife to determine impacts and develop management recommendations for wildlife viewing areas. The study specifically examined wildlife viewing impacts on moose, the motivation of wildlife viewers, their attitudes about forest and wildlife management practices, and their knowledge levels about related management activities. Stimuli-response interactions between human activity at a wildlife viewing site and moose behavior were also examined.

The following provides a review of relevant research providing justification for the study, the overall objectives of the study, a detailed description of the study area, and concludes with a description of the individual chapters.

Wildlife Viewing , Recreational Impacts and Research Needs

Nonconsumptive recreational activities have grown in popularity relative to traditional wildlife and fish recreational pursuits over the past 35 years (More 1979, Duffus and Deardon 1990, Mangun et al. 1992, Flather and Cordell 1995). Fishing has been and continues to be a popular wildlife dependent activity with nearly 25% of the U.S. population having fished in 1985, although the annual number of days spent fishing has declined. The number of hunters has essentially remained unchanged since 1975, although there have been shifts in the species pursued (Flather and Cordell 1995). Wildlife viewing activities grew steadily from the mid-1970s through the early-1990s, with an average annual rate of increase that exceeded all other wildlife-oriented recreation. Between 1991 and 1996 there was a decline in the number of wildlife viewers in the U.S. (Duda et al. 1998), however, projections of future participation indicate that wildlife viewing will increase in popularity (Flather et al. 1999). Fish and wildlife agencies increased their information and education efforts during the period of rapid growth of wildlife watching in the 1980s. In the early 1990s, a memorandum of agreement amongst state and federal agencies addressed the increased activity in wildlife-related recreation with the development of wildlife viewing programs (Vickerman 1991).

A wildlife viewing program integrates education and wildlife viewing components (Duda and Young 1994). These programs address the public's growing interest in viewing wildlife in natural settings, while helping to meet the demand for outdoor recreation by providing opportunities for people to experience nature. As part of the experience, educational components are provided to promote a conservation ethic. Watchable wildlife programs are based on the assumption that if we fail to provide a sufficient amount of high quality habitat, our children and grandchildren will not have the current opportunities to enjoy wildlife (Hudson et al. 1992). The underlying postulate is that if people care about wildlife because they have viewed them, they will work to protect habitat and be good stewards of the land.

The terms wildlife viewing or wildlife watching encompass distinct activities: "nonresidential" wildlife watching refers to wildlife watching that occurs on trips of one mile or more from home; "residential" wildlife watching refers to wildlife watching that takes place within one mile of the home. Further, primary wildlife watching occurs when it is a person's deliberate intention to view wildlife; secondary wildlife watching occurs while a person is doing something else, such as observing an eagle at a family picnic, when the family picnic was the primary activity (Duda et al. 1998)

The 1996 National Survey of Fishing, Hunting and Wildlife Associated Recreation reported that almost 63 million Americans, 31% of the population 16 years of age and older, viewed and photographed wildlife in 1996 (US Department of the Interior 1997). Just under 61 million had a primary interest in wildlife around their homes, while 24 million took trips more than one mile from their homes for the primary purpose of watching wildlife (US Department of the Interior 1997).

Historically, environmental impacts of nonconsumptive recreation were considered benign, however, the notion that such recreation has no environmental impact is no longer tenable (Flather and Cordell 1995). Recreationists often degrade the land, water, and wildlife resources that support their activities by simplifying plant communities, increasing animal mortality, displacing and disturbing wildlife, and distributing refuse (Boyle and Samson 1985).

For example, songbirds may alter their behavior after repeated interactions with humans. Red-winged black birds (*Agelaius phoeniceus*), goldfinches (*Carduelis tristis*), and American robins (*Turdus migratorius*) became much more aggressive toward humans who repeatedly visited their nests

(Knight and Temple 1986a). Knight et al. (1991) studied responses of an avian scavenging guild (composed of bald eagles (*Haliacetus leucocephalus*), common ravens (*Corvus corax*) and American crows (*Corvus brachyrynchos*)) to the presence of anglers on gravel bars and found that although most eagles and ravens typically foraged during early- and mid-morning hours, the presence of anglers caused an unusually high percentage to shift feeding to late afternoon hours. Bighorn sheep (*Ovis canadensis*) have a variety of behavioral responses to human disturbances, from no reaction to passing vehicles, to an alarm reaction to hikers who approached from above (Hicks and Elder 1979, MacArthur et al. 1982).

Research in the area of human impacts on wildlife has been relatively sparse and fragmented (Larson 1995). Wildlife viewers and photographers actively seek and approach wildlife, unlike other recreationists who mostly encounter wildlife accidentally. Thus, these activities are potentially more disturbing to wildlife as encounters are more frequent and of longer duration (Boyle and Samson 1985). In order to minimize potential conflict between recreational use and wildlife management goals there is a need to: 1) understand the responses of wildlife to recreational activities, 2) understand the factors that influence the nature and magnitude of impacts, 3) improve research methods, and 4) develop and implement new management strategies (Cole and Knight 1990). An assessment of potential wildlife impacts should consider types of visitors to an area, their recreational activities, their interaction with wildlife and wildlife habitat, and the behavioral and physiological response of wildlife (Pomerantz et al. 1988).

Research on the multiple satisfaction approach in game management and development of outdoor recreation typologies in the late 1960s and early 1970s provided the foundation for increased interest in the human dimensions approach to wildlife management (Hendee 1969, 1974, Hendee et al. 1971, Lyons 1982). Research in the human dimensions aspects of wildlife enhances efforts in decision-making that is more responsive to the public, and in the long term, increases the effectiveness of decision-making (Decker et al. 1987, 1992).

In its simplest form, a human dimensions approach is described in two parts. The first emphasizes acquisition of sound information utilizing concepts and methods of social science to explain human thought and action regarding wildlife. The second part concerns the use of that information in decision-making processes of wildlife management (Manfredo et al. 1995). The human dimensions approach provides a way of examining interactions of wildlife and recreationists.

To date, most studies that have used the human dimensions approach to examine human wildlife interactions have focused on recreational activities such as hunting and fishing. There are basic gaps in our knowledge about wildlife viewers and factors that influence people to participate in this activity. For example, what are people's motivations for taking wildlife viewing trips, what is the relationship between knowledge of wildlife and unintended impacts to wildlife, and to what extent do interactions with wildlife influence knowledge of wildlife. Further, are there multiple satisfactions involved in viewing wildlife (Manfredo et al. 1995), and what constitutes a quality wildlife viewing experience (Vaske et al. 1995)?

Not only has scant attention been paid as to why wildlife viewers choose such recreation, few have attempted to integrate findings across ecological and social science research (Kuss et al. 1990s, Decker et al. 1992). This lack of integration of the available empirical evidence has limited the application of research data to visitor impact management. Natural resource planners must contend with both ecological and social issues. Perceptions of ecological disturbance, for example, may influence the quality of a visitor's experience (Vaske et al. 1995). At issue is how can wildlife viewers achieve maximum overall satisfaction and have minimal impact on the wildlife they are viewing. Research needs to be applied to both development of viewing programs and to mitigation strategies for recreational impacts (Larson 1995).

In New Hampshire, the Fish and Game Department developed a concept proposal for a watchable wildlife program in 1991. The proposal outlined a statewide program that included a wildlife viewing guide, a variety of viewing sites with varied levels of facilities development, and public programs. The proposal stressed the need for partnerships with state and federal agencies, non-profit organizations, and private enterprise (Silverberg 1992). The 1994 New Hampshire Outdoors Report supported the importance of wildlife observations by noting that in the year 2040 it would be one of the most popular recreational activities. Arguably, wildlife watching was extremely popular already and important by any measure. For example, moose (*Alces alces*) were a primary tourist attraction in the northern part of the state, as evidenced by entrepreneurial moose viewing tours and town promoted moose festivals.

The New Hampshire Fish and Game Department in partnership with the

New Hampshire Scenic and Cultural Byway program, administered through the Office of State Planning, with funds provided from the Federal Highway Administration, built a wildlife viewing area on Route 26 in Dixville Notch during the fall of 1996. This viewing area was located on property owned by Boise Cascade Corporation which was subsequently purchased by Mead Paper Publishing Division in 1997. A number of factors led to this choice as a wildlife viewing site, the primary being the presence of a salt lick caused by runoff of road salt that attracted numerous visible moose; moose exhibit natural craving toward sodium (Schwartz and Renecker 1997). A second factor was the proximity of clear cuts with abundant forage (Peterson 1955).

Since this was the first wildlife viewing site of this type in New Hampshire, numerous questions existed about the demographics of potential visitors, their motivation for stopping, their general knowledge of moose, and their attitudes toward forest and wildlife management. During the planning phase of the project, a number of questions arose regarding the impact of a viewing site on moose and other wildlife that inhabited the area. For example, NH Fish and Game wildlife biologists received anecdotal informationthat indicating moose changed their visitation pattern to avoid constant viewing along Route 3 in Pittsburg .

Similar questions warranting further study have been identified by other researchers. Manfredo et al. (1995) identified four areas of human-wildlife interactions in need of examination. The first was understanding factors that lead to human-wildlife interactions and the relationship between knowledge about wildlife and unintended impacts. The second area was identifying factors that dictate the flow and nature of interactions between humans and wildlife, and the third was concerned with the types of short and long-term effects resulting from such interactions. Finally, they suggested examining the extent to which managers can influence and control recreation-wildlife interactions.

The planning phase of the viewing area project provided the opportunity to design a research project that would explore specific questions regarding this site and contribute to the general knowledge about wildlife viewing. Baseline biological data collected on moose and other wildlife using the area prior to construction could be compared with data collected after construction. Because the site would have a parking area, trail, and viewing blind, there was a focal point to collect sociological data about visitors and their behavior. The integration of biological and sociological portions of the study would provide a unique and necessary approach to best address management of wildlife viewing areas.

Research Objectives

The overall objective of this study was to integrate sociological and biological data collected about wildlife viewing, wildlife viewers, and viewed wildlife to assess potential impacts and develop recommendations for management of wildlife viewing areas as part of a wildlife viewing managment plan. Specific objectives were:

1) to compare whether moose changed their rate and time of visitation at the salt lick after construction of the wildlife viewing site,

2) to survey wildlife viewers to determine their demographics, knowledge level, motivation for wildlife viewing, and attitudes toward

specific wildlife viewing management techniques,

3) to determine whether there was a predictable response by moose to viewing behavior and other human-caused stimuli,

4) to utilize information from this research to develop optimal management protocols for wildlife viewing sites, and

5) to measure the presence of vertebrate wildlife inhabiting the wildlife viewing site and proximate habitat during pre- and post-construction.

Study Area

The viewing site was located to the east of Dixville Notch on Route 26 (Fig. 1). A four hectare area inclusive of the viewing area was harvested (clearcut) in 1991, and was characterized by a regenerating northern hardwood/spruce-fir forest community. A buffer strip of mature balsam fir (*Abies balsamea*) and red spruce (*Picea rubra*) was left on both sides of the road and a section of Clear Stream ran through the south side of the study area. The main salt lick was approximately 175 m long on the north side of the road and a smaller lick approximately 70 m long the south side. Roadside salt licks are created from runoff salt used to clear roadways in winter.

A six car parking lot, trail, and viewing blind were built in December 1996. Construction occurred in December because moose reduce their use of licks after the rut (Adams 1995). A trail approximately 125 m in length led to a viewing blind that held up to twenty people. The viewing blind had slits which faced the main lick and a moose trail that entered the lick from the

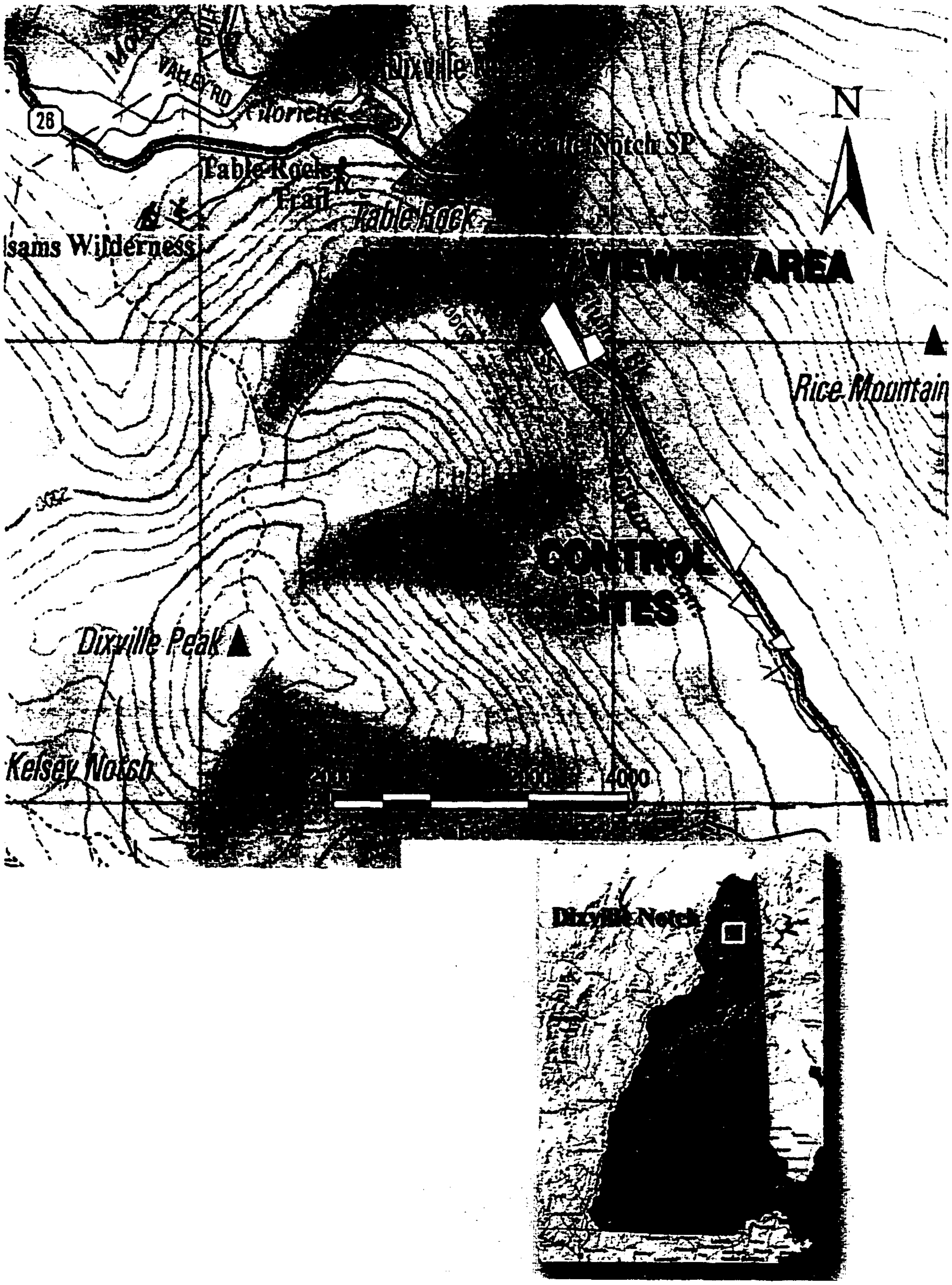

Figure 1. Dixville Notch Wildlife Viewing Area study site and control site located on Route 26, in Dixville Notch, New Hampshire.

east. A kiosk at the parking lot had information about wildlife viewing ethics, services in the area, and nearby designated viewing sites. Seven educational signs were located along the trail and covered topics about wildlife management, wildlife found in the area, suggestions for successful wildlife viewing, and viewing etiquette. In the viewing blind were two signs that provided specific information about moose.

The control site (Fig. 1) consisted of two salt licks approximately 200 m and 50m long, 1.5 km east of the viewing site. The similarity between the viewing and control site was ascertained by comparing aerial photographss which showed the original spruce and balsam fir vegetative composition before timber harvest. The control site was cut one year after the study site. The primary soil types for both sites were 520B (Machais fine sandy loam) and 632A (Micholveill very fine sandy loam) with soil in the lick areas having a wetland classification of PSS1 (Palustrine, scrub-scrub, broad leaved deciduous). Both sites were frequented regularly by moose. A minor difference between the viewing and control sites was that the two salt licks at the control sites were approximately 0.2 km from the proximate clearcut.

Plan of the Dissertation

The dissertation consists of five chapters. The first three chapters focus on human and wildlife data collected at the study area. Each of these chapters include a literature review, rationale, objectives, methods, results, discussion, and conclusion. More specifically, Chapter 1 examines the impact of wildlife viewing on moose use of a roadside salt lick. Chapter 2 describes the characteristics, motivations and attitudes of wildlife viewers who stopped at the Dixville Notch Wildlife Viewing Area. Moose responses to wildlife viewing activities and other human caused stimuli are the focus of Chapter 3. Chapter 4 explores how human dimensions information has historically been integrated into wildlife management and discusses an interdisciplinary approach. It also examines this study with suggestions for further research. The final chapter summarizes findings from this study with recommendations for inclusion in a wildlife viewing management plan using a more traditional approach of research, management, and education. Appendix V and VI contain information on the presence of small mammals, birds, amphibians, and reptiles found on the study area.

Literature Cited

Adams, K.P. (1995). Evaluation of moose population monitoring techniques and harvest data in New Hampshire. MS Thesis. University of New Hampshire.

Boyle, S.A. And F.B. Samson.(1985). Effects of nonconsumptive recreation on wildlife: a review. Wildlife Society Bulletin

Cole, D.N., and R.L. Knight. (1991). Wildlife preservation and recreational use: conflicting goals of wildland management. Transactions of 56th North American Wildlife and Natural Resources Conference 56:233-237.

Decker, D.J., T.L. Brown, B.L. Driver and P.J. Brown. (1987). Theoretical developments in assessing social values of wildlife:toward a comprehensive understanding of wildlife recreation involvement. Pages 76-95 in D.J. Decker and G.R.Godd, eds., Valuing wildlife: economic and social perspectives. Westview Press Inc., Boulder, Colorado.

_______, T.L. Brown, N.A. Connelly, J.W. Enck, G.A. Pomerantz. K.G. Purdy, and W.F.Siemer. (1992). Toward a comprehensive paradigm of wildlife management: integrating the human and biological dimensions. American Fish and Wildlife Policy: The HumanDimension. W.T.Mangun (ed). Southern Illinois University, Carbondale.

Duda M.D. And K.C.Young. (1993). Wildlife viewing in Maryland: participation, opinions and attitudes of adult maryland residents toward a watchable wildlife program. Responsive Management, Harrisburg, VA.

_______, S.J. Bissell and K.C. Young. (1998). Wildlife and the American mind-public opinion on attitudes toward fish and wildlife management. Responsive Management. Harrisonburg VA.

Duffus, D.A. and P.Dearden. (1990s). Non-consumptive wildlife-oriented recreation: a conceptual framework. Biological Conservation 53:213-231.

Flather, C. H. and H.K.Cordell. (1995). Outdoor recreation:historical and anticipated trends. Wildlife and Recreationists: Coexistence Through Management and Research. R.L. Knight and K.J. Gutzwiller (eds.). Island Press, Washington D.C.

Hendee, J.C. (1969). Appreciative versus consumptive uses of wildlife refuges: studies of who gets what and trends in use. Transactions of the 34th North American Wildlife Conference 34:252-264.

______(1974). A multiple satisfaction approach to game management. Wildlife Society Bulletin 2(3):104-113.

______, R.P.Gale, and W.R. Catton Jr. (1971). A typology of outdoor recreation activity preferences. Journal of Environmental Education 3(1):28-34.

Hicks, L.L., J.M. Elder. (1979). Human disturbance of Sierra Nevada bighorn sheep. Journal of Wildlife Management 43(4): 909-915.

Hudson, W. Ed.(1992). NatureWatch. Falcon Press, Helena, Montana. 199 pp.

______ and D.N. Cole. (1991). Effects of recreational activity on wildlife in wildlands. Transactions of 56th North American Wildlife and Natural Resources Conference 56:238-247.

Knight, R.L. and S.A.Temple. (1986a). Why does intensity of avian nest defense increase during the nesting cycle. Auk 103:318:327.

______ and S.A. Temple. (1986b). Nest defence in the American goldfinch. Animal Behavior 34:887-897.

Kuss, F.R., A.R. Graefe and J.J. Vaske.(1990s), Visitor Impact Management, a review of the research. Vol 1 and 2, National Parks and Conservation Association, Washington, D.C.

Larson, R.A. (1995). Balancing wildlife viewing with wildlife impacts: a case study.Wildlife and Recreationists: Coexistence Through Management and Research. R.L. Knight and K.J. Gutzwiller (eds.). Island Press, Washington D.C.

Lyons, J.R. (1982). Nonconsumptive wildlife-associated recreation in the U.S.: identifying the other constituency. Transactions of the 47th North American Wildlife Conference 47:677-685.

MacArthur, R.A., V. Geist, and R.H. Johnston. (1982). Cardiac and behavioral responses of mountain sheep to human disturbance. Journal of Wildlife Management 46:351-358.

Manfredo, M., J.J. Vaske and D.J. Decker. (1995). Human Dimensions of wildlife management: basic concepts.Wildlife and Recreationists: Coexistence Through Management and Research. R.L. Knight and K.J. Gutzwiller (eds.). Island Press, Washington D.C.

Mangun, J.C., J.T.O'Leary and W.R. Mangun. (1992) Nonconsumptive recreation in the United States identity and dimension. American Fish and Wildlife Policy: The Human Dimension. W.R. Mangun (ed.). University of Southern Illinois. Carbondale IL.

More, T.A.(1979). The demand for nonconsumptive wildlife uses: a review of the literature. USDA Forest Service General Technical Report NE-52, Broomall, PA.

New Hampshire Office of State Planning. (1994).New Hampshire Outdoors 1994-1999: Statewide Comprehensive Recreation Plan. Concord, NH.

Peterson, R.L. (1955). North American moose. University Toronto Press, Toronto Ontario. 280 pp.

Pomerantz, G.A., D.J. Decker, G.R.Goff and K.G.Purdy. (1988). Assessing impact of recreation on wildlife:a classification scheme. Wildlife Society Bulletin 16:58-62.

Schwartz, C.C. And L.A. Renecker. (1997) Nutrition and energetics. Ecology and management of North American moose. Franzmann, A..W. And C.C. Schwartz (eds) . Smithsonian Institution Press, Washington D.C. p. 475.

Silverberg, J.K. (1992).A New Hampshire watchable wildlife concept paper. Report prepared for NH Fish and Game Department. Concord. NH.

United State Department of Interior, Fish and Wildlife Service and US Department of Commerce, Bureau of Census. (1997). 1996 national survey of fishing, hunting and wildlife associated recreation. Washington D.C.

Vaske, J.J. and D.J. Decker and M.J. Manfredo. (1995). Human Dimensions of Wildlife Management: An integrated framework for coexistence. Wildlife and Recreationists: Coexistence Through Management and Research. R.L. Knight and K.J. Gutzwiller (eds.). Island Press, Washington D.C

Vickerman, S. (1989). Watchable wildlife: a new initiative. Defenders of Wildlife.17 pp.

CHAPTER ONE

IMPACTS OF WILDLIFE VIEWING ON MOOSE USE OF A ROADSIDE SALT LICK

This chapter examines potential impacts of wildlife viewing on moose use of a roadside salt lick. The literature review considers impacts of nonconsumptive wildlife users and the activities they engaged in on a variety of wildlife species. The rationale and objectives of the study are followed by description of the research, methods, interpretation of the results, ensuing discussion, and conclusions relative to management of a moose viewing site.

Impacts of Nonconsumptive Wildlife Activities

Nonconsumptive wildlife users such as wildlife watchers consume and disturb recreational resources along spatial, visual, and physical dimensions. Disturbances may be intentional or unintentional; unintentional disturbances often occur when photographing wildlife, viewing nesting birds, or hiking into an animal's territory (Knight and Cole 1991, 1995). Unintentional impacts also include direct harassment of animals or alteration of habitat (Kuss et al. 1990). Recreational activities can result in habitat modifications by disturbing vegetation and soil that change microhabitats and microclimates (Dale and Weaver 1972). Nonconsumptive users trample and rearrange vegetative patterns, disturb wildlife behavior and activity, and are the chief distributors of refuse across the land (Goldsmith 1974, Wilkes 1977).

Geist (1978) suggested that in order to maximize productivity of big game, harassment of a managed population must be severely reduced.

Harassment is the term applied to actions which may cause arousal in one situation, but may lead to panic, exertion, or death of the individual in another situation. Harassment can elevate metabolism at the cost of energy resources and reserves needed for an animal's normal growth and reproductive potential; harassment can cause death, illness, or reduced reproduction due to secondary effects from physical exertion and temporary confusion. Harassment can also cause avoidance or abandonment of areas, reduction in a population's range, and ultimately, reduction in population due to loss of access to resources, increased predation, or increased energy cost for existence (Geist 1978).

Kuss et al. (1990) summarized recreational impacts on wildlife into four categories: 1) impact interrelationships are direct impacts best described by the term harassment and indirect impacts that result from changes in habitat; 2) use impact interrelationships are when the number of people in an area plays a smaller role than other selected characteristics of recreational use such as frequency of use, type of use, and the behavior of the visitor; 3) varying tolerance impacts are the way that wildlife species and individual animals differ in their tolerance of interactions with people; 4) site specific influences are affected by a variety of environmental and seasonal conditions.

Knight and Cole (1991, 1995) described four ways that recreational activities impact animals; harvesting, habitat modification, pollution (leaving litter and garbage or affecting air quality from automobile emissions while visiting a site), and disturbance. Pomerantz et al. (1988) developed a classification of recreational use impact on wildlife with refuge managers in the northeastern United States. Their six categories of impact were: direct mortality, indirect mortality, lowered productivity, reduced use of the refuge, reduced use of preferred habitat on refuges, and aberrant behavior or stress.

Human disturbance can result in changes in wildlife physiology, behavior, reproduction, population levels, and species composition and diversity (Knight and Cole 1995). There is no uniform relationship between the amount of human disturbance caused by recreational use and wildlife population variables. Some species have declined as a result of increasing recreational activity, while others have increased in abundance. The response to human disturbance resulting from recreational activities is neither uniform nor consistent (Kuss et al. 1990).

Research on the impacts of nonconsumptive recreation has been focused in parks, forests, wilderness, and other types of recreation areas where the primary activities were camping, hiking, boating, or backpacking; limited research has occurred relative to wildlife viewing. A large body of research has focused on a variety of recreational impacts on birds. Cole and Knight (1991) described how recreation could affect species diversity depending on the severity of recreational disturbance and the spatial scale and level of the biological hierarchy for which diversity is described. Skagen et al. (1991) found that human disturbance reduced species diversity in an avian scavenging guild. Studies in the Netherlands showed a significant negative correlation between recreational intensity and population density of certain bird species (van der Zande et al 1984a, 1984b). Beach nesting birds suffer habitat loss, mortality, displacement, and reduced reproductive success from recreation (Burger 1995). Songbirds may alter their behavior after repeated interactions with humans (Knight and Cole 1995); singing behavior of certain songbirds was altered by low levels of human intrusion (Gutzwiller 1994). Mathiesen (1968) noted that human disturbance could interfere with food gathering and cause unrest among bald eagles, and Stalmaster and Newman (1978) found that bald eagles were most sensitive to human interference while feeding.

Recreational activities can cause a variety of responses in large mammals. Hikers approaching Sierra Nevada bighorn sheep (*Ovis canadensis californiana*) from above solicited a stronger behavioral response than those approaching from downslope (Hicks and Elder 1979). MacArthur et al. (1982) reported elevated heart rates and flight in bighorn mountain sheep (*Ovis canadensis canadensis)* approached by hikers but minimal reactions to vehicular traffic. They concluded that bighorn sheep responded minimally to predictable human disturbance.

Griffiths and VanSchaik (1993) examined the impact of intense human foot traffic in a tropical rain forest on the abundance and activity periods of wildlife by comparing the large mammal communities of two lowland areas in and near the Gunung Leuser National Park of northern Sumatra, Indonesia. They found that some animals avoided the heavily traveled area, and at least one species became nocturnal. They suggested caution when proposing ecotourism areas, with careful consideration of areas with wildlife vulnerable to disturbance by human traffic.

The effect of road traffic was examined in Denali National Park, Alaska, from 1973-1983 when there was a 50% increase in daily vehicular traffic on the main park road. This elevated traffic volume was correlated with a 72% decrease in moose (*Alces alces*) sightings and a 32% decrease in grizzly-bear (*Ursus arctus* *horriblis*) sightings per trip; sightings of Dall sheep (*Ovis dalli*) and caribou (*Rangifer tarandus*) were unaffected (Signer and Beattie 1986).

A number of studies have documented disturbance of wildlife by winter recreational activities. In Yellowstone National Park, elk (*Cervis elaphus)* moved an average of 1,765m when approached within 400m by cross country skiers (Cassirer et al. 1992). In Minnesota, Dorrance et al. (1975) found that snowmobile traffic displaced white-tailed deer (*Odocoileus virginianus*) from areas immediately adjacent to snowmobile trails and increased their home range in some cases. In contrast, Eckstein et al.(1979) found no changes in home range of deer in Wisconsin, but found that snowmobiling caused some deer to leave the immediate vicinity of snowmobile trails. Snowmobile traffic in Wyoming influenced the behavior of moose (*Alces alces*) within 300m of a trail by displacing them to less favorable habitats (Colescott and Gillingham 1998).

Rationale for Dixville Notch Study

Moose are strongly attracted to supplementary sodium during spring and early summer in large parts of their North American range (Fraser 1979), and commonly use roadside salt licks in New Hampshire that are created from runoff of salt spread on roadways in winter (Miller and Litvaitis 1992). Such areas provide excellent places to view moose during May, June, and July and their high visibility has created a strong interest in moose viewing throughout northern New Hampshire.

Northern New Hampshire and Maine are well known places to view moose and the wildlife viewing programs of both states have published guides for wildlife viewing. Unfortunately, many viewing opportunities occur along roadsides during summer, and traffic congestion regularly occurs in certain locations. Anecdotal information from moose viewers on Route 3 in Pittsburg, NH, a popular moose viewing area, suggested that moose shifted use of salt licks to late night to avoid disturbance from viewers. Limited research has been conducted on impacts of wildlife viewing in situations such as that associated with moose viewing in northern New Hampshire.

The wildlife viewing program of the New Hampshire Fish and Game Department proposed construction of a moose viewing area on Route 26 in Dixville Notch to provide viewers with an opportunity to view moose from a blind as an alternative to viewing from their cars along the roadside. The planning phase of this project provided the opportunity to design a research project that would explore specific questions about the use of roadside salt licks by moose at a state-sanctioned wildlife viewing facility. Specifically, the impact of the facility and viewing activities could be assessed by monitoring moose activity pre- and post- construction.

Objectives

This study was designed to determine if the visitation rate and time of use by moose at the salt lick in Dixville Notch were affected by the construction and subsequent use of the wildlife viewing area. Specific objectives were:

1) to compare if there was a change in visitation rate of moose at the Dixville Notch salt lick after construction of the wildlife viewing area,

2) to compare if there was a change in the time of day moose visited the Dixville Notch salt lick after construction of the wildlife viewing area, and

3) to compare the rate and time of day moose visited the Dixville Notch salt lick to a salt lick at a nearby control site.

Viewing and Control Sites

The viewing site was located to the east of Dixville Notch on Route 26 (Fig. 1, 2). This 4 hectare area, inclusive of the viewing site, was harvested (clearcut) in 1991 and was characterized by a regenerating northern hardwood/spruce-fir forest community. A buffer strip of mature balsam fir (*Abies balsamea*) and red spruce (*Picea rubra*) was left on both sides of the road. A section of Clear Stream ran through the south side of the viewing area, the primary salt lick, about 175m long, was on the north side of the road, and a smaller lick, about 70m long was on the south side.

A six car parking lot, trail, and viewing blind were built in December 1996. Construction occurred in December because moose reduce their use of licks after the fall rut (Adams 1995). A trail approximately 125m long led to a viewing blind that held up to twenty people. The viewing blind had slits which faced the main lick and a moose trail that entered the lick from the east.

The control site consisted of two roadside salt licks (200m and 50m long) 1.5 km east of the viewing site (Fig. 3). The similarity between the two sites was ascertained by comparing aerial photos which showed that both were predominately spruce-fir forest before harvest; the control site was clearcut one year after the study site. The control site salt licks were approximately 0.2 km from the proximate clearcut. Both sites were frequented regularly by moose.

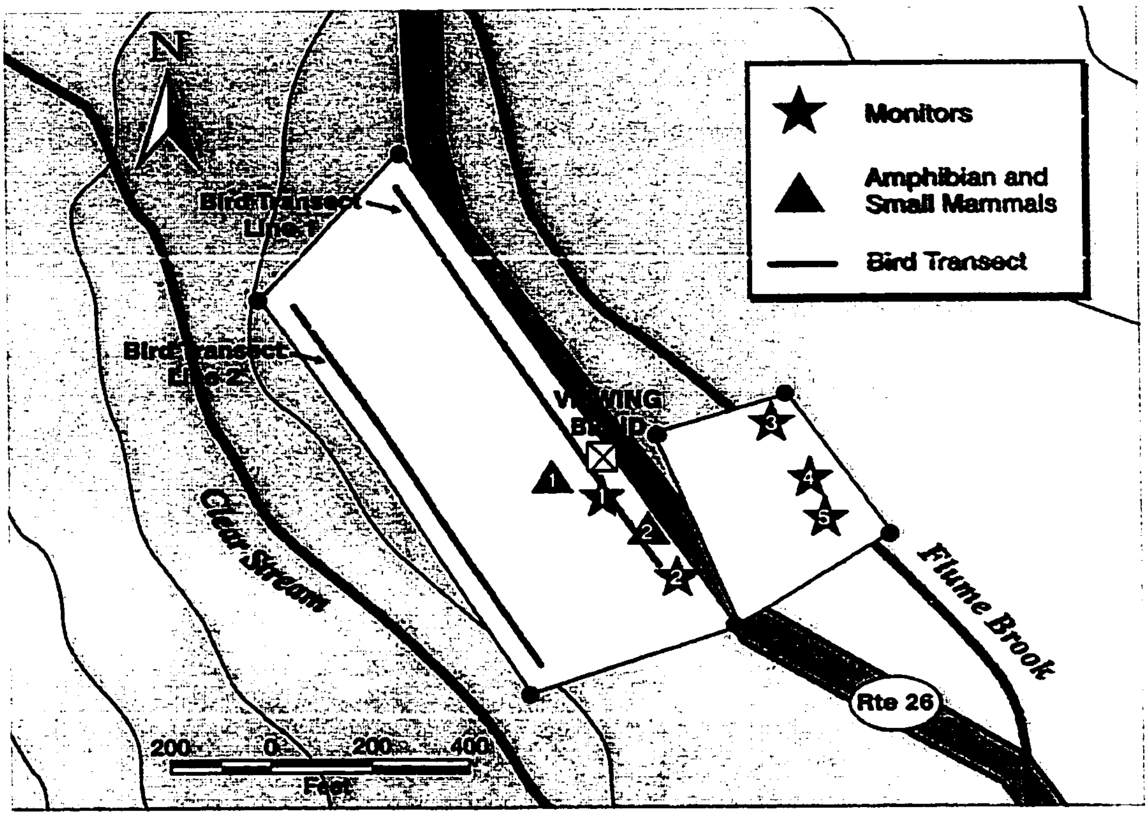

Figure 2. Map of study area (wildlife viewing site) depicting location of trailmaster monitors in Dixville Notch, NH.

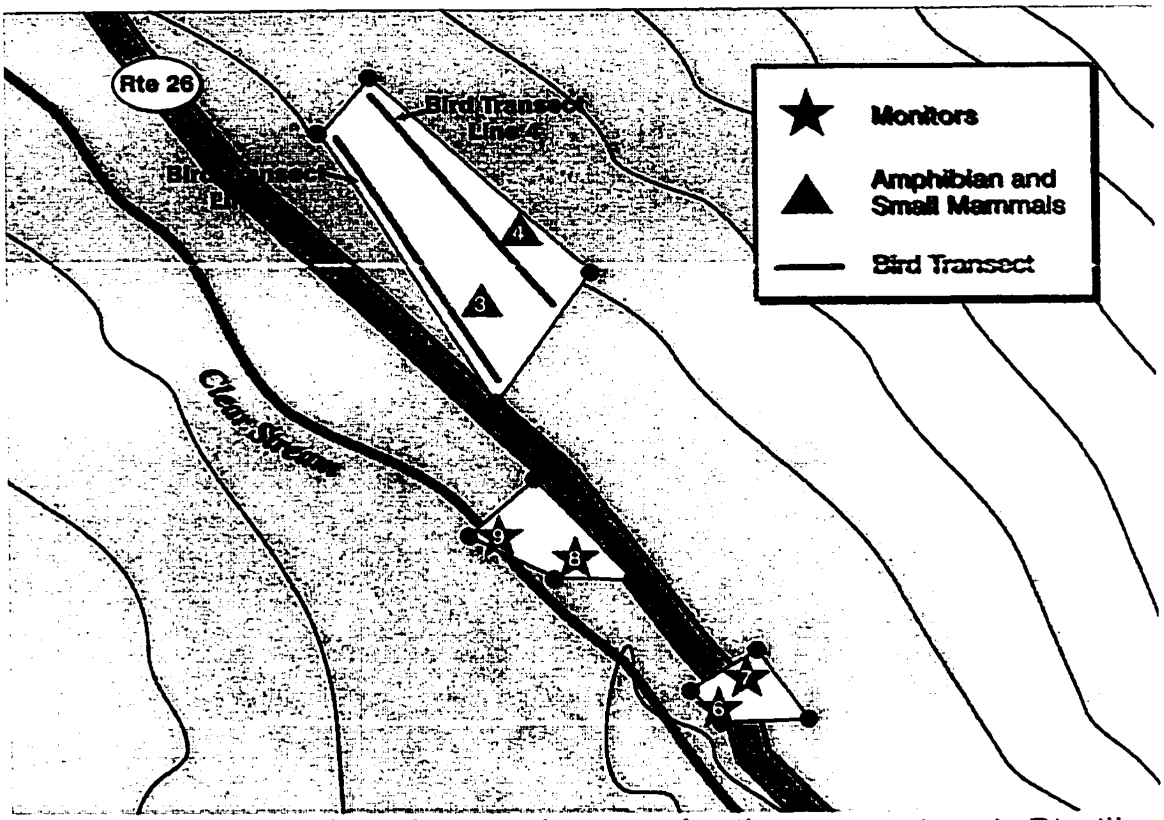

Figure 3. Map of control site depicting location of trailmaster monitors in Dixville Notch, NH.

Methods

Trailmaster 1500 game monitors were used to measure the visitation rate and time of use of salt licks by moose. The monitors are ideal for monitoring moose and other mammal movements because measurement is continuous and potential interference from observers is eliminated (Kucera and Barrett 1993). These monitors were used to measure moose use of salt licks in Pittsburg and Milan, New Hampshire during 1994-1995 (Adams 1995). A monitor consisted of a transmitter which emitted an infrared beam to a receiver that tripped an automatic 35 mm camera. When an animal walked through the beam, the receiver recorded the date and time, and the camera took a picture. A maximum of 1,000 events could be stored by the monitor. The sensitivity of the trigger and the length of time the beam must be broken to register an event was adjusted to 0.05 seconds, and a photograph was taken every 2 seconds. Date and time were recorded on each photograph. The cameras had flashes and professional high speed (ASA1600) film was used to ensure an image was recorded at night.

Five monitors were placed at the viewing site (#1-5) and four monitors were placed at the control sites (#6-9) simultaneously (Fig. 2 and 3). The licks at the control site were considered as one due to their proximity and their interconnected moose trails.

Because the location of monitors was crucial to provide maximum information (Kucera and Barrett 1993), they were located on major moose trails entering the licks. A monitor and receiver camera package were placed on a tree or stake on the opposite sides of a well established trail (Fig. 4). Specific placement took advantage of localized terrain, trail characteristics, and

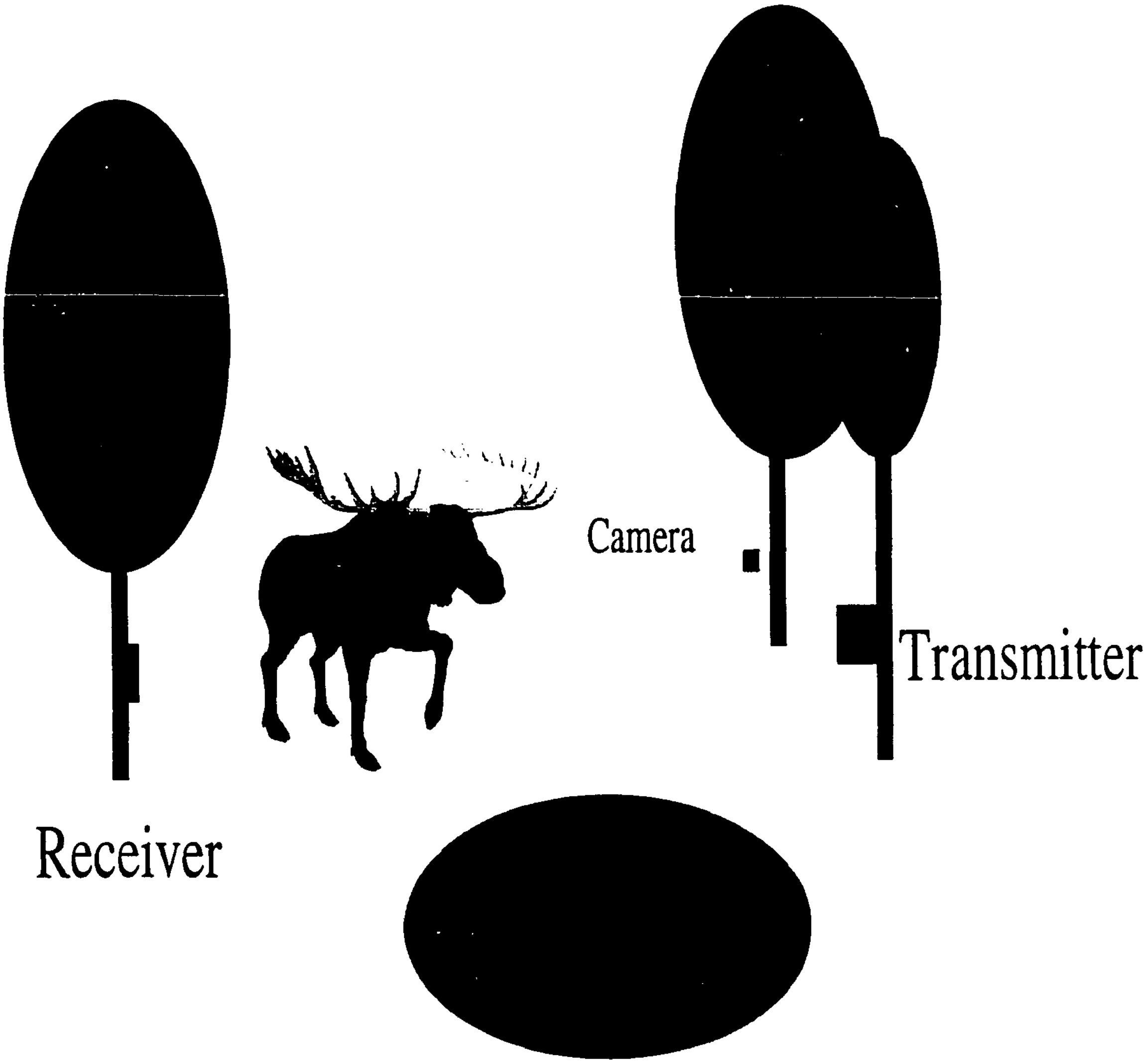

Figure 4. Depiction of infrared trail monitor and camera used to determine rates and time of visitations to the salt licks at the viewing and control site in Dixville Notch, NH, 1996-1999.

surrounding vegetation. Care was taken to ensure that sunlight and blowing vegetation didn't break the infrared beam thus triggering the camera. Monitors were placed at heights of 30-75 cm to also record the presence of medium-sized mammals (e.g., white-tailed deer, bear (*Ursus americanus*), and coyote (*Canis latrans*)). Monitors were placed in the same location each year.

Data from the monitors were collected from 10 June-14 July during 1996-1999. Monitors were checked twice weekly when data were downloaded and recorded in a logbook; film was replaced as needed. The date and time stamp on the developed film was compared to the information recorded by the monitor. The data were entered into a spreadsheet indicating the monitor number, year of the study, time, date, whether there was a photograph, whether an animal was seen on the photograph, identity of animal, and sex and age of moose (if possible). Judgements were made to eliminate multiple data collected in a short period of time caused by a stopped animal, or an animal moving in and out of the lick within a two minute period. For example, if the monitor recorded ten passes within two minutes, and photographs indicated that it was the same moose, only one visit was counted. Moose were not marked, consequently, there was no way to determine how many times a particular moose entered a lick, or if the same moose used the area annually.

In situations when a camera ran out of film, but events were recorded at similar frequencies as when photographs indicated single visits, these events were classified as moose visits. It was assumed that a monitor malfunctioned when it recorded hundreds of events per day. Malfunction was apparent during periods of heavy rain or wind.

Weather data including daily high temperature and precipitation were obtained from the NOAA weather station at the Berlin Airport, Berlin, NH (http://www. noaa.gov). Temperature was compared to weekly visitation rate by year using an ANOVA. Precipitation was averaged by week and then compared to weekly visitation rate using an ANOVA. This information was used to determine if visitation was related to weather conditions.

Data were analyzed using SPSS. Graphs and frequency distributions were used to provide an overall depiction of moose encounters. For ANOVA, moose encounter data were aggregated on a weekly basis by year to test for differences in the number of moose visits at the viewing and control sites annually. Combining data on a weekly basis eliminated the problem of small sample size on any given day. Data of visitation times were aggregated into 12, two-hour time blocks for analysis. This aggregation eliminated potential problems with small sample sizes in any one hour block. Time was described as 14 diurnal hours (0600-2000h) and 10 nocturnal hours (2000-0600h) based on daylight and times when viewers could view moose without artificial light. All statistical test used at a 0.05 level of significance.

Results

The number of moose encounters at the viewing site ($x=228 \pm 16.7$ (mean $\pm$ std. dev.)) and the control site ($x=273.5\pm19.7$) was relatively constant during the four years (Fig. 5). There was no difference in the annual weekly encounter rate from year to year at the viewing site ($F=0.280$, $df=3$, $df=16$, $p=0.839$) or control site ($F=0.712$, $df=3$ $df=16$, $p=0.559$).

Variability occurred at individual monitors at both sites annually (Fig. 6).

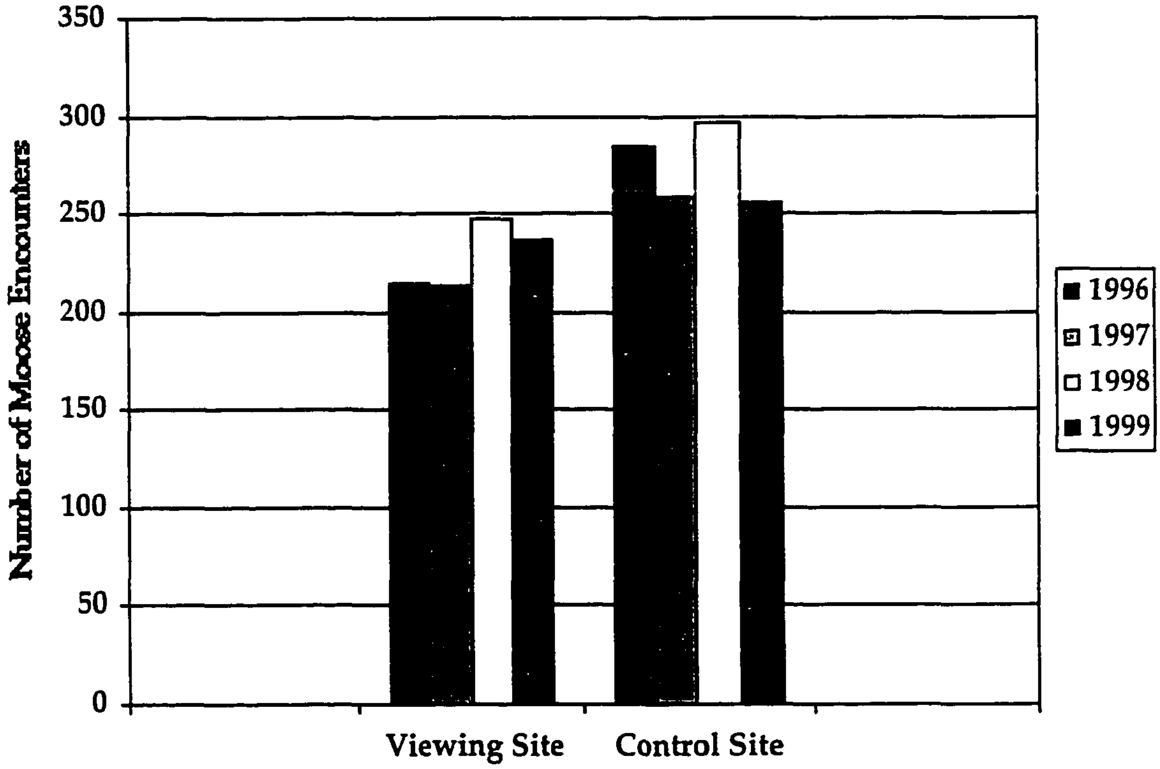

Figure 5. Total number of moose encounters at the viewing and control site 10 June-14 July, 1996-1999 in Dixville Notch, NH.

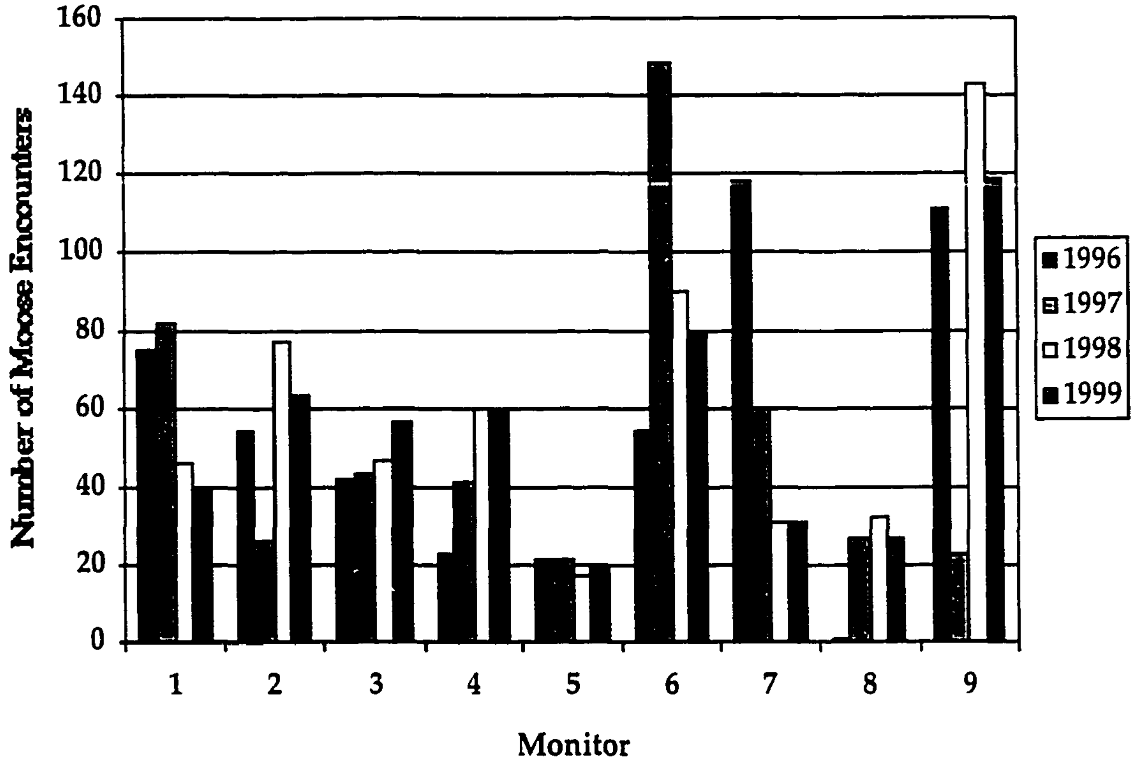

Figure 6. Annual moose encounters per monitor at the viewing site (monitors 1-5) and control site (monitors 6-9), 10 June July, 1996-1999, Dixville Notch, NH.

Monitors 2-4 had more encounters the last two years than the previous years; encounters at monitor 5 were constant. Conversely, monitor 1, located <10m from the viewing blind had about 50% less encounters the last two years (Fig. 6), and the pattern of encounters was different than that at monitors 2 (X^2=52.63, df=3, p=0.000), 3 (X^2=18.44, df=3, p=0.000), 4 (X^2=44.19, df=3, p=0.000), and 5 (X^2=7.810, df=3. 0=0.050). The most dramatic variability in moose encounters occurred at the control site where monitor 6 ranged from 56-148 moose encounters and monitor 9 from 23-142 over the four year period, although no obvious pattern was evident (Fig. 6).

Time of day and number of encounters at the viewing and control sites were graphed (Fig. 7, 8, 9, 10) to assess moose activity at the licks. At the viewing site, more moose encounters occurred nocturnally (n=661) than diurnally (n=182) . Diurnal moose encounters per time block (n=2-19) were also compared to nocturnal encounters (n=15-56). Moose encounters at the viewing site occurred most often between 2200-2400h and 0400-0600 (Fig. 8). There were no significant changes in the diurnal or nocturnal patterns of moose encounters when comparing data from 1996 prior to construction of the viewing blind with data from 1997-1999. No change occurred in visitation rate (F=0.280, df=3, df=16, p=0.839) or time at the viewing site throughout the 24 hour period (F=0.321, df=3 df= 16, p=0.810) (Fig. 7) over the four years. No difference in nocturnal patterns were observed when comparing 1996 to 1997 (X^2=4.20. df=4, p=0.378), 1996 to 1998 (X^2=0.334, df=4, p=0.987), or 1996 to 1999 (X^2=1.21 df=4, p=0.875). No differences occurred in diurnal patterns when

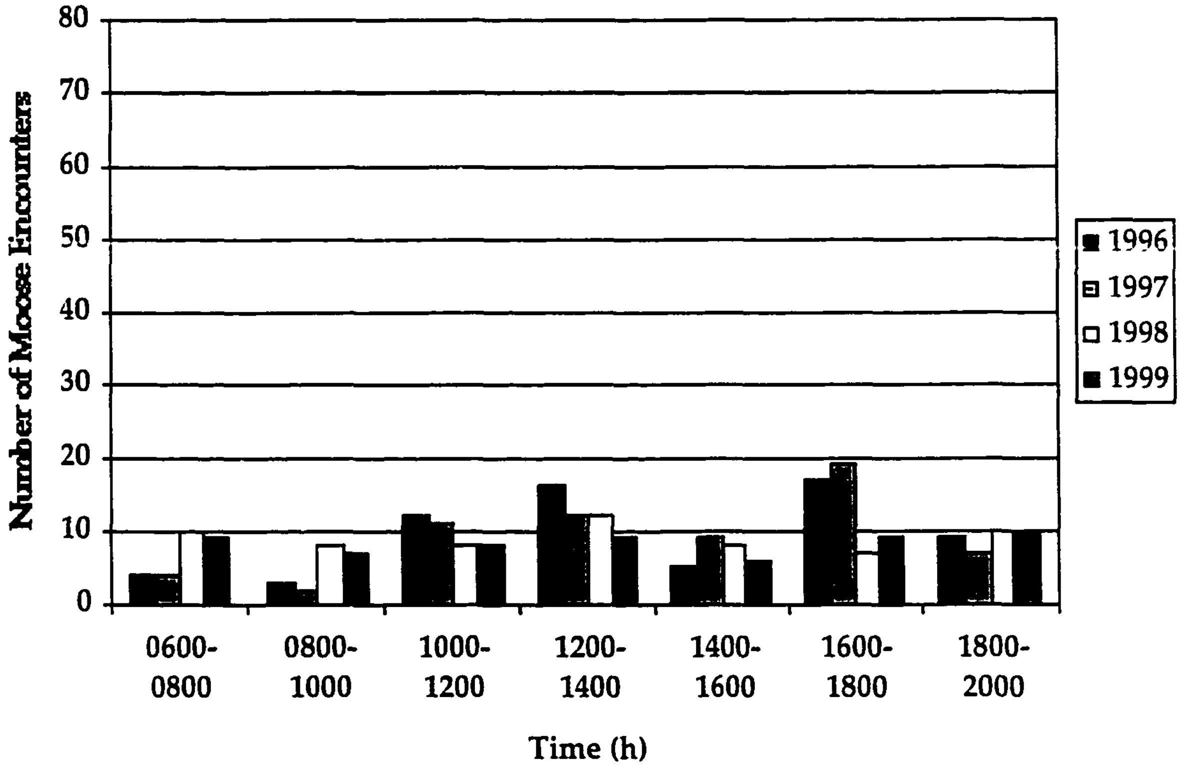

Figure 7. Time and number of diurnal moose encounters at the viewing site by year, 10 June-14 July, 1996-1999, Dixville Notch, NH.

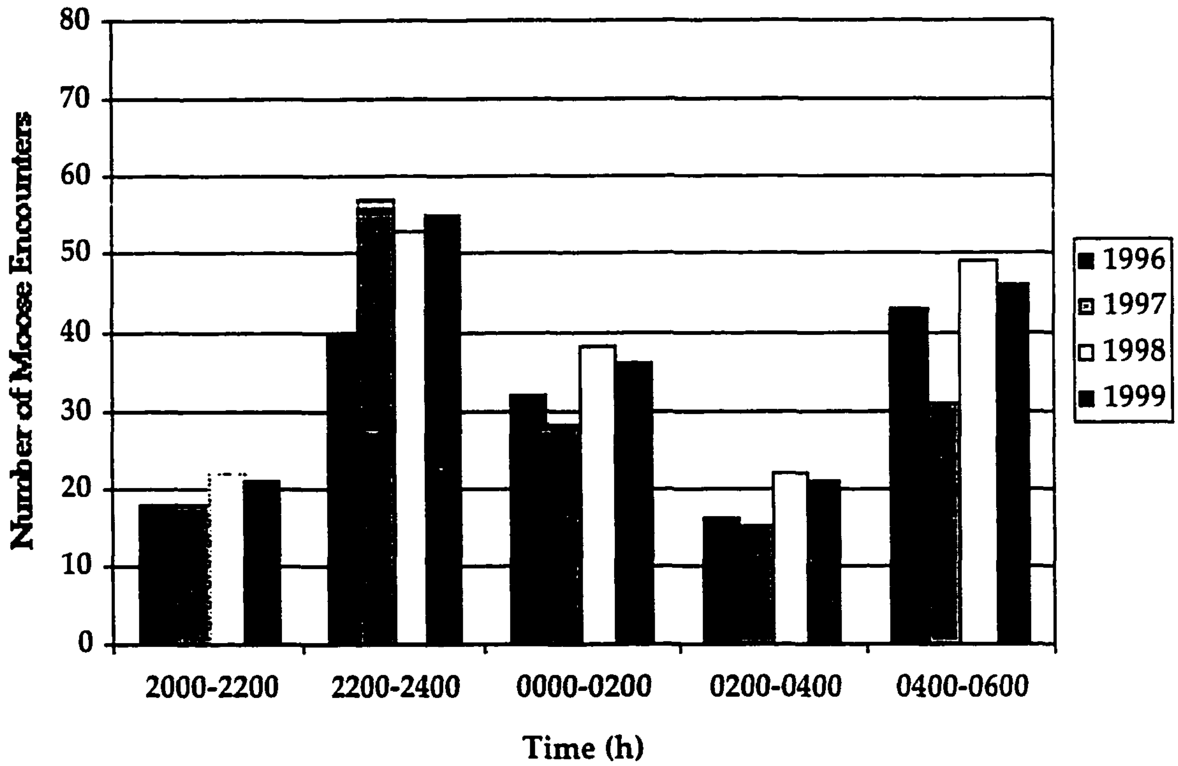

Figure 8. Time and number of nocturnal moose encounters at the viewing site by year, 10 June-14 July 1996-1999, Dixville Notch, NH.

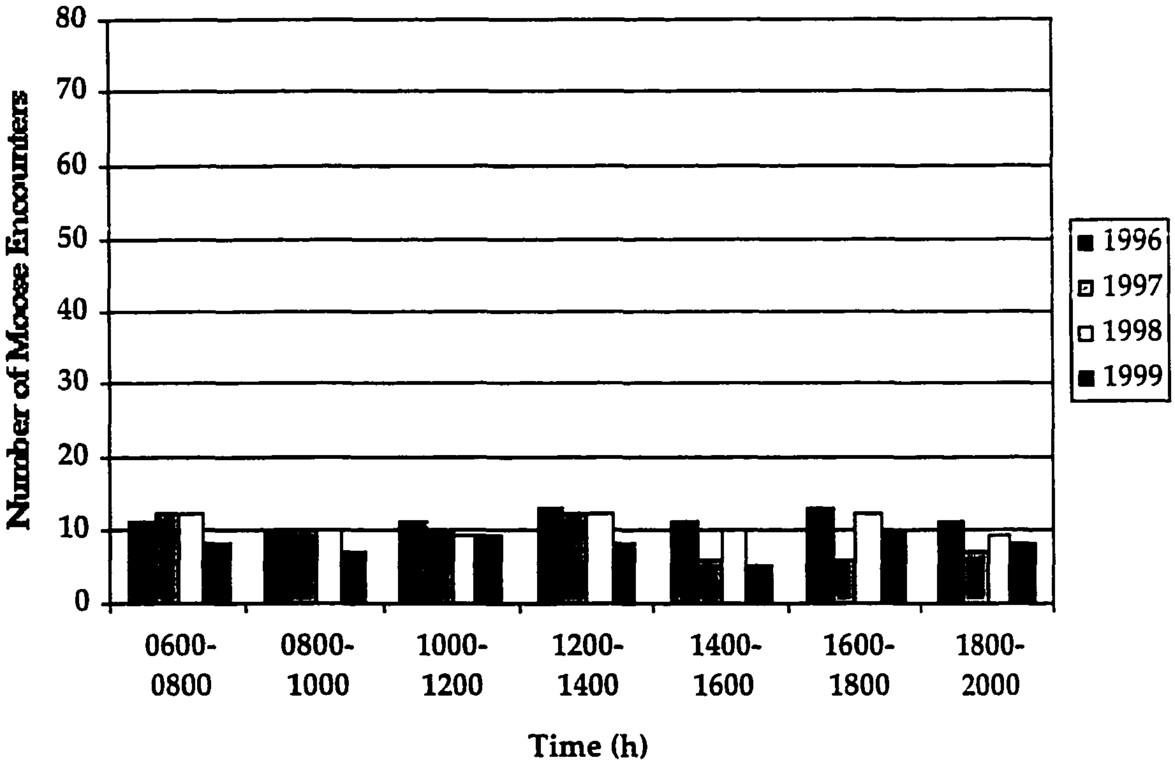

Figure 9. Time and number of diurnal moose encounters at the control site by year 10 June-14 July 1996-1999, Dixville Notch, NH.

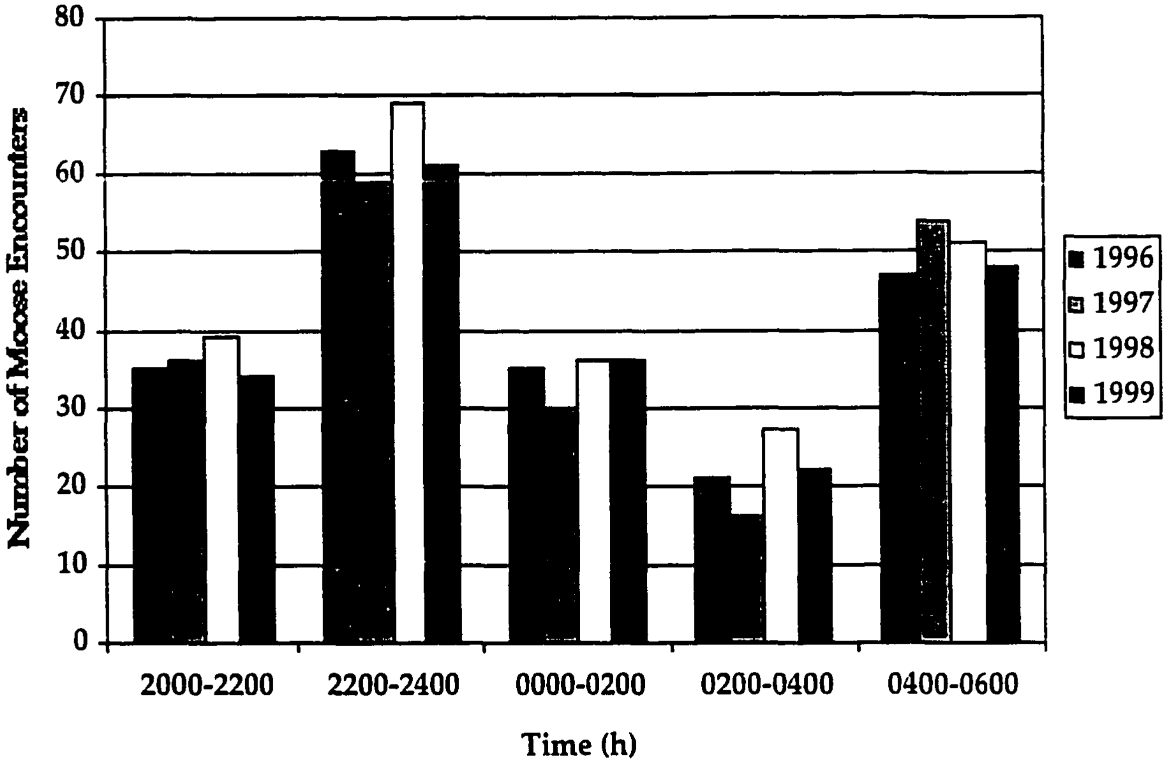

Figure 10. Time and number of nocturnal moose encounters at the control site by year 10 June-14 July 1996-1999, Dixville Notch, NH.

comparing 1996-1997 (X^2=2.28, df=6,p=0.891), 1996 to 1998 (X^2=11.06, df=6, p=0.086), or 1996 to 1999 (X^2=8.40, df=6, p=0.209). However, two trends were apparent including a >50% reduction at 1600-1800h and a greater than two-fold increase at 0600-0800h and 0800-1000h in 1998-1999. Moose encounters were fairly constant over the four years during the 1800-2000h.

More moose encounters occurred nocturnally (n=824) then diurnally (n=194) (Fig. 9 and 10) at the control site. Encounters were most frequent at 2200-2400h and 0400-0600h. The number of diurnal moose encounters was relatively low per time block ranging from 5-13 versus 17-69 nocturnally. No change occurred in weekly visitation rate (F=0.712, df=3 df=16, p=0.559) or time throughout the 24 hour period (F=0.558, df=3 df=16, p=0.643) in any year.
No trends were apparent with annual variability of time and frequency of encounters (Fig. 9 and 10). There was no significant change at the control site in the diurnal patterns when comparing 1996 to 1997 (X^2=2.91, df=6,p=0.892), 1996 to 1998 (X^2=0.337, df=6,p=0.999), or 1996 to 1999 (X^2=0.509, df=6, p=0.999) There was no significant change at the control site in nocturnal patterns of moose encounters when comparing data from 1996 to 1997 (X^2=0.741, df=4, p=0.946), 1996-1998 (X^2=0.552, df=4,p=0.968) or 1996 to 1999 (X^2=0.047, df=4,p=0.999).

There was no annual difference in the time patterns of moose encounters in a 24 hour period at the viewing site versus the control site (F=0.239, df=3 df=16, p=0.787). There was no relationship found between visitation rate and temperature (F=0.780, df=3 df=16, p=0.681) or precipitation (F=0.543, df=3 df=16, p=0.628).

Discussion

The total number of moose encounters fluctuated slightly over the four year time period at the viewing and control sites. While there was no overall effect on encounter rates at the viewing site, the decline at monitor 1, located <10m from the viewing blind, indicated that an increase in wildlife viewing near the entry trail probably caused moose to enter the lick from other trails. Impact could be minimized by addressing movement patterns in similar projects.

The most active time for moose at the control and viewing sites was 2000-0600h. There was no evidence moose changed their nocturnal visitation patterns as was suggested might occur from anecdotal information from Pittsburg, NH, where moose viewing has been a popular pastime since the mid-1980s. It should be noted that most viewing in Pittsburg occurs at night with the use of spotlights and viewing pressure is so intense on weekends that traffic jams are common on Route 3 north of Pittsburg.

The general pattern of visitation was similar to that at licks on Route 3 in Pittsburg and on Route 110 in Milan from 10 June- 14 July 1994 (Adams 1995). Comparative data indicated that most visits occurred nocturnally, or at 2000-0600h at all sites and peak visitation occurred between 2200-2400h at all sites (Fig. 11).

There was a striking lack of overlap between presence of moose in the licks and potential viewing opportunity. Moose were most active nocturnally at the viewing site particularly at 2200-2400h and 0400-0600h. There were several interesting changes in encounter numbers, although none statistically significant, relative to diurnal moose visitation at the viewing site during the four years of the study. These included a more than two-fold increase in the number of encounters at 0600-1000h in 1998 and 1999, a > 50% reduction in encounters at 1600-1800h in 1998 and 1999. Further, the three peak diurnal visitation times in 1996 had ≥33% reductions by 1999 (Fig. 7). These reductions in moose visitation occurred during popular viewing times. It should be noted that further examination of the data and photographs after these reductions were found indicated that on at least two occasions the same moose entered and exited the lick twice on one day in 1996 between 1600-1800h and in 1998 between 0600-0800h twice within a ten minute period. Based on the original criteria for moose encounters these were counted as separate encounters even though they may not have actually been separate visits. Although the number of encounters during all diurnal periods was relatively small continued measurements may indicate whether visitations patterns were altered by wildlife viewing.

The overall tolerance of human activity was consistent with observations on Shiras moose (*Alces americana shiras*) in Yellowstone National Park, where moose behavior in an area where tourists were prevalent was compared with moose behavior in an area with few people. Moose at the tourist site showed little interest in humans and appeared to tolerate their presence (McMillan 1954). The aquatic feeding behavior of moose in Sibley Provincial Park, Ontario was only slightly affected by viewing (Cobus 1972a).

Wildlife viewers should be informed their best time to view moose in natural light in June and July is shortly before and after sunrise (0400-0600h) when moose were active at licks. Considering evidence from this and other studies, the impact of increased viewing during these hours should be minimal

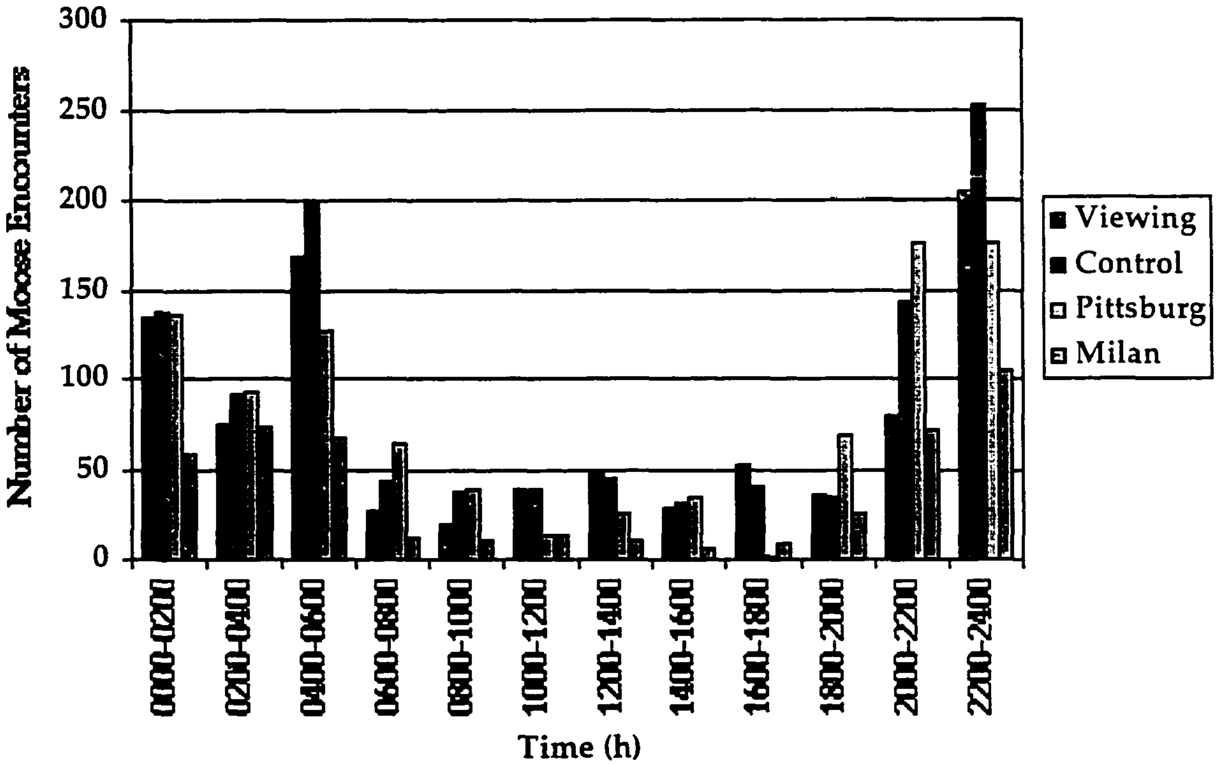

Figure 11. Visitation time of moose to salt licks 10 June-14 July 1994, Pittsburg, NH and Milan, NH and 10 June-14 July 1996-1999 at the viewing and control site in Dixville Notch, NH.

but may warrant further monitoring.

At the viewing site, moose viewing opportunities were relatively low between 0600 and 2000h. Currently, viewer satisfaction levels were not affected by whether they saw a moose (Ch.2). Most viewers were well aware that the best time to view moose is early morning or late in the evening. It is possible that by promoting early morning viewing opportunities, expectation levels of seeing a moose would increase and satisfaction levels could be affected. Further information regarding viewer motivation, knowledge levels and satisfaction levels are discussed in Chapter 2.

Conclusions

Predominant use (72.5%) of the licks occurred nocturnally (2000-600h) pre and post-construction. The viewing area had no significant effect on the weekly visitation rate and time of visitation by moose at the salt lick, however a slight shift in the diurnal pattern toward early morning was noted.

The reduced use of the trail closest to the viewing blind indicated that movement patterns should be recognized prior to modification of a site.

This would ensure that facilities are built in locations that are least likely to change movement patterns into a lick. Encouraging viewers to look for moose as early as sunrise (0400-0800h) should increase viewing success. Promotion of earlier viewing should also include information about proper viewing behavior to assure that viewing impacts remain minimal.

Literature Cited

Adams, K.P. (1995). Evaluation of moose population monitoring techniques and harvest data in New Hampshire. MS Thesis. University of New Hampshire.

Bart, J. (1977). Impact of human visitation on avian nesting success. Living Bird 16:187-192.

Burger, J. (1995). Beach recreation and nesting birds. Wildlife and Recreationist Coexistence through Management and Research. R.L. Knight and K.J. Gutzwiller (eds.) Island Press, Washington D.C.

Cassirer, E.F., D.J. Freddy, and E.D. Ables. (1992). Elk responses to disturbance by cross-country skiers in Yellowstone National Park. Wildlife Society Bulletin 20:375-381.

Climatological data- Berlin Airport 1996, 1997, 1998.http://www. noaa.gov.

Cobus, M.W. (1972a). Moose as an aesthetic resource and their summer feeding behavior. 8th North American Moose Workshop Proceedings. pp. 244-275.

Colescott, J.H. and M.P. Gillingham. (1998). Reaction of moose (*Alces alces*) to snowmobile traffic in the Greys River Valley, Wyoming. Alces 34(2):329-338)

Dale, D. and T.Weaver. (1972). Trampling effects on vegetation of the trail corridors of North Rocky Mountain forests. Journal of Applied Ecology. 11: 767-772.

de Vos, A.(1958). Summer observations on moose behavior in Ontario. Journal of Mammalogy 39(1): 128-139.

Dorrance, M.J., P.J. Savage , and D.E. Huff. (1975). Effects of snowmobiles on white-tailed deer. Journal of Wildlife Management 39:563-569.

Eckstein, R.G., T.F. O'Brien, O.J. Rongstad, and J. G. Bollinger. (1979). Snowmobile effects on movements of white-tailed deer: a case study. Environmental Conservation 6:45-51.

Fraser, D. (1979). Sightings of moose, deer and bears on roads in northern Ontario. Wildlife Society Bulletin 7:181-184.

Geist, V. (1978). Behavior. In Big Game of North America:Ecology and Management. J.L. Schmidt and D.L. Gilbert (eds). Stackpole Books. Harrisburg, PA. pp. 283-296.

Goldsmith, F.B. (1974). Ecological effects of visitors in the countryside. Conservation In Practice, A.Warren and F.B. Goldsmith (eds.). John Wiley and Sons. London. pp. 217-231.

Gotmark, F.(1992). The effects of investigator disturbance on nesting birds, Current Ornithology, R.F. Johnson, ed. Plenum Press, NY Vol. 9: 63-104.

Griffiths, M. And C.P. VanSchaik. (1993). The impact of human traffic on the abundance and activity periods of Sumatran rain forest wildlife. Conservation Biology. Vol.7:3:623-626.

Gutzwiller, K.J. (1994). Effects of intrusion and singing behavior. Auk 111:29-37.

Hicks, L.L. and J.M. Elder. (1979). Human disturbance of Sierra Nevada bighorn sheep. Journal of Wildlife Management 43(4): 909-915.

Knight, R.L.and D.N. Cole. (1991). Effects of recreational activity on wildlife in wildlands. Transactions of 56th North American Wildlife and Natural Resources Conference 56:238-247.

______ and_____. (1995). Wildlife responses to recreationists. Wildlife and Recreationists: Coexistence Through Management and Research. R.L. Knight and K.J. Gutzwiller (eds.), Island Press, Washington D.C.

______ and_____. (1995). Factors that influence wildlife responses to recreationists.Wildlife and Recreationists: Coexistence Through Management and Research. R.L. Knight and K.J. Gutzwiller (eds.). Island Press, Washington D.C.

______ and R.E.Fitzner. (1983). Human disturbance and nest site placement in black-billed magpies. Journal of Field Ornithology 56(2):153-157.

______ and S.A.Temple. (1986a). Why does intensity of avian nest defense increase during the nesting cycle. Auk 103:318:327.

______ and_____. (1986 b). Nest defence in the American goldfinch. Animal Behavior 34:887-897.

Kucera, T.E. and R.H. Barrett. (1993). The trailmaster camera system for detecting wildlife. Wildlife Society Bulletin 21:505-508.

Kuss, F.R., A.R. Graefe and J.J. Vaske.(1990), Visitor Impact Management, a review of the research. Vol 1 and 2, National Parks and Conservation Association, Washington, D.C.

MacArthur, R.A., V. Geist, and R.H. Johnston. (1982). Cardiac and behavioral responses to human disturbance. Journal of Wildlife Management 46(2):351-358.

Major, R.E. (1990). The effect of human observers on the intensity of nest predation. Ibis 132:608-612.

Mathieson, F.E. (1968). Effects of human disturbance on nesting of bald eagles. Journal of Wildlife Management 32(1):1-6.

McMillan, J.F. (1954). Some observations on moose in Yellowstone Park. American Midland Naturalist 52 (2): 392-399.

Miller, B.K. And J.A.Litvaitis. (1992). Use of roadside salt licks by moose, *Alces alces*, in northern New Hampshire. Canadian Field Naturalist 106:112-117.

Pomerantz, G.A., D.J. Decker, G.R.Goff and K.G.Purdy. (1988). Assessing impact of recreation on wildlife:a classification scheme. Wildlife Society Bulletin 16:58-62.

Signer, F.J. and J. B. Beattie. (1986). The controlled traffic system and associated wildlife responses in Denali National Park. Arctic: 195-203.

Stalmaster, M.V. and J. R. Newman. (1978). Behavioral responses of wintering eagles to human activity. Journal of Wildlife Management 42(3):506-513.

van der Zande, A.N., J.C.Berhuizen, H.C. van Latesteijn, W.J. Ter Keurs and A.J. Poppelaars. (1984a). Impact of outdoor recreation on the density of a number of breeding bird species in woods adjacent to urban residential areas. Biological Conservation 30:1-39.

_______ and P.Vos. (1984 b). Impact of a semi-experimental increase in recreation intensity on the densities of birds in groves and hedges on a lake shore in the Netherlands. Biological Conservation 30:237-259.

Wilkes, B. (1977). The myth of the nonconsumptive user. Canadian Field Naturalist 91:343-349.

CHAPTER TWO

CHARACTERISTICS, MOTIVATIONS AND ATTITUDES OF WILDLIFE VIEWERS TO DIXVILLE NOTCH WILDLIFE VIEWING AREA

The goal of this chapter was to examine the human dimensions of wildlife viewers in order to better understand their characteristics, motivations, knowledge levels and attitudes toward wildlife viewing at Dixville Notch Wildlife Viewing Area. This information will be included in the development of a framework for a wildlife viewing management program. The first section of this chapter provides an overview of wildlife viewing and the aspects of cognitive, motivational and satisfaction theory as related to wildlife viewing. The rationale, methods, results and discussion follow. The chapter concludes with implications for integrated management of wildlife viewing sites and wildlife viewers.

Overview of Wildlife Viewing and Human Dimensions

Due to increasing demand for wildlife viewing opportunities (Flather and Cordell 1995), wildlife and land management agencies have expanded "watchable wildlife" or wildlife viewing programs. Providing wildlife viewers with quality viewing opportunities, while building an understanding of wildlife conservation, is the major goal of state wildlife viewing programs. However, understanding who the viewers are, their knowledge levels about the wildlife they watch, their attitudes toward management, and the diverse motivations of the viewing public are important challenges facing wildlife viewing managers. A human dimensions approach with it's roots in social sciences can assist in answering these questions.

Research in the early 1970s formalized the need for knowledge about the behavioral aspects of traditional user groups in order to manage wildlife (Hendee 1969, Hendee and Schoenfeld 1973). On a parallel course, researchers in the field of outdoor recreation began to develop theories and methods directed toward the psychological dimensions of their constituency (Driver and Knopf 1977).

Over the past 20 years, a scientific approach to human dimensions of wildlife has developed. There have been three primary theoretical traditions for approaching the social aspects of wildlife management: economic valuation, cognitive approaches (attitudes, values and norms), and motivational approaches (expectations, outcomes and satisfactions) (Manfredo et al 1995, Decker et al. 1996). This project used cognitive and motivational approaches to determine the knowledge level, attitudes toward management, motivations, and satisfaction level of wildlife viewers at the Dixville Notch Wildlife Viewing area. Standard demographic information was also collected.

<u>Cognitive Approach</u>

The cognitive approach is based on the theory that there is a collection of mental processes and activities that are used in perceiving, remembering, thinking, and understanding. It suggests that people's values determine attitudes and their attitudes affect their behaviors (Fishbein and Ajzen 1975). Basically, cognitive theory examines the process from thoughts to actions.

Values are shaped largely during childhood by environmental surroundings and people with whom there is close contact (e.g. parents, peers, and teachers)(Manfredo et al. 1995). Because attitudes are formed early in life and are tied with one's identity, they are extremely resistant to change (Bem 1970).

Attitudes have been defined in a variety of ways, but a common definition is that attitudes are an evaluation or a feeling stated about a person, object, or action (Manfredo et al. 1995). Attitudes have a cognitive base, referring to information or knowledge an individual holds about a person, object, or action. The knowledge a person has may be right or wrong when measured by other people's standards, but that knowledge serves as the basis of their attitudes.

Attitude surveys can produce better resource management by providing a manager information about user preferences. How useful this information is depends on how these attitudes are related to other variables and the relationship between attitudes and behavior. However, before knowledge of user attitudes can be helpful in the area of social control, you must know something of their organization. If attitudes do not lead to behavior or cannot be modified, they will not be helpful in controlling unwanted behaviors (Heberlein 1973). Some of the earliest work on user attitudes were conducted in wilderness and camping situations (Clark et al. 1971), and in personal value assessment around changing land use issues in Pennsylvania (Groves et al. 1973).

Studies that employ measures of preferences, opinions, perceptions, or images can often be classified as attitudinal investigations (Manfredo et al. 1995) Information from attitude surveys is helpful because it allows wildlife managers to design programs focused on achieving attitude change through changing the beliefs that form the foundations of attitudes. Available to managers are approaches that interpret, inform and educate the public (Manfredo et al. 1995).

There are two tenets taken from cognitive theory that form the basis for a portion of this study.

Tenet 1: Knowledge levels can be measured and affected through use of a variety of techniques.

Tenet 2: Attitudes can be measured and are affected by knowledge. A change in knowledge may lead to a change in attitude. Change in behavior or attitude can be accomplished by changing the beliefs that form the foundation for the attitude.

<u>Motivational Approach</u>

Motivational approaches in human dimensions help identify why people participate in a particular activity, user segments, potential conflicts among users, and possible substitute activities (Manfredo et al. 1995). Motivation is related to topics of needs, satisfactions, and desired outcomes. Motivation has been addressed in the work of need classification theorists who suggest that humans have five levels of need including physiological, safety, belongingness and love, esteem, and the need for self-actualization (Maslow 1970).

Early work in determining activity preferences was conducted by Hendee et al (1971). They proposed a typology of preferred activities that consisted of five conceptually linked groups of activities: appreciative-symbolic, extractive symbolic, passive free play, social leaning, and active expressive (Hendee et al 1971). Crandall (1980) listed 17 types of motivations, many of which came from an item pool developed by Driver (1976). His work clustered motives in four general categories and several single item clusters. They included: 1) extraversion, being with others, being creative; 2) privacy and pastoralism, antigroup experience, liking nature, and being alone; 3) achievement, self worth, exercise, and skill development; and 4) hedonism, thrill seeking, and avoiding boredom. Three single clusters were learning new things, doing something single, and doing something with the family (Crandall 1980).

Understanding viewer motivation is central to providing wildlife viewers with quality opportunities. While extensive research has been conducted on the concepts of multiple motivations/satisfactions and how they relate to anglers, hunters, birdwatchers, campers and leisure recreationists (Hendee 1969,Bultena and Klessig 1969, Hendee and Schoenfeld 1973, Driver and Knopf 1977, Dorfman 1979. Duffus and Dearden 1990, Kelly 1992, Manfredo et al. 1995, McFarlane 1996), limited research has been conducted on motivations of wildlife viewers. The approach taken in this research typically involves questions associated with a behavior; data are usually grouped based on similarities among motivations using factor analysis.

It is well documented that people tend to pursue multiple experiences when participating in outdoor recreation activities (Hendee 1974). There is variability among motives across recreational activities. Decker et al. (1987), for example, proposed three principal categories of motivations underlying wildlife-related activities: affiliation, achievement, and appreciation. Affiliation motives include a desire to strengthen interpersonal relationships and to enjoy the company of others. Achievement motives include a desire to meet some standard of performance. Appreciative motives include enjoyment of the natural environment, relaxation, and solitude. Motives may shift and change over time based upon experiences. McFarlane (1994) confirmed and extended these ideas in a study of birdwatchers in Alberta. She found that 52% of the birders were primarily motivated by conservation factors, 33% by appreciation of nature, and 25% by achievement reasons; none of the birders had affiliation reasons as a primary motive.

Manfredo and Larson (1993) explored motivations for wildlife viewing among residents of Denver, Colorado to determine their preferred wildlife viewing experiences. Through cluster analysis they classified four types of experiences that were sought, including: 1) a general experience where wildlife viewing was combined with other activities like fishing, boating and scenic drives while seeking tranquility, relaxing in the outdoors, experience new and different things and engaging in activities as a family, 2) high involvement experiences were where several outdoor activities were participated in and solitude was enjoyed, there was emphasis on new and different experiences, and opportunities to teach and lead others, 3) the creative experience linked wildlife viewing with photography, painting and other creative pursuits as well enjoying the social part of the experience, 4) the occasional experience was where there was infrequent participation in wildlife viewing. These typologies have since been utilized in the development of a recreational experience based management program for wildlife viewing.

Motivational theory provides for a third tenet that the research at Dixville Notch research was based.

Tenet 3: Motives can be measured. The motives people have for participating in an leisure activity can be measured with a standard list of criteria (Driver 1976). Motivation to engage in recreational activity can stem from two different expectancies: 1) the expectancy that expended effort will lead to certain outcomes, and 2) the expectation that these occurrences will lead to valued psychological outcomes. The concept of motivation is used to determine user segments and in planning recreational experiences (Manfredo et al. 1995).

Wildlife Recreational Satisfaction

While motivation focuses on what initiates behavior, satisfaction focuses on the result of the action. Satisfaction deals with the extent to which the motivational forces that people act upon are actually fulfilled (Manfredo et al. 1995). One of the earliest works in recreation satisfaction centered on the components of camping. Bultena and Klessig (1969) hypothesized that satisfaction was a function of the degree of congruency between aspirations and perceived reality of experiences. A fundamental assumption was that individuals show evidence of a set of aspirations in their camping that transcend specific camping experiences. These values grow out of deep seated needs and are consistently sought in camping. The needs themselves are a product of a camper's social background and current life situation.

One of the most widely recognized uses of the satisfaction concept was developed by Hendee (1974) who suggested that hunting recreation should be managed for multiple satisfactions, as opposed to more traditional methods of managing only for hunter success. Participants' satisfactions with an experience is complex and consists of many elements of the experience including their own expectations.

Dorfman's (1979) research illustrated that recreational satisfaction could be conceptualized and measured in many different ways. It should not be assumed that two methods designed to measure recreational satisfaction measure the same thing or are highly correlated. User satisfaction is a useful construct, but it is important to remember that employing various dependent variables to measure satisfaction may produce inconsistent results depending upon particular variables (Dorfman 1979).

The satisfaction that recreationists derive depends on the interaction between individual characteristics and the characteristic of the activity. Vaske et al. (1982) compared participants in consumptive and nonconsumptive activities and found that consumptive users (hunters and anglers) reported lower satisfaction scores than nonconsumptive recreationists (hikers, campers, canoeists and other outdoor users). Satisfaction ratings of successful hunters and anglers were higher than those that were unsuccessful, but were lower than those of nonconsumptive user groups. The difference was presumably related to the fact that consumptive users were dominated by one clear and specific goal, the acquisitions of a commodity to be consumed, versus the more diffuse and less central goals of the nonconsumptive user. A second influence involved the amount of control that recreationists have in achieving their goals. Nonconsumptive users have more control in selecting environments that provide the outcomes central to their recreation goal.

This idea of satisfaction formed a fourth section of the study at Dixville Notch Wildlife Viewing Area.

Tenet 4: Satisfaction is an outcome of the experience and can be measured. It can be influenced by a number of situational and individual factors.

Rationale For Dixville Notch Wildlife Viewing Area Case Study

New Hampshire is one of 41 states with a wildlife viewing program. Moose are the primary focus of wildlife viewing in northern New Hampshire. A moose management program was implemented by the NH Fish and Game Department (NHFG) in the mid-1980s as moose populations expanded statewide. During the development of the plan, it was recognized that moose have aesthetic values and the public was interested in viewing them (NH Fish and Game Department 1988). Since then, the number of people inquiring about where to view moose has greatly increased, and the state is recognized as a place to view moose. A number of business enterprises have capitalized on moose viewing, including resorts in the northern part of the state that advertise viewing opportunities and the availability of moose viewing tours. As moose viewers increase, wildlife viewing program managers and biologists are interested in the opportunities that viewers desire, the type of viewing areas, and other information necessary to ensure that these recreationists have a quality experience.

The Dixville Notch Wildlife Viewing Area, built by the New Hampshire Fish and Game Department in 1997, was the first wildlife viewing area isolated from an established recreational facility in the state. Located across from a roadside moose lick in northern New Hampshire, the site provided a unique opportunity to gather information about wildlife viewers at a new facility. Based upon the review of cognitive and motivational theories, the goal was to better understand the characteristics, knowledge, motives, and satisfaction levels of wildlife viewers at the Dixville Notch Wildlife Viewing Area. The results from this portion of the research are incorporated in the development of recommendations (Chapter 5) for creating a comprehensive management plan for wildlife viewing.

Objectives

The primary objective of this study was to measure the motivations, knowledge, attitudes, and satisfaction level of wildlife viewers at the Dixville Notch Wildlife Viewing Area. Specific objectives were:

1) to determine demographic characteristics of wildlife viewers who visited Dixville Notch Wildlife Viewing Area,

2) to compare knowledge levels regarding moose and wildlife management practices pre- and post visit to the viewing site (Tenet 1),

3) to determine attitudes or preferences toward potential management practices to be used at wildlife viewing sites (Tenet 2),

4) to determine motivations of wildlife viewers who visited Dixville Notch Wildlife Viewing Area (Tenet 3),

5) to determine satisfaction levels related to the experience of viewing wildlife at Dixville Notch Wildlife Viewing Area (Tenet 4), and

6) to utilize the information gained from this study to design marketing programs, educational materials, and management strategies for other wildlife viewing sites in New Hampshire.

Description of the Study Area

The 10-acre study site incorporating the viewing area was located to the east of Dixville Notch on Route 26. The area, harvested in 1991, was characterized by a regenerating northern hardwood/spruce-fir forest community. A buffer strip of mature balsam fir and red spruce was left on both sides of the road. A large salt lick was on the north side of the road and a smaller lick area on the south side (Fig. 1 and 2). A parking lot for six cars, trail, and viewing blind were built in December 1996. The trail, approximately 125m in length, led to the viewing blind which held up to twenty people. The blind had viewing slits facing the lick and moose trail was located nearby to the east. A kiosk at the parking lot provided information about wildlife viewing ethics, services in the area, and nearby designated viewing sites. Seven educational signs located along the edge of the trail covered topics about wildlife management, other wildlife found in the area, tips, and ethics for wildlife viewing. Two signs addressed specific information about moose in the viewing blind.

Methods

Survey data were collected in two phases. Initially, a five-minute site interview was conducted in the parking lot prior to a viewer visiting the educational signs and viewing platform. Subsequently, a survey was mailed to a subset of interviewees to further assess additional demographic information, knowledge level and attitudes, motivations for stopping, and satisfaction with the experience.

Site Interview

Interviews were conducted 6 June-6 September, 1997 and 31 May-7 October, 1998. All vehicles were approached upon arrival; visitors were greeted by the interviewers and asked if they would participate in a five minute survey. If there was more than one person in a vehicle, the person with the birthday closest to the date was interviewed in 1997; the opposite procedure was used in

1998. Most interviews occurred during June and July.

Standard information included date, time of day, gender of the interviewee, weather, and relative insect conditions. An interviewee was classified as alone, part of a couple or family, with a group of friends, or on a tour. Interviewees were asked a series of questions regarding why they stopped at the viewing site, their residence, local lodging, and whether they previously visited the site (Appendix II).

Six questions were asked to ascertain their level of knowledge about moose and forest management practices. These questions were reviewed by the Public Affairs staff of NHFG, members of the dissertation committee, and a dozen people not associated with the project. These questions were considered a pre-test as they were asked before the visitors were exposed to the educational signs. Answers to the questions were included in the educational signs that were placed along the trail that led to the viewing blind. Interviewees were asked if they were willing to complete a mail survey about their experience.

Mail Survey

Willing interviewees were sent a ten-page return-addressed, postage paid survey 2-4 weeks after their visit (Appendix III). Reminder postcards were sent two weeks afterward, and non-respondents were mailed a second survey after one month (Dillman 1978). The mail survey was reviewed for clarity by staff of NHFG, members of the dissertation committee, and a dozen people not associated with the project. The survey included a number of questions regarding demographics, knowledge, attitudes toward management, motivation, and satisfaction. Data were compiled and analyzed with SPSS. The level of significance for all tests was p= 0.05. Each interviewee was assigned an identification number that was used to track their interview and survey results. Descriptive statistics were derived for each variable (Appendix II and III) including frequency, %, mean, and median.

Demographics - Questions focused on age, income, education, membership in conservation organizations, time spent wildlife viewing, and participation in other outdoor recreational activities. Frequency distribution, mean and median were determined for each category.

Knowledge - Eight knowledge based questions were asked, including several questions worded similarly to those in the site interview. Answers to these questions were found in the educational signs located at the viewing site. The signs focused on tips for viewing wildlife, safe viewing, natural history information on moose, birds, mammals, reptiles and amphibians found in the area, and information about forest succession and how it relates to local wildlife. The questions included multiple choice, fill in the blank, and true/false. Each wildlife viewer was assigned a percent correct for the pre- and post-tests. Chi square analysis was conducted to determine if there were differences in how the respondents scored on their pre-and post-tests. Analysis of variance was used to determine if there were differences in knowledge based upon age, income, and level of education. All statistical tests performed were at a significance level of p=0.05.

Attitudes Toward Wildlife Management Techniques-Specific attitudes toward wildlife management techniques at wildlife viewing areas were explored. The management approaches used were derived by those proposed by Lime

(1974) in considering moose as an aesthetic resource. A Likert five-point scale was used, with 1 as totally unacceptable and 5 as totally acceptable. Frequency distributions, mean, and median were derived for each technique. Factor analysis was performed on these attitudinal questions to determine whether there were patterns of response. Subsequently, Cronbach's alpha reliability analysis was performed and it was found that the internal consistency of the factors was unacceptable.

Motivation - Fourteen questions were drawn from Driver's (1983) recreational experience preferences and adapted for wildlife viewing. A five-point Likert scale was used with 1 being not important and 5 being extremely important. Factor analysis using principal component analysis with varimax rotation in SPSS was used to identify motivation components. This was useful for reducing the heterogeneous sample into homogeneous clusters creating four groupings of experiences people were seeking. It is important to remember that these factors do not represent individuals, but rather the underlying dimension of the experience they are seeking. The varimax rotation converged in 6 iterations. A minimum of 0.50 factor loading was used to identify variables belonging in each factor component. The primary motivation for each factor was determined by selecting the variable with the highest factor loading. All fourteen questions were used in the factor analysis. Factors with eigenvalues slightly smaller and over 1.0 were considered. Cronbach's alpha reliability analysis was used to determine internal consistency of the factor. Analysis of variance was performed to determine if there were any relationships between age, income, or education level and motivation at $p = 0.05$ level of significance.

Satisfaction - Five questions, with a five point Likert scale from strongly disagree (1) to strongly agree (5), were used to examine the viewer's overall satisfaction with their wildlife viewing experience at Dixville Notch. Questions 25, 32, 36, 39, 44 were modified for this situation from a previous study (Ditton et al. 1981) that examined satisfaction of recreational experiences through creation of a satisfaction scale. Scale reliability was examined using Cronbach's alpha. The scale was recoded from a 1-5 scale to a -2-+2 scale, with 0 as neutral. This recode allowed for interpretation of a negative versus positive satisfactory experience. Stepwise multiple regression, first backward then forward, was used to compare 26 independent variables with the dependent variable of satisfaction to identify the variables which explain the most variation. Variables were required to be significant at the 0.05 level in order to be included in the model. Standardized coefficients were used to facilitate examination of the relative importance of the variables.

Results

A total of 431 interviews were conducted with 222 completed in 1997 and 209 in 1998. In 1997, 97% of the interviewees agreed to complete the mail survey, while in 1998 only 66% agreed. A total of 335 surveys were mailed, 202 in 1997 and 133 in 1998. Analysis was conducted on 209 completed surveys. In 1997, the interviewers were female, in 1998 the interviewers for the six weeks were male, and for the remaining of the summer, they were female. It is acknowledged that the mail survey group was self-selected as they agreed to be surveyed after their site interview.

<u>Demographics of Dixville Notch Wildlife Viewers</u>

About half (55%) of the viewers surveyed were non-residents of New Hampshire, 42% lived in the nine other counties of New Hampshire with 5% from local Coos County, and 3 % were visiting the United States. Almost half (48%) came to the site as couples, and a third (33%) were with families. A third of the viewers were on a day trip; the rest lodged somewhere in New Hampshire with 19% at the BALSAMS.

The interview sample was 57% female, while the mail survey was completed almost equally by males (48%) and females (52%). Viewers were overwhelmingly white (97%). Nearly half (49%) of the respondents were college graduates, 25% had attended some college, trade or business school, 23% graduated from high school, and 3% did not finish high school (Table 1). The income level varied from 2% with an income of <$10,000, to 11% with an income >$100,000. A similar proportion fell into the $20,000-39,000 (26%), and the $40,000-$59,999 range (27%) (Table 2). Removing persons staying at the BALSAMS influenced the pattern of income distribution in the highest and lowest categories. No one staying at the BALSAMS had less than $10,000 per year income, while two-thirds of the viewers in the >$100,000 bracket stayed at the BALSAMS. Viewers varied in age with 10% between 18-29, 16% were 30-39, 31% were 40-49, 26% were 50-59, 14% were 60-69, and 3% were > 70 years (Table 3). The average age was 44.6 years.

The majority (57%) did not belong to any conservation organization; 23% held membership in one organizations, 11% were members of two, and 9 % belonged to ≥ three conservation organizations.

Table 1: Education levels of wildlife viewers Dixville Notch Wildlife Viewing Area 1997-1998

Education Level	% of Viewers
Less than High School Graduate	3.4
High School Graduate	22.9
Some College or Technical School	24.4
College Graduate	29.3
Graduate School	20.0

Table 2: Income categories of wildlife viewers at Dixville Notch Wildlife Viewing Area 1997-1998

Income Levels	% of Wildlife Viewers
< $10,000	1.6
$10,000-$19,999	5.9
$20,000-$39,999	25.7
$40,000-$59,999	26.7
$60,000-$79,999	19.8
$80,000-$99,999	9.6
>$100,000	10.7

Table 3: Age of wildlife viewers at Dixville Notch Wildlife Viewing Area 1997-1998

Age Categories	% of Wildlife Viewers
18-29	10.1
30-39	15.9
40-49	30.9
50-59	25.6
60-69	14
>70	3.4

The viewers participated in a number of outdoor recreation activities during the previous five years (Fig. 12). Wildlife viewing was the most common activity (88%) with >50% having camped, hiked, fished, birdwatched, boated, or canoed. Between 20 and 30% participated in 7 other activities including hunting.

Two-thirds of the viewers did not see a moose that day; however, the majority (81%) saw birds and about half (51%) saw small mammals. They spent 0-≥21 days viewing wildlife in the past year: 70% spent ≥8 days and 45% spent ≥21 days. Viewers had visited different types of wildlife viewing areas including sites along roads (69%), remote sites (45%), sites with informational signs (29%), and developed sites with parking lots and trails (27%).

<u>Knowledge Level of Dixville Notch Wildlife Viewers</u>

A basic tenet of this research is that knowledge levels can be measured and affected through use of a variety of techniques. Less than 10% of the interviewees considered themselves knowledgeable about moose, with 28% believing they had limited knowledge. However nearly a quarter scored 100% on the pretest, over half scored ≥ 75%, and only 13% scored ≤ 50%. Neither education level (F=1.115, df 4, p=0.330) or income (F=1.111, df 6, p=0.357 was related to pre-test scores. The mean score of male (67.4± 1.9 (mean± std. dev.)) and female viewers (64.6±1.6) was not different (F=1.197, df 1, p=0.274). On the mail survey all viewers answered at least one question correctly. Over 70% of viewers scored >75%; <5% scored <50%. Sixty-five percent of the increased their score on the post-test, and 33% scored lower; post test scores were higher (78.7%±1.1) than pre-test scores(66% ±1.3) (X^2=124.88, df=42, p=0.000). Scores also increased on the three questions that appeared on both the interview

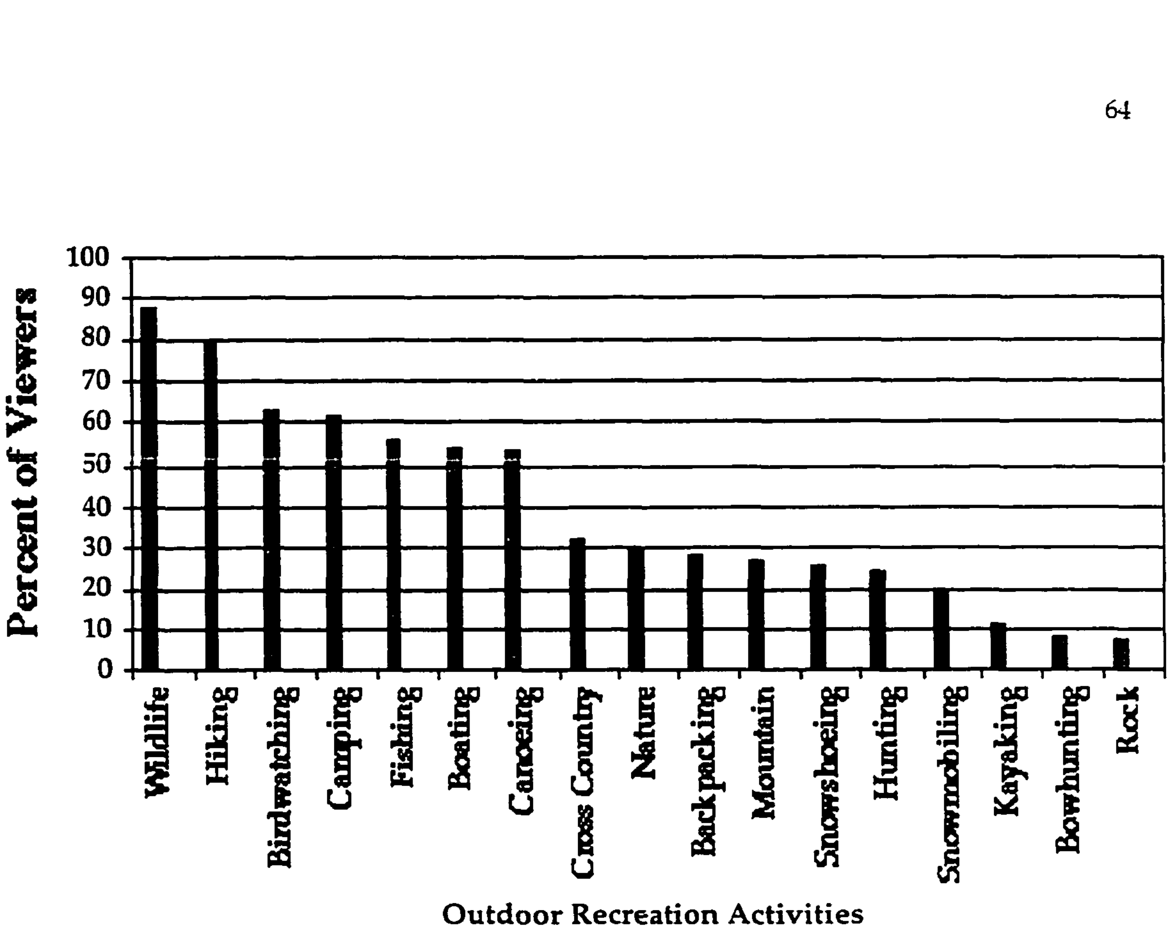

Figure 12. Participation rate in outdoor recreation activities during the past five years by viewers visiting the Dixville Notch Wildlife Viewing Area in 1997-1998.

and the survey: why moose were attracted to muddy areas (X^2=41.6, df 1, p=0.000), what adult moose eat (X^2=10.4, df 1, p=0.000), and the best time to view wildlife (X^2=137.5, df 1, p=0.000). Scores on the post test were not influenced by level of education (F=0.487, df 4, p=0.745), age (F=1.1.54, df 5, p=0.154),or gender (F=1.051, df 1, p=0.306). Scores of those earning >$80,000 were lower (F=4.482, df 6, p=0.000) than those of other income levels.

Attitudes Toward Management of Dixville Notch Wildlife Viewers

Attitudes can be measured and are based on the knowledge held by the individual. The majority of wildlife viewers felt that there should be limits on human behavior at the viewing site (Table 4). Ninety percent thought it unacceptable to approach moose as close they want. About half (48%) thought it was totally acceptable (x=4.03) to control the distance that people were allowed to approach wildlife. The majority (71%) thought that it was totally acceptable (x=4.38) to arrest people who harassed wildlife. No trend was evident with regard to limiting people to the site: 35% felt it was acceptable to limit people, 32% were neutral and 33% felt it was unacceptable. The majority of viewers (82%) felt there should be no hunting zones around wildlife viewing sites (x=4.35). Over three-quarters (78%) felt the site should be closed if negatively impacted by people (x=4.38). Likewise, 80%,felt it was acceptable to have some wildlife habitat off limits to people (x=4.31).

When asked about management options that involved attractants, (65%) felt it was unacceptable to place salt in the lick to ensure wildlife sightings (x=2.09). When asked whether wildlife should be held captive at sites like this, the

Table 4: Response of viewers at the Dixville Notch Wildlife Viewing Area to proposed management activities, 1997-1998.

			Percent of Responses				
	No. Of Viewers	Mean	Totally Unaccept-able	Unaccept-able	Neutral	Accept-able	Totally Acceptable
Educational information present	208	4.38	.5	1.9	13.5	26.9	57.2
Arrest people for harassing wildlife	209	4.38	6.7	4.3	3.8	13.9	71.3
No hunting zones	207	4.35	7.2	4.3	6.8	9.2	72.5
Some habitat off limits	208	4.31	5.3	2.3	9.1	14.4	66.3
Close sites if impacted	207	4.15	6.8	7.7	7.2	19.8	58.5
Distances people allowed should be controlled	209	4.03	5.3	7.2	13.9	25.8	47.8
Forest should be kept in this stage to ensure moose	207	3.74	7.7	9.7	23.2	18.8	40.6
Naturalist on site	208	3.35	7.2	8.7	41.8	26	16.3
All sites should be as developed as this one	206	3.25	10.7	13.6	37.4	16.5	21.8
No. of people should be limited	208	3.00	18.8	13.9	32.3	18.3	16.8
Salt should be placed in the lick	209	2.09	45.5	19.1	23.4	4.8	7.2
Wildlife that injures people should be killed	206	1.97	49	17.5	23.8	6.8	2.9
Allowed to get as close to moose as they want	209	1.44	73.2	16.7	5.7	1.4	2.9
Wildlife should be held captive	209	1.12	92.8	4.3	1.4	1.0	.5

response was overwhelmingly negative (97%, x= 1.12). Fifty-nine percent of the viewers thought it was acceptable to conduct forestry practices to sustain moose habitat.

Almost 75% of viewers were neutral or agreeable to developing viewing sites like Dixville Notch. The majority of viewers (85%, x=4.38) felt that educational information should be presented at wildlife viewing sites, and 42% indicated it was acceptable to have a naturalist on site to answer questions. However, only 33% were willing to make a voluntary contribution.

Motivations of Dixville Notch Wildlife Viewers

The third tenet of this research is that wildlife viewing is a leisure activity and as such viewers motivations were measured using a standard list of criteria. The majority (76%) of viewers were actively looking for wildlife, and 84.5% of these were specifically looking for moose. An overwhelming majority (86%) had seen at least one moose in the wild, and 23% saw a moose previously that day. The primary reasons for stopping were because they saw the sign (27%), they were looking for moose (24%), they were curious (14%), they were told (8%), or they had combinations of other reasons (27%). The mail survey examined people's motivations for stopping based upon Driver's (1976) leisure motivations (Table 5). The majority of viewers (73%, x=4.02) wanted to experience new and different things, to see what was there (68%, x=3.99), or wanted to learn and study about nature (65%, x=3.84). About half (52%) were motivated by doing something with their family, being away from the office/home (55%), having a quiet time in the north woods (48%), developing wildlife viewing skills or experiencing excitement (43%). Of less importance was

Table 5. Rank order, mean score of motivations and percent of viewers identifying a motivation as moderately or strongly important for stopping at the Dixville Notch Wildlife Viewing Area 1997-1998.

Motivations	Number of Respondents	Mean	% of Moderate to Strongly Important
To experience new and different things	207	4.02	73.4
To see what was there	209	3.99	68.4
To learn or study about nature	207	3.84	65.2
To do something with my family	203	3.59	51.9
To experience a quiet time in the north woods	208	3.45	47.7
To get away from the usual demands of home and office	205	3.37	54.7
To develop my wildlife viewing skills and abilities	204	3.17	43.3
To experience excitement	204	3.13	42.7
To get exercise	204	2.65	29.9
To be with my friends	195	2.49	27.7
To share my outdoor knowledge with others	197	2.27	20.8
To have a personal spiritual experience	198	2.27	21.2
To do something creative, such as sketch, paint or take photographs	198	2.18	9.3
Because someone told me it was a good place to stop	189	2.17	20.6

having a spiritual experience (21%) or doing something creative (9%). About one in five stopped (21%) because someone told them it was a good place.

Four groupings of motivations were identified by factor analysis using principal component analysis with varimax rotation and were labelled general, creative, experiential, and opportunist (Table 6). Motivation Factor 1 (general) (Eigenvalue 5.078, % of variance 36.3%) represented a grouping of underlying dimensions of experiencing a quiet time, getting away from the office, doing something with family and friends, a way to be away from the daily grind, and to get exercise. Motivations of experiencing a quiet time, followed by getting away and doing something with family were strongest. These are activities of a general nature and could occur in many settings.

Motivation Factor 2 (creative) (Eigenvalue 1.314, % of variance 11.5) represented doing something creative like photography or sketching, sharing outdoor skills and developing wildlife viewing skills. These motivations are associated with activities that may require materials such as a camera, sketchbooks, or field guides. The motivation to see what was there, experience new things and learn about nature were grouped in Factor 3 (experiential)(Eigenvalue 1.624, % of variance 9.4). The underlying dimension in this group was active involvement in and with the experience.

Motivation Factor 4 (opportunist) (Eigenvalue 0.92581, % of variance 6.6) was based upon people telling viewers it was a good place to stop. This underlying dimensions appears to allow viewers to take advantage of an opportunity presented to them.

Using one way ANOVA, age was not related to Motivation Factor 1

Table 6. Preferred experiences based on factor analysis using principal component analysis with varimax rotation of motivations of visitors to the Dixville Notch Wildlife Viewing Area 1997-1998.

	Eigenvalue	% Var.	Factor 1	Factor 2	Factor 3	Factor 4
Motivation Factor 1-General	5.078	36.3				
Experience a quiet time			0.80632	0.14460	0.18473	-0.14099
Get away from the usual demands			0.79168	0.13129	0.03789	0.35180
Do something with family			0.72590	0.00809	0.03789	0.35180
To get exercise			0.59724	0.33054	0.20441	0.13231
To be with friends			0.55727	0.31701	-0.08522	0.37550
Motivation Factor 2- Creative	1.314	11.5				
To do something creative			0.06076	0.81847	0.09986	-0.02857
Share outdoor knowledge			0.15384	0.73543	-0.07727	0.31880
Personal spiritual experience			0.23258	0.64456	0.16356	0.21181
To develop wildlife viewing skills			0.26957	0.53343	0.49815	0.15407
Motivation Factor 3-Experiential	1.624	9.4				
To see what was there			- 0.10422	-0.09537	0.77579	0.14535
To experience new and different things			0.28811	0.18381	0.73920	-0.07210
Learn about nature			0.4.568	0.02272	0.65978	0.02483
Motivation Factor 4-Opportunist	0.925	6.6				
Someone told me it was a good place to stop			0.02636	0.26516	0.02651	0.78785
To experience excitement			0.38906	0.09090	0.37506	0.55099

(F=0.423, df 5, p=0.825), Motivation Factor 2 (F=0.412 df 5, p=0.840), or Motivation Factor 4 (F=0.340, df 5, p=0.888). There was a relationship to age with Motivation Factor 3 (F=0.2665, df 5, p=0.024), however, because there was only one person in the ≤ 70 age group category, a type I error was probable.

More females than males were associated with the general experience group (Motivation Factor 1) (F=6.925, df 1, p=0.009). There was no relationship between motivation factors and income levels: Motivation Factor 1, (F=0.278, df 6, p=0.947), Motivation Factor 2 (F=0.666, df 6, p=0.678), Motivation Factor 3 (F=1.302, df 6, p=0.259), Motivation Factor 4 (F=0.517, df 6, p=0.795).

Satisfaction Levels of Dixville Notch Wildlife Viewers

This portion of this research focuses on satisfaction as an outcome of the experience and attempts to determine the influence of a number of situational and individual factors. The majority of viewers (74%) indicated that they thoroughly enjoyed their visit to Dixville Notch; 65% wanted to return, and 71% felt that travel was a worthwhile expense (Table 7).

The five statements in Table 7 were scaled to form an overall satisfaction level of the viewers' experience at the Dixville Notch Wildlife Viewing Area. The question regarding disappointment in some aspect of their visit was recoded to reflect the positive aspects of strongly disagreeing or disagreeing with the statement. A Cronbach's reliability analysis of the scale resulted in an alpha of 0.8132 indicating the scale had good internal consistency. The majority (71%) were satisfied or highly satisfied with their experience, 22% were dissatisfied or highly dissatisfied, and 7% were neutral (Fig. 13).

There were two additional questions, that also may provide an indication of the level of satisfaction that viewers had with their visit. For 46% of the viewers, knowing wildlife was in the area was important while only 23% of the viewers felt that seeing a toad would be as satisfying as seeing a moose.

Daily temperature, cloud and blackfly conditions were recorded by the interviewers. Using simple linear regression, there was no relationship between satisfaction level and ambient temperature (R^2= 0.000, Beta 0.0829, Significance 0.2371), cloud condition (R^2= 0.0090, Beta-0.0949, Significance 0.2371), and blackfly condition (R^2= 0.0023 Beta 0.0476 Significance 0.4908).The majority (68%) felt that seeing a moose would be the highlight of their day, while 10 % felt that seeing either a moose, bear, or deer would be their highlight. In actuality only 33% of the viewers saw ≥ 1 moose at the site. There was no relationship found between having a satisfactory experience and seeing a moose (F=0.203, df 6, p=0.976)

Twenty-six variables including motivation factors, age, income, education and recreational activities were used to build a stepwise regression model using backward then forward procedures to identify the variables which explain the most variation in satisfaction (Table 8). The appropriate multiple regression model for the examined data includes three independent variables: Motivation Factor 1, Motivation Factor 3 and Motivation Factor 4. It was found that those viewers influenced by Motivation Factor 1 were more likely to be satisfied with the experience at Dixville Notch Wildlife Viewing Area, (beta=0.429, significance =0.000) while viewers influenced by Motivation Factor 4 were also likely to be

Table 7. Responses to questions used to create a satisfaction scale for visitors at the Dixville Notch Wildlife Viewing Area 1997-1998.

	No. of Respondents	Mean Score	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Thoroughly enjoyed visit	209	4.06	0.5	2	21.5	32.5	43.5
Worth the money to get there	201	3.91	2.5	6	33	115	56
Want to come back and visit	206	3.89	2	5	28	31	34
Disappointed in some aspect of visit	204	3.52	26	21	31	16	3
Cannot imagine a better wildlife viewing experience	204	2.54	22	22	42	10	4

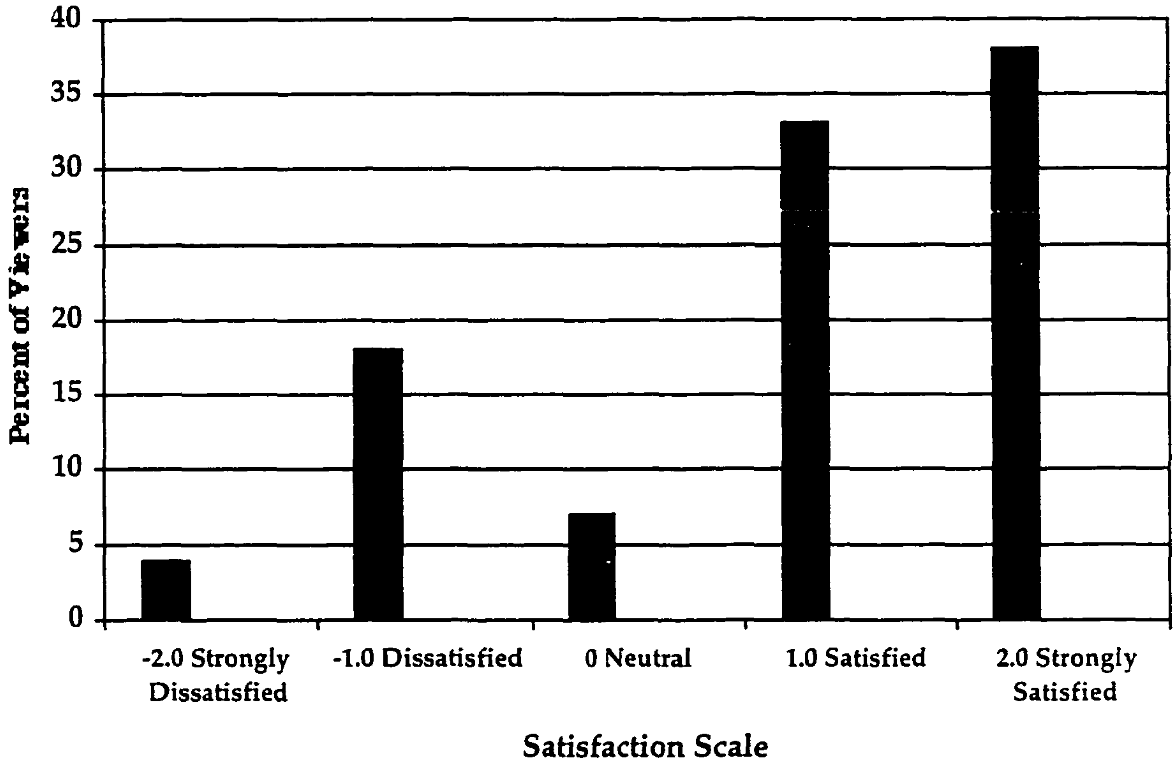

Figure 13. Satisfaction scale created by combining five questions measuring the satisfaction level of viewers visiting the Dixville Notch Wildlife Viewing area in summer of 1997-1998.

Table: 8. Results from stepwise multiple regression using backward than forward procedures of 26 dependent variable as predictors of satisfaction from viewer responses at Dixville Notch Wildlife Viewing Area during summers 1997-1998.

Dependent Variable: Satisfaction

Variable Included: Motivation Factor 1, 3 and 4
Multiple R:0.50948
R Square .25957

Variables in the Equation

Variables	B	SE B	Beta	Sig
Motivation Factor 1	0.321099	0.050544	0.429556	.0000
Motivation Factor 3	-0.151772	0.052571	-0.195201	.0000
Motivation Factor 4	0.131098	0.048082	0.184363	.0000
Constant	0.568305	0.50553		

Variables Included: Motivation Factor 1, 3

Multiple R: 0.47497
R Square 0.22559

Variables in the Equation

Variables	B	SE B	Beta	Sig
Motivation Factor 1	0.323067	0.05126	0.432189	.0000
Motivation Factor 3	-0.150006	0.053595	-0.192929	.0000
Constant	0.562811	0.51500		

Variables Included: Motivation Factor 1

Multiple R:0.43402
R Square 0.18837

Variables in the Equation

Variables	B	SE B	Beta	Sig
Motivation Factor 1	0.324436	0.052587	0.434020	.0000
Constant	0.559727	0.05255		

satisfied (beta=0.184, significance 0=.000). Those influenced by Motivation Factor 3 had a negative influence on satisfaction (beta = -0.195, significance = 0.000).The R square indicates that about 26% of the variance is explained by the 3 predictor variables. Motivation Factor 1 had the most influence on satisfaction and explained the greatest variance (18.8%), while Motivation Factor 3 explained 3.7% of the variance and Motivation Factor 4 explained 3.4%.

Discussion

For this research is to be useful in developing a recommendations for a wildlife viewing management plan it is important to discuss the results in terms of what is known about the wildlife viewers at Dixville Notch. The majority of viewers came as couples or families (80%) and the mail survey was completed by males (48%) and females (52%).

These findings are congruous with the 1996 Department of Interior survey (1997) that found equal representation of men and women among nonresidential wildlife watchers and . Shaw and Mangun (1984) found that male and female birdwatchers tended to have equal participation rates as opposed to consumptive activities like hunting (92% male) and fishing (69% male). Wight (1996) also found no overall gender differentiations among experienced ecotourists, although gender differentiation varied by activity. The fact that significant numbers of women participate in bird and wildlife watching is also reflected in the travel and tourism industry where women represent 75% of participants in nature-based and cultural tours (Bond 1997).

In dealing with wildlife watchers in northern New Hampshire, it is important that messages be crafted in such a way as to appeal to both males and females.

For example, photographs used in marketing pieces of people engaged in wildlife viewing, should include both males and females.

The Dixville Notch Wildlife Viewing Area was located in Coos County New Hampshire where the 1989 median household income was $24,897 (US Census Data 1990). However, about two-third of the viewers reported annual household incomes ≥$39,000. The viewers who visit this area in all likelihood have a positive benefit on the local economy. Further study should examine if these viewers have a level of expectation about the local for regional tourism.

Wight (1996) found that 82% of experienced ecotourism travelers had graduated from a college or university, as compared to 45% of general consumer tourists. The education level of visitors to Dixville Notch was similar to that of general tourists; 49% graduated from a college or university. This is not surprising, as this area of New Hampshire has only recently marketed itself as an ecotourism destination. The majority of summer and fall recreational activities were general tourist activities including golfing, hiking, camping, and canoeing. Moose and wildlife viewing have gained popularity and enhance these other recreational activities.

Two-thirds of the survey respondents indicated that they were birdwatchers, suggesting that there were similarities between wildlife viewers to Dixville Notch and birdwatchers in general. When comparing specifics such as age and membership in conservation organizations, differences existed between Dixville Notch wildlife viewers and birdwatchers.

It should be noted that the majority of visitors (76%) to Dixville Notch were actively looking for wildlife and more specifically for moose. Differences in the purposive activity of wildlife viewers and birdwatchers may account for their demographic differences. For example wildlife viewers at Dixville Notch were people who incorporated moose viewing within a vacation. Conversely, birdwatchers travelled to the Platte River to view an annual, time limited event of sandhill cranes on their spring migration (Eubanks et al. 1998).

The average age of wildlife viewers (44.6) at Dixville Notch was nearly 10 years less than that of Platte River birders (53 years)(Eubanks et al. 1998). The average age of birdwatchers from other studies also reflected a slightly older constituency: 47 years in a nationwide survey (Wiedner and Kerlinger 1990). 46 years in Cape May , New Jersey (Kerlinger and Wiedner 1991), 51 years in Sabel Palm Grove, Texas (Kerlinger et al. 1994), and 54.8 years along the south coast of Texas (Payne 1991). An explanation for this lower average age at Dixville Notch may be that this study was conducted during the summer and 33% of the viewers came in family groups when children were on vacation. Most birdwatcher studies are based on specific birding events during winter and spring that are was less likely to be family oriented.

Membership in conservation organizations varied greatly between wildlife viewers of Dixville Notch and birdwatchers. For example, McFarlane (1964) found that one of the prime motivations for birdwatchers was a conservation orientation. When comparing the Dixville Notch wildlife viewers with birdwatchers from the Platte River, the majority (57%) of viewers at Dixville Notch did not belong to any conservation organization, whereas 60% of those who visited the Platte River belonged to at least one conservation organization. When taken in the broader context of wildlife viewing programs, the supposition is that people who participate in wildlife viewing will become more involved in wildlife conservation. Participation in wildlife conservation by the nonconsumptive user is primarily through voluntary donations to nongovernment organizations, memberships in these organizations, and maintaining or improving habitat (Filion et al. 1993). If further studies indicate that wildlife viewers have low participation rates in conservation organizations, opportunities need to be designed at wildlife viewing sites to encourage involvement in wildlife conservation.

Knowledge Levels and Providing Educational Opportunities

One of the goals of wildlife viewing programs is to integrate education aspects into viewing components (Duda and Young 1994). Natural history information was provided on a series of educational signs at the Dixville Notch Wildlife Viewing Area. Of significance was the fact that viewer scores on the post-test increased after visiting the site. Presumably, this increase occurred because viewers learned more about moose ecology from the educational information.

Given that 90% of the viewers felt it was moderately to extremely important to learn or study about nature, educational material at the site not only provided an opportunity for people to learn about moose ecology, it probably is related to their overall satisfaction level. Not surprisingly, nearly all viewers felt it was acceptable to have education information at the site. This interest and the increased scores indicate that wildlife viewing sites can and should be used to present information effectively about wildlife and wildlife management. The information presented at the site should assist viewers in developing positive attitudes about wildlife management.

Clearly, providing educational opportunities is an important factor for wildlife viewers. When designing materials, writers should realize that viewers may know the natural history about specific wildlife, but probably have limited knowledge about wildlife management. The level of information at a site should be related to the type of viewer. Because Dixville Notch was visited primarily by family groups and couples, information should be easily comprehended by children. All sites should guide people to view wildlife properly to reduce/prevent impacts on wildlife.

Attitudes Toward Management

Viewers provided information about their attitudes toward different management approaches, including: (1) habitat enhancement activities such as forestry practices, placing salt in the lick; (2) rules and regulations, and (3) education.

There were several management activities viewers felt were totally unacceptable. Viewers were least favorable to killing wildlife that injures other viewers. If taken at face value, this attitude may place a wildlife viewing area manager with a paradoxical situation if a moose were to injure a visitor. This survey reflects an answer not based on the emotions of the injured party or the party's family, which may insist that something be done about the animal. If that type of situation arose, wildlife managers may need to consider a number of options besides the one expressed in this survey. One approach to prevent a scenario like this from happening is to educate viewers about proper viewing techniques to prevent potential injury.

It was evident that the viewers at Dixville Notch did not agree with artificial situations to ensure the presence of moose. Viewers felt it was totally unacceptable to create a zoo-like situation by keeping captive animals at the site. Another technique that was unacceptable was to place salt at the site to attract and keep moose coming to the area. Ironically, viewers did not equate runoff of road salt to an artificial situation.

Wildlife managers have an interesting conundrum relative to forest management. Only 60% of the respondents felt it was acceptable to maintain the forest at its current stage in order to ensure moose presence even though 83% knew that forestry practices will influence the wildlife found in an area. This suggests that wildlife viewers may be willing to accept a lower probability to view moose by not cutting the forest. This is not unlike other situations that are found in natural resources management. For example in situations where deer populations are extremely high and visibly damaging habitat, many oppose reduction of the herd despite recognizing habitat degradation (Chase et al. 1999). Educational material that explains the relationships among forest management, forest types, habitat, and wildlife may help resolve this paradox.

When examining the rank order of acceptable wildlife management practices, it is evident the wildlife viewers at Dixville Notch considered regulatory options acceptable. This is interesting because New Hampshire has no specific rules and regulations that deal with moose or wildlife viewing except a rather vague regulation about harassing wildlife (RSA207:A). However the definition of harassment varies from person to person, and the definition within the law is unclear. In the case of some endangered and threatened species, harassment is better defined and there are specific rules and regulations. For example, RSA 212-A:7 addresses the distance of boats can approach a bald eagle (*Haliaeetus leucocephalus)* nest sites.

In terms of no hunting zones around wildlife viewing areas there are different regulations depending upon the species. It is unlawful to hunt moose within 250 yards of the road, so consequently the immediate area around the lick, parking lot, trail, and viewing blind is off limits to moose hunters. In terms of hunting for deer or bear, the distance must be > 300 feet from the blind and outside the highway right of way. Whether or not these current laws would satisfy what the Dixville Notch wildlife viewers perceive as a no hunting zone is equivocal. When providing information about wildlife viewing sites, it will be important to educate viewers about local hunting to minimize potential conflict between the user groups. The acceptability of closing areas if wildlife were negatively impacted was extremely high, as well as leaving certain wildlife habitats off limits. A dimension of this needs further exploration to determine viewer behavior, attitude, and support if a heavily used area closed.

Lime (1974) proposed management practices for moose viewing from his experience on national forests in Minnesota. These practices included habitat enhancement, providing multimedia interpretive information, development of self-guiding trails or auto tours, encouraging businesses related to moose viewing, development of artificial attractants, and erection of viewing platforms. This research corroborates some of Lime's (1974) recommendations including use of interpretive (educational) information and limited habitat enhancements. However, there were discrepancies with other recommendations because of the perception of wildlife viewers toward various management practices. Specifically designed educational materials that explain the relationship between forestry and moose could build on viewer knowledge causing them to alter their attitudes toward forestry management.

Motivational Dimensions of Dixville Notch Wildlife Viewers

This study examined the underlying motivations other than the obvious desire to see a moose of wildlife viewers at Dixville Notch. When considering the responses of each individual motivation statement, it is evident that having one motivation does not mutually exclude another motivation, indicating that people have primary and secondary motivations. This study suggests that there are sets of underlying motivational dimensions for people seeking wildlife viewing experiences besides seeing an animal, including 1) a general experience, 2) a creative experience that engages people in an artistic or spiritual activity while viewing, 3) an experiential experience where the viewer actively participates in the viewing experience, and 4) an opportunistic experience.

Motivation Factor 1(general), 2(creative) and 3 (experiential) are clearly defined. The attributes of the general experience included experiencing a quiet time, getting away from the usual demands, doing something with family, getting exercise and being with friends. These motives can be fulfilled by participating in a variety of activities not just wildlife viewing. Motivation Factor 2 (creative) links using a camera or sketchbook, developing wildlife viewing skills and sharing outdoor knowledge. Participants seeking to achieve this dimension often need to have equipment such as cameras, sketchbooks or field guides with them. Motivation Factor 3 (experiential) involves seeing what was there, experiencing new and different things and learning about nature. The very nature of these attributes means active involvement with the experience.

Motivation Factor 4 (opportunist) is somewhat more difficult to interpret. It could be argued that this factor should be dropped since the Eigenvalue fell below 1 and Cronbach's alpha results were in the unacceptable range. The reason for inclusion however is the strong factor loading on the "someone told me it was a good place to stop" variable. This may represent an important subset of wildlife watchers motivations. The idea that some may be participating in a wildlife viewing experience because someone told them about it, presents the manager with a unique opportunity to provide new information about wildlife and wildlife management and perhaps encourage them to repeat the experience. It may also be a reflection that when local residents were asked where to look for moose, they told visitors to the area to stop at the viewing area.

In the larger context of wildlife viewing, the motivational factors found in this study may give further insight to describe wildlife viewers and their expectations. Certainly the findings build upon work done by other researchers and point in the direction of further refinements and ways of assessing viewer motivations that can assist in developing viewer profiles in order for them to be useful in different situations and locations.

Decker et al. (1987) proposed three principle categories of motivations underlying wildlife-related activities: affiliation, achievement, and appreciation. When comparing these three areas of motivation with Dixville Notch Wildlife viewers, there are some broad similarities, particularly with the generalist (Motivation Factor 1) and the affiliative group. The importance of doing things with family and friends are certainly affiliative activities. However, one could also extend the generalist dimensions of this study to the criteria of exhibiting appreciative motives such as having a quiet time and relaxing. When it comes to Decker's achievement motivation of setting a standard of performance there is nothing similar in the four groupings determined by this study. These differences may be attributable to several things. Participants from consumptive and nonconsumptive activities were included by Decker et al. (1987), whereas this study focused on wildlife viewers at a specific location. Another reason may be a discrepancy between the list and phraseology of leisure activity motives used in the two studies. MacFarlane (1996) built on the research of Decker et al. (1987) when she specifically examined the motivations of birdwatchers. Her findings concluded that birdwatchers were motivated by three primary factors: conservation, appreciation and achievement. Affiliation was not recognized as being a primary motivation by this group. Again there are differences between MacFarlane's research and that conducted at Dixville Notch. Dixville Notch wildlife viewers appear to have attributes of the Decker et al. (1987) affiliation category but do not appear to be conservation oriented. These differences may have the same causal factors found when comparing the Decker research. Other differences may be due to the differences in demographic characteristics found between Dixville Notch wildlife viewers and birdwatchers.

Manfredo and Larsen (1993) used cluster analysis to create user typologies for preferred wildlife experiences in Colorado. The Colorado study was designed for the development of user typologies to be used in a recreational experience based management model. Information was gathered from a randomly selected group of Denver residents some of whom were wildlife watchers and others who were not. They identified four distinct, experience groups for wildlife viewing: high involvement, creative, general and occasional.

The findings of this study are similar, however the purpose of the study was different. In this study, viewers participated in a wildlife viewing experience consequently their underlying motives may be more indicative of what they were actively seeking during the experience. Both studies used a modification of Driver's (1983) motivation list for recreational experience preference. Thirteen of the 14 variables used in this study were also used in the Manfredo and Larsen(1993) study. The variable of being told this was a good place to stop was added in this study. There were differences in how the two studies were analyzed. This study used all 14 variables and factor analysis was performed. Manfredo and Larson (1993) selected five variables and used cluster analysis to create their typology. Consequently while there are similarities a direct comparison can not be made.

These two studies provide wildlife viewing managers with findings that are necessary for managing the wildlife viewing experience. The typologies from the Colorado study describe the types of experiences that may be attractive to active and potential wildlife viewers, and this study describes the outcomes actively sought at a moose viewing site.

It would be useful to have a standard classification system of wildlife viewer motivations allowing for comparisons from site to site and region to region. Building off the list of motivations used in this study a standardized list of motivations for people who actually visit an area was developed (Table 9). The list of motivations includes a consolidation of several of the similarly worded motivation statements such as experience a quiet time and to get away from usual demands. Several additional statements including to use specific equipment, to see as much wildlife as I can and to see unusual wildlife will be useful in further defining viewers motivations.

It is obvious that the variety of motivations associated with wildlife viewing make it desirable to provide for different experiences at wildlife viewing sites. Wildlife viewing sites should be designed to provide family groups experiences, as well as opportunities that allow people to learn, develop, and share skills. Other elements that promote creative pastimes such as sketching and photography could be available at specified viewing sites. For example a program could be developed for children to become wildlife viewing superstars where they receive a t-shirt, membership card or book. Such a program would require them to visit different types of viewing areas where they could experience a variety of habitats and wildlife. An accompanying booklet could provide activities associated with visiting specific sites. An adult based program similar to hunter and aquatic resources education could be implemented to improve and develop wildlife viewing skills, wildlife photography, and other activities associated with wildlife viewing. For viewers who are opportunists, many of these activities are marketing opportunities that should attract them to visit certain locations. These activities would also provide a connection with the regional tourism organization.

Satisfaction

Most (71%) of the wildlife viewers were satisfied with their experience at

Table 9. Proposed list of standardized motivations for use in wildlife viewing research.

1. Experience a quiet time in the outdoors
2. Do something with family and friends
3. To do something creative such as sketch, paint or take photographs
4. To learn or study about nature
5. To develop my wildlife viewing skills and abilities
6. To share my outdoor knowledge with others
7. To experience something new and different
8. To have a personal spiritual experience
9. Because someone told me it was a good place to stop
10. To use my binoculars or other special equipment
11. To see unusual wildlife
12. To see as much wildlife as I can
13. To get exercise
14. Contribute to the conservation of wildlife

the site. While indicating the relative success of the Dixville Notch Wildlife Viewing Area, it does not provide us with specific information about why 30% were not satisfied or what constitutes an overall satisfactory wildlife viewing experience.

Of interest is that there was no relationship between seeing a moose on the day of the visit and a viewers satisfaction. This is counter intuitive however, when you consider that the majority of viewers were specifically looking for moose. Most did see other wildlife, however, only 23 % felt that seeing a toad was as satisfying a moose. This may be an indication that the act of looking for wildlife provides for feelings of satisfaction despite specific wildlife viewing goals, or that multiple outcomes were met during the wildlife viewing experience. Of interest is that weather and insect conditions were not related to satisfaction levels.

This leads us to examine what are the variables that can explain feelings of satisfaction or dissatisfaction, remembering that satisfaction is based on the outcome of meeting needs. The general experience category had the strongest positive relationship to satisfaction. Viewers with underlying motivations of a quiet time in the north woods, a place to get away and be with family and friends were seeking experiences not necessarily directly related to viewing wildlife. They were rather seeking experiences that they may have been able to realize in at any number of locations. The fact that the site was in a forested setting, away from a town and job and they visited with either family or friends, allowed them to achieve their desired experience and thus feel satisfied. Because these underlying motivations could be met on the site, whether they saw a moose or not would not influence their level of satisfaction. Maintaining a level of satisfaction requires offering activities for families and small groups while creating a quiet, relaxed atmosphere.

The experiential factor explained only a small amount of variance in satisfaction. However, it is important to look at this relationship, because the direction of the influence was negative. The underlying dimensions of this factor included the desire to see what was there, to experience something new and different thing and learn about nature. There may be several reasons for this negative relationship including that the experience was not new and different enough from what had been previously experienced or that there was nothing there to see if a moose wasn't present. A manager may be able to increase the satisfaction level of people with these dimensions through providing opportunities to learn about nature since providing a new and different experience or ensuring there was something to see is unpredictable. While education materials were available at the site, they may not have provided the level of information this group was seeking. To determine the action necessary to reverse the negative relationship will require further understanding. This might entail additional survey work, interviews or conducting focus groups with viewers for whom this factor is their primary motivation.

A relatively small amount of variance in relationship to positive satisfaction can be explained by the opportunist factor. The strongest motivation within this factor had little to do with seeking a wildlife viewing experience but rather fulfilling the expectation that it would be a good place to stop. Viewers who have this as part of their underlying motivation offer wildlife viewing area managers challenges as well as opportunities. The challenge comes in trying to quantify what "good" is. The opportunities include providing experiences that are exciting enough that they will then be motivated to learn more about wildlife and wildlife viewing.

Understanding satisfaction is extremely complex and it is evident that at Dixville Notch Wildlife Viewing Area as with other wildlife related activities there are multiple reasons for satisfaction. There are many other variables which may be important in predicting satisfaction with the experience at Dixville Notch including crowding, overall success rate in viewing wildlife and comparison with other experiences that need further research.

Conclusion

The Dixville Notch Wildlife Viewing Area presented viewing opportunities for individuals, couples and families. Most of the viewers were visitors to the region and spent purposeful time looking for moose and other wildlife. Motivations of viewers feel into four groupings, general, experiential, creative and opportunist. Although the majority did not see moose at the site, most had a satisfactory experience.

Marketing Programs Based on Demographics

Viewers participated in a number of recreational activities that provided opportunities to view wildlife. Certainly, the impacts of moose viewing on tourism and business opportunities in the area needs further exploration. The region's tourism industry recognizes wildlife as an important resource, as they have recently renamed the region "The Great North Woods." The area is now promoted as a place for wildlife recreational opportunities including wildlife viewing, hunting and fishing. Marketing programs to attract wildlife viewers to the area should be based upon the area offering new and different experiences in a relaxed environment with opportunities to learn about nature. Programs should be designed to reach a middle-aged, family oriented, gender equal audience with higher than average income. Marketing efforts should be focused both in and out of state. Additional research needs to be conducted regarding the expectations for accommodations and other services for this tourist type. Even though the areas name has changed the majority of marketing is oriented more towards the general tourist who enjoys outdoor experiences, efforts should be made to develop an ecotourism product. This would entail making sure that the activities and accommodations have minimum impact upon the resources. Marketing efforts can also be based on the motivational preferences such as emphasizing wildlife viewing as a way to enjoy a quiet time, get away and do something with family and friends.

Education and Conservation

A desire to learn and study about nature was an important motivation dimension. Wildlife viewers expected interpretive information to be available and felt that education was completely acceptable. This study indicated that knowledge can be increased while visiting a site through the presentation of information on signs. Since knowledge plays a role in influencing attitudes, it is essential to provide education at sites. For example, while wildlife managers often rely on habitat site enhancements, some wildlife viewers don't understand the reasons behind such activities. Educational materials should explain how and why site enhancement activities occur and what are the projected results. There is a need to implement a multi-faceted education program providing for a full spectrum of interpretive techniques including written, face to face and experiential at viewing sites. Techniques should be tailored for different types of sites and situations.

Since wildlife conservation is a goal of viewing programs, it is worthwhile to explore how viewers not involved with conservation organizations could be involved in conservation activities at viewing sites. This would require designing activities that people could easily participate and should be designed to meet the general, experiential, and creative motivational dimensions people were seeking. Some potential ideas to further explore include: 1) monitoring numbers and behaviors of wildlife through recording observations at a site or a number of different sites, 2) specific enhancement activities such as removing non-native vegetation or brushing to perpetuate early successional habitat, 3) creating a program with incentives to visit a number of different sites to expose viewers to numerous conservation messages, and 4) recruiting volunteers at sites to assist in enhancement and education programs.

Wildlife Viewing Management

In considering management of wildlife viewing sites in a region there is a need for a variety of sites as evident by a third of the viewers felt that not all sites should be as developed at Dixville. Based on the types of sites visited by viewers in other locations, the mix of sites should include roadside, remote sites, and those accessible by foot travel. Motivation preferences should also be taken into account when designing a site. The four experience preferences found in this study can serve as a framework for developing specific wildlife viewing opportunities. The experience based management approach can be useful in meeting the recreational aspects of wildlife viewing. However because the goals of viewing programs extends beyond just a recreation activity, it will be helpful to use the characteristics of the four motivation factors to design activities and sites. Through designing opportunities that fulfill the outcomes of these desires, wildlife viewers will generally have a satisfactory experience.

There are a number of wildlife and recreational management activities wildlife viewers readily accept and can be used at wildlife viewing sites including providing educational opportunities, rules and regulations to minimize impacts and site selected habitat enhancements.

In summary, the primary reason that resource management agencies developed wildlife viewing programs was to promote wildlife conservation. One of the greatest benefits of developing wildlife viewing sites is that they provide a place to provide educational materials, demonstrate wildlife management techniques and ultimately help viewers develop a sense of stewardship toward wildlife and other natural resource. The survey of wildlife viewers at Dixville Notch provides a list of elements important to wildlife viewers for inclusion into a wildlife viewing management plan.

Literature Cited

Applegate, J.E., and E.E. Clark. (1987). Satisfaction levels of birdwatchers: an observation on the consumptive-nonconsumptive continuum. Leisure Science. 9:129-134.

Bem, D.J. (1970). Beliefs, attitudes and human affairs. Brooks-Cole, Belmont CA.

Bond, M. (1997). Who really wears the (adventure travel) pants? Adventure Travel Business. August 1997. Pp 13-15.

Bultena, G.L. and L.L. Klessig. (1969). Satisfaction in camping: a conceptualization and guide to social research. Journal of Leisure Research 1(4):348-354.

Chase, L.C., W.F. Siemer, and D.J. Decker. (1999). Suburban deer management: a case study in the Village of Cayuga Heights, New York. Human Dimensions of Wildlife. 4:2:59-60.

Clark,R.N., J.C.Hendee, and F.L. Campbell. (1971). Values,behavior and conflict in modern camping culture. Journal of Leisure Research 3(3): 143-159.

Cobus, M.W. (1972a). Moose an aesthetic resource and their summer feeding behavior. 8th North American Moose Workshop Proceedings. 244-275.

_____(1972b). Moose (Alces alces) and campers in Sibley Provincial Park: a study of wildlife aesthetics. M.S. Thesis. University of Guelph. Guelph, Ontario.

Crandall,R. (1980). Motivations for leisure. Journal of Leisure Research 12(1):45-54.

Decker, D.J. and N.A. Connelly.(1989). Motivations for deer hunting: implications for anterless deer harvest as a management tool. Wildlife Society Bulletin. 17:455-463.

_______and G. R. Goff.(eds.). (1987). Valuing Wildlife: Economic and Social Perspectives. Westview Press. Boulder CO.

______, T.L. Brown, B.L. Driver and P.J. Brown. (1987). Theoretical developments in assessing social values of wildlife:toward a comprehensive understanding of wildlife recreation involvement. Pages 76-95 in D.J. Decker and G.R.Godd, eds., Valuing wildlife: economic and social perspectives. Westview Press Inc., Boulder, Colorado.

______,T.L. Brown and B.A. Knuth. (1996). Human dimensions research:its importance in natural resource management. Natural Resource Management: The Human Dimension. A.W. Ewert (ed). Westview Press, Boulder CO.

Ditton, R., A. Fedler and A. Graefe. (1981). Recreational satisfactions at Buffalo National River: Some measurement concerns. Some Recent Products of River Recreation Research. USDA forest Service General Technical Report NC-63.

______,D.K. Loomis, and S. Choi. (1992). Recreation specialization: re-conceptualization from a social world's perspective. Journal of Leisure Research 24:33-51.

Dillman, Don A. (1978). Mail and telephone surveys: the total design method. Washington State University. Pullman, Washington.

Dorfman, P.W. (1979). Measurement and meaning of recreation satisfaction: a case study in camping. Environment and Behavior 11(4):483-510.

Driver, B.L., (1976). Toward a better understanding of outdoor recreation participation. Proceedings Southern States Recreation Resources Application Workshop. USDA Forest Service General Technical Report. SE-9. pp. 163-189.

______, (1983), Master list of items for recreation experience preference scales and domains. U.S. Dept. Agric. Rocky Mt. Forest and Range Experiment Station. Fort Collins, Colorado. 11 pp.

______ and R.C. Knopf (1977). Personality, outdoor recreation and expected consequences. Environment and Behavior 9(2):169-193.

Duda, M.D. And K.C.Young. (1993). Wildlife viewing in Maryland: participation, opinions and attitudes of adult maryland residents toward a watchable wildlife program. Responsive Management, Harrisburg, VA.

Duffus, D.A. and P.Dearden. (1990). Non-consumptive wildlife-oriented recreation: a conceptual framework. Biological Conservation 53:213-231.

Eubanks,T.L., R.B.Ditton, J.R. Stoll. (1998). Platte River nature recreation study: the economic impacts of wildlife watching on the Platte River in Nebraska. Fermata Inc. Austin, Texas.

Filion,F., E. Duwors, P. Boxall, P. Bouchard, R. Reid, P.A. Gary, A. Bath, A. Jacquiemot and G. Legere. (1993). The importance of wildlife to Canadians.: highlights of the 1991 survey. Environment Canada. Ottawa, ON.

Fishbein, M., and I. Ajzen. (1975). Belief, attitudes, intention, and behavior: an introduction to theory and research. Addison-Wesley, Reading, MA.

Flather, C.H and H.K. Cordell.(1995). Outdoor recreation: historical and anticipated trends. Wildlife and Recreationists: Coexistence Through Management and Research. R.L. Knight and K.J. Gutzwiller (eds.)

Groves, D.L., C.T.Cushwa and J.S.Lindzey. (1973). A method of utilizing personal value information for assessing administrative changes on public lands. Transactions of the 38th North American Wildlife Conference 38:158-169.

Heberlein, T.A. (1973). Social psychological assumptions of user attitude surveys: the case of the wilderness scale. Journal of Leisure Research 5(summer): 18-22.

Hendee, J.C. (1969). Appreciative versus consumptive uses of wildlife refuges: studies of who gets what and trends in use. Transactions of the 34th North American Wildlife Conference 34:252-264.

Hendee, J.C. (1974). A multiple satisfaction approach to game management. Wildlife Society Bulletin 2(3):104-113.

_______, and C. Schoenfeld,(eds). (1973). Human dimensions in wildlife programs. Washington D.C.

_______, R.P.Gale, and W.R. Catton Jr. (1971). A typology of outdoor recreation activity preferences. Journal of Environmental Education 3(1):28-34.

Kelly, J.R. (1992). Sociological perspectives on recreation benefits. Benefits of Leisure 2nd ed. pp. 419-422.

Kerlinger, P.T., T.L. Eubanks, and R.H. Payne. (1994). The economic impact of birding ecotourism on the Sabal Palm Grove Sanctuary, Texas, 1993-1994. A report to the U.S. Fish and Wildlife Service.

_______and D.S. Weidner. (1991). The economics of birding at Cape May, New Jersey. In Ecotourism and Resource Conservation, a collection of papers. Second International Symposia Ecotourism and Resource Conservation, 191, Miami, Florida. Island Press, Washington, D.C., Vol. 1:271-280

Kuss, F.R., A.R. Graefe and J.J. Vaske.(1990). Visitor Impact Management, a review of the research. Vol 1 and 2, National Parks and Conservation Association, Washington, D.C.

Lime,D.W. (1974). Moose as a nongame recreational resource. 10th North American Moose Conference and Workshop. 110-134.

Manfredo,M. (1989). Human dimensions of wildlife management. Wildlife Society Bulletin 17:447-449

_______and R. A. Larson. (1993). Managing for wildlife viewing recreation: an application in Colorado. Wildlife Society Bulletin 21(3):226-237. Manfredo, M., J.J. Vaske and D.J. Decker. (1995). Human Dimensions of wildlife management: basic concepts.Wildlife and Recreationists: Coexistence Through Management and Research. R.L. Knight and K.J. Gutzwiller (eds.)

_______, J.J. Vaske and D.J. Decker. (1995). Human Dimensions of wildlife management: basic concepts.Wildlife and Recreationists: Coexistence Through Management and Research. R.L. Knight and K.J. Gutzwiller (eds.). Island Press, Washington D.C.

Maslow, A. (1970). Motivation and personality. 2nd ed. Harper and Row, New York, NY.

McFarlane, B. (1994). Specialization and motivations of birdwatchers. Wildlife Society Bulletin 22:357-370.

________. (1996). Socialization influences of specialization among birdwatchers. Human Dimensions of Wildlife 1(1):35-50.

National Survey on recreation and the Environment. (1996). University of Georgia Survey Research Center.

Payne, R. H. (1991). Potential economic and political impacts of ecotourism: a research note. Texas Journal of Political Studies 13: 65-77.

Shaw, W.W., and W. R. Mangun. (1984). Non-consumptive use of wildlife in the United States. U.S. Department of the Interior: Fish and Wildlife Service, Resource Publication 154. Washington, D.C.

Vaske, J.J. and D.J. Decker and M.J. Manfredo. (1995). Human Dimensions of Wildlife Management: An integrated framework for coexistence. Wildlife and Recreationists: Coexistence Through Management and Research. R.L. Knight and K.J. Gutzwiller (eds.). Island Press, Washington D.C.

______ and M.P. Donnelly. (1982). Differences in reported satisfaction ratings by consumptive and nonconsumptive recreationists. Journal of Leisure Research 14(3):195-206.

United States Census Data 1990. http://venus.census.gov/cdrom

Wiedner,D. And P.T., Kerlinger. (1990) Economics of birding: a national survey of active birders. American Birds. 44:209-213.

Wight, P.A. (1996). North American Ecotourists: Market profile and trip characteristics. Journal of Travel Research. Spring 1996. 2-10.

CHAPTER THREE

MOOSE RESPONSES TO WILDLIFE VIEWING ACTIONS AND OTHER HUMAN CAUSED STIMULI

This chapter focuses on responses of moose to specific human-caused stimuli. The literature review examines impacts of recreational activities on wildlife and highlights research on moose in parks. As in Chapters 1 and 2, a rationale for the study is presented followed by objectives, methods, results and discussion. This chapter concludes with recommendations for managing human viewing to minimize disruption of moose behavior.

Behavioral Response of Moose in Parks

Wildlife managers must attempt to understand and minimize the sometimes poorly understood impacts of nonconsumptive wildlife users on species and habitats (Duffus and Dearden 1993). There exists a wide range of intra and inter-specific variation of wildlife responses to disturbance (Knight and Temple 1995). For example, flight distance of bald eagles responding to human activities differ within and between sites, as well as seasonally (Knight and Knight 1984, Fraser et al. 1985). In the Netherlands, recreational activity negatively influenced eight species of passerines, while five others were unaffected (van der Zande et al. 1984). Bighorn sheep have a variety of behavioral responses to human disturbances, from no reaction to passing vehicles to an alarm reaction when hikers approach from above (Hicks and Elder 1979, MacArthur et al. 1982).

The behavioral response of moose to viewing has been explored in several park situations. McMillan (1954) studied an area in Yellowstone National Park subjected to heavy tourist pressure where moose were often photographed at close range. He found that moose eventually reduced their wariness to his approach, with his approach distance dependent upon the moose's activity. If a moose was feeding in water it was less tolerant of a close approach, regardless of the frequency of observation. If the disturbance appeared between the moose and its avenue of escape, they were much more wary than if they had a clear way to escape. When a moose fled, it ran only far enough for concealment in protective cover. Further, moose intently watched people at a distance of ≥100 yards for a few seconds to several minutes before resuming feeding. By comparing moose in a heavily utilized tourist area to moose in a lesser visited area, McMillan (1954) found that: 1) the closeness of approach was dependent on the manner of approach, 2) some moose were able to recognize an individual, and 3) their awareness of a person was dependent on visibility not who the individual was.

McMillan (1954) also examined response of moose to sounds. Moose in Yellowstone reacted to the snapping of twigs or rustling through brush. The metallic click of a field notebook brought a quick response, whereas shouting or a sharp whistle failed to produce a response. He found that automobile horns and other sounds from the highway failed to produce any response.

Moose often appear unalert because they can be approached closely without causing visible alarm reactions. However, deVos (1958) found that ear position was a good indicator of the level of alertness, and when alerted, moose extended their ears upward at a 45 degree angle to the head. He also found that flight, flushing distance, and the relative sign of alarm varied among moose.

In Yellowstone National Park, Altmann(1958) found that flight distance varied by month and situation. For example, during the fall hunting season moose fled at 200-300 yards, whereas a cow with a new calf could be approached within 30-70 yards in May and June. Bulls in velvet during summer were quite wary, stayed in cover, and had long flight distances. Bulls lost almost all caution and their flight distance became nonexistent during the rut.

Cobus (1972b) studied moose as an aesthetic resource at Joe Lake in Sibley Provincial Park, Ontario. In general, he found that the reactions of moose to humans indicated a developed tolerance. Voices frequently scared moose that seemed relatively unaffected by the sight and scent of viewers at the lake. He also noted that the noise of traffic passing the lake did not cause a reaction, but a sudden car horn or slam of a door frequently disturbed moose 500 yards away.

The effect of road traffic from 1973-1983 was examined in Denali National Park, Alaska, where there was a 50% increase in daily vehicular traffic on the main park road. This elevated volume correlated with a 72% decrease in moose (*Alces alces*) sightings and a 32% decrease in grizzly-bear (*Ursus arctus horriblis*) sightings per trip; sightings of Dall sheep (*Ovis dalli*) and caribou (*Rangifer tarandus*) were unaffected (Signer and Beattie 1986).

Rationale for Dixville Notch Study

In New Hampshire, moose are commonly viewed along major roadways in licks created by runoff of road salt. The Kancamagus Highway, Route 3 in Pittsburg, and Route 16 between Berlin and Errol were well known places to watch moose in the 1990s. Many other roadways had salt licks where moose were easily viewed including the Dixville Notch salt licks on Route 26, with less viewing pressure. Moose in Dixville Notch were observed primarily from cars, with some viewers exiting their vehicles directly at the lick.

The wildlife viewing program of the New Hampshire Fish and Game Department proposed the construction of a moose viewing area with a viewing blind on Route 26 in Dixville Notch. This site would provide viewers an opportunity to view moose out of their vehicle off the roadway, thereby reducing traffic congestion, road safety concerns, and direct human-moose interactions. The site would potentially change how people viewed moose and how moose responded to viewing. Specifically, people would park their cars away from the lick, walk a short distance to the viewing blind, and view moose from within the blind. The planning phase for building the viewing area provided the opportunity to design a research project that would explore behavioral responses of moose to viewer-caused stimuli. The two major factors at the Dixville Notch site that were different from previous research in parks were that visitors were encouraged to leave their cars and walk to a blind, and the viewing location was on a well traveled highway.

Objectives

The major objective of this study was to determine whether there was a predictable response by moose to certain human-caused stimuli at a roadside salt lick. Specific objectives included:

1) categorizing moose reaction to stimuli caused by wildlife viewers in a viewing blind to determine if there was a predictable response to

wildlife viewing behavior, and

2) categorizing moose reaction to stimuli caused by viewing activities and vehicular traffic on the roadway in order to determine whether there was a predictable behavioral response.

Study Area-Viewing Site

The 4 hectare study site which incorporated the viewing area was located to the east of Dixville Notch on Route 26. The area, harvested (clearcut) in 1991, was characterized by a regenerating northern hardwood/spruce-fir forest community. On the north side of the road was a significant salt lick about 175m long , with a smaller lick about 70 m long on the south side (Fig. 2).

A six car parking lot, trail, and viewing blind were built in December 1996. A trail approximately 125m in length led to a viewing blind that held up to twenty people. The viewing blind had viewing slits which faced the lick and a moose trail entering the lick from the east side, and affording a view across the roadway. A kiosk at the parking lot provided information about wildlife viewing ethics, services in the area, and other nearby designated viewing sites. Along the trail, seven educational signs covered topics about wildlife management and wildlife found in the area, and tips and ethics for wildlife viewing. Two signs providing information about moose were in the viewing blind.

Methods

Observers recorded reactions of moose to stimuli associated with people visiting the viewing site during June and July 1997- 1999.

The observer noted time, visitor numbers, and moose behavior on a recording sheet set up in a grid (Appendix I) (Lehner 1979). Most observation periods occurred during the evening when moose were most likely to visit the lick. Typically, multiple moose behaviors and human stimuli were recorded during each observation period. Seven specific human stimuli were categorized: car passing, truck passing, car stopped, car stopped with human outside of vehicle, visitor walking to or from blind, visitor in the blind talking, visitor talking loudly or creating a disturbance.

Moose responses were defined as one of six behaviors: feeding, looking, alert, moving, fleeing, and grooming. The number of moose in the lick and sex of the moose if determinable were recorded during each observation period. A moose was considered feeding if it was actively feeding or licking mud. Looking was defined as when a moose appeared to stare at the stimulus. Alertness was defined as when a moose stopped its previous behavior, stared, and had its ears in a 45 degree position (deVos 1958). A moose was regarded as moving if it took several steps and resumed its previous behavior. Fleeing meant a moose rapidly moved from the lick to perceived cover. Grooming was defined as licking or moving to repel insects.

An observation period was defined as the elapsed time when a moose entered the lick to the time it left, or it was too dark to continue observation. Within each observation period, the observer recorded both moose behavior and human stimuli that occurred every other minute. All responses and stimuli were noted during each recorded minute. Because moose were not marked, and moose have affinity for specific salt licks, the same moose was probably observed on different days. Multiple observations occurred each observation period. These two facts meant that observations were not independent.

Moose behavior was not documented with the viewing blind empty. The observer, referred to as the standard visitor, set the standard of behavior to which the behavior of other wildlife viewers was compared. The standard visitor approached the blind quietly, did not talk while in the blind, and usually was in the blind before moose visited the lick. Presumably, moose rarely detected the presence of the standard visitor or, at the very least, showed no reaction to the standard visitor. Baseline moose behavior was recorded only when the standard visitor was present and there were no other human stimuli. The recording sheets and other written comments of the observer were used to construct a narrative of each period to provide further description of the interactions (Appendix IV).

Analysis of single and multiple combinations (2-4) of human stimuli were necessary because multiple stimuli often occurred simultaneously (e.g., car stopped and truck passing). Moose response was quantified by totalling the number of observed responses and calculating the percentage of each response that was exhibited for individual and combinations of stimuli. A Chi-square test ($p \leq 0.05$) of independence (Zar 1996) was used to compare the distribution patterns of the various behavioral responses to different stimuli to the pattern of responses associated with the standard visitor.

Results

A total of 48 observation periods occurred; 9 in 1997, 19 in 1998, and 20 in 1999. Observation periods ranged from 5- 93 minutes; the average period lasted 22 minutes. During an observation period an average of 6.4 cars passed, 1.6 trucks passed, 3.2 cars stopped and 0.9 humans were out of their car. No observation period had only viewers in the blind and moose in the lick.

During the 342 minutes of observation when the standard visitor was present, moose spent 34% of time feeding, 20% of time looking, and approximately 25% of time alert. They moved within the lick almost 15% of the time. Little grooming behavior (<2%) was witnessed and moose fled without apparent reason <4% of the time (Fig. 14).

Differences in behavioral response patterns when compared to the standard visitor response pattern were found when a truck passed (X^2=26.5, df 5, p=0.000) and a car stopped (X^2=18.8, df 5, p=0.002)(Table 10)(Fig. 15). When trucks passed moose fled 14.5% of the time or four times as often when the standard visitor was present, feeding declined >25%, and looking declined by 23%. Moose were most alert (29.7%) when a truck passed the lick; this percentage of time alert was higher than that occurring with any other single or combination of stimuli. When cars stopped, moose fled 12% of the time, or three times more than with the standard visitor, feeding behavior declined by >30%.

In contrast to trucks passing, cars passing had little effect on feeding (31 %), but elicited a similar response in alertness (29.6%)as when trucks passed. Moose fled 7% of the time when a car passed or a visitor talked loudly. Although, only 20 minutes of loud visitors were recorded, they caused the largest behavioral responses as feeding behavior decreased >46%, looking increased >33%, and moving increased >20%. Visitors talking in a normal voice had minimal influence only looking increased by > 8%.

Moose fled 12% of the time when cars stopped at the edge of the road. However, if a moose didn't flee immediately when a car stopped and a human got out of the car, moose spent an equal amount of time looking (27.2%) and

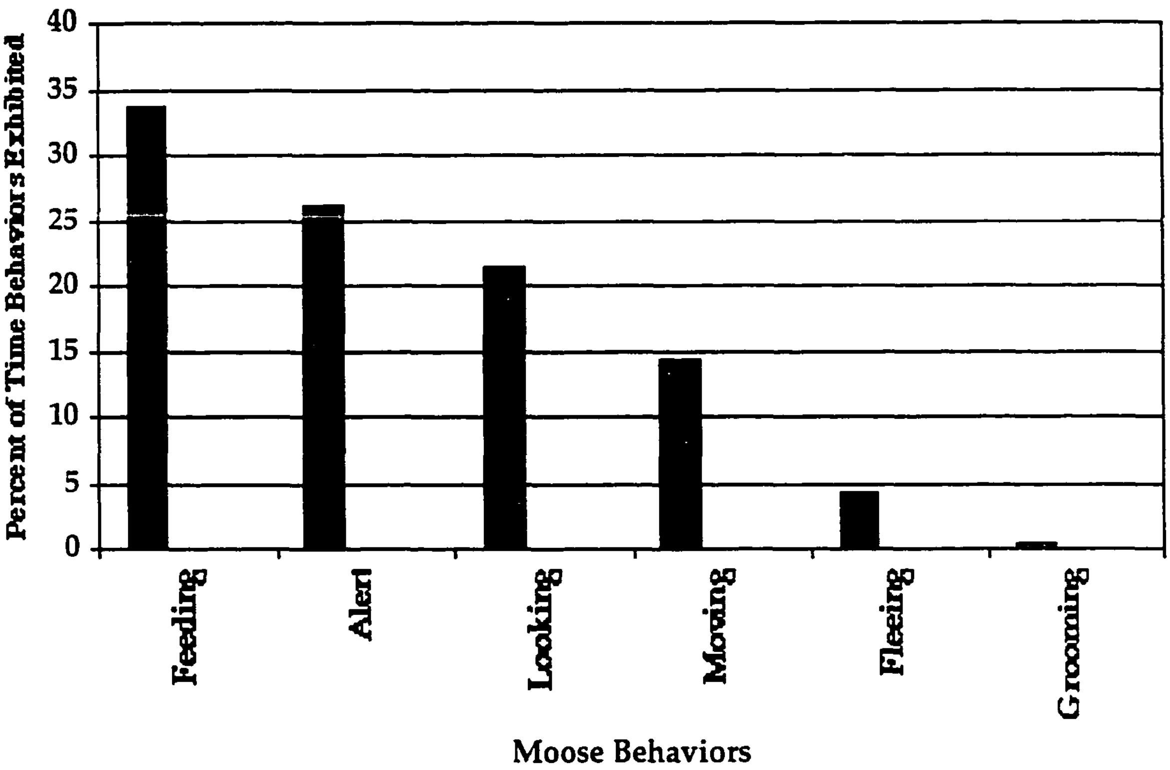

Figure 14. Moose behavioral responses when only the standard visitor was present in the viewing blind in Dixville Notch, NH. These data were used to compare all other response patterns to individual and combined stimuli.

Table 10. Chi square analysis of behavioral response patterns for singular stimulus and percentage of time moose fled or were feeding for observations made from the viewing blind in Dixville Notch, NH during summer 1997-1999.

Stimulus	No. Of Observations	Chi-Square	df	p-value	% time fled	% time feeding
Standard Visitor	246				4.2	33.6
Car Passing	267	3.84	5	0.572	7.1	31.3
Truck Passing	72	26.5	5	**7.136E-05**	14.5	24.2
Car Stopped	117	18.5	5	**0.002**	12.0	23.3
Visitor Walking	37	5.08	5	0.406	9	35.2
Visitor Talking	128	2.81	5	0.729	3.8	31.6
Visitor Loud	20	4.54	5	0.475	7.4	18.5

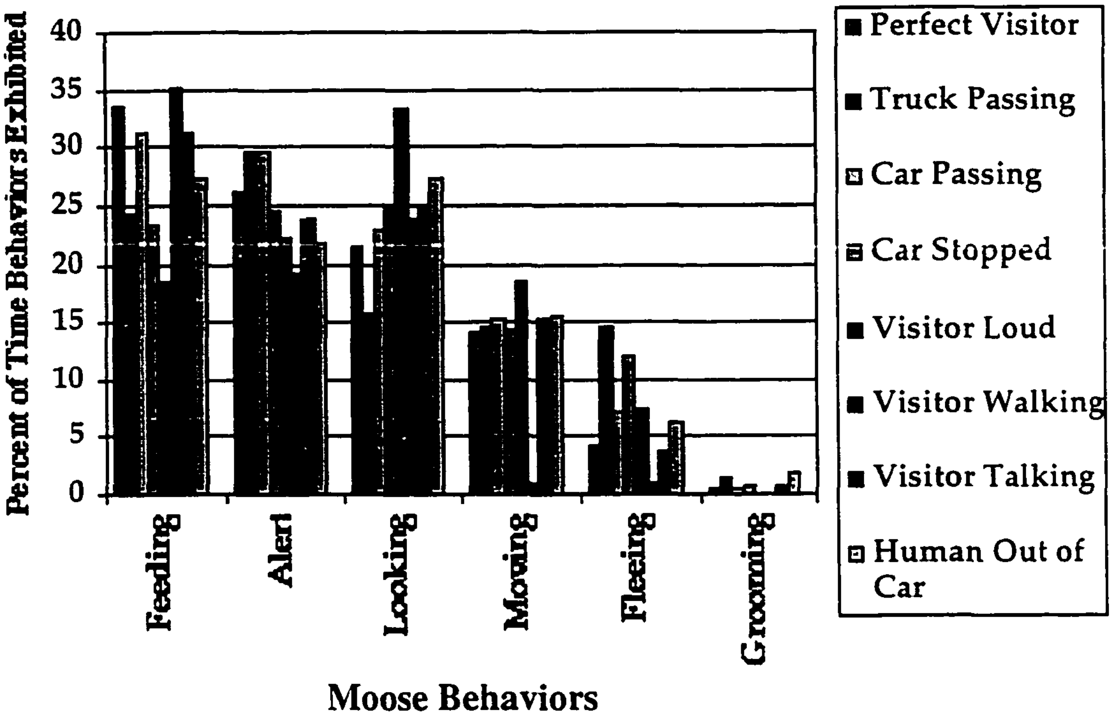

Figure 15. Moose behavioral responses to stimuli.

feeding (27.2%). If a person moved toward a moose, it generally fled when approach within 5-6m. In one case, the observer witnessed a person approach a moose within 2.5m; the animal's ear position indicated a constant state of alertness. No moose showed aggression towards people.

Three, two-way combinations of stimuli caused different responses than those associated with the standard visitor: car stopped and visitor walking (X^2=18.8, df=5, p=0.002), truck passing and car stopped (X^2=15.56, df=5, p=0.002), and visitor walking and truck passing (X^2=12.2, df=5, p=0.033)(Table 11)(Fig. 16). Moose in each of these situations fled >10 % of the time, or twice the rate associated with the standard visitor. Trucks passing and cars passing reduced feeding by 13% compared to the standard visitor, but the overall change in pattern of response was not significant (X^2= 2.36, df=5, p=0.79) (Table 11). All of the multiple combinations of stimuli that had significance included single stimuli that were important. Chi-Squares were within the same ranges indicting no additive effects.

Three-way combinations had similar patterns as the two way combinations if a truck passed and car stopped. The largest differences relative to the standard visitor occurred when: visitor walking, truck passing and car stopped (X^2=19.58, df=5, p=0.001), and truck passing, car stopped and human out of car (X^2=18.32, df=5, p=0.002)(Table 12). In these situations moose fled >10 % of the time and the percentage of time feeding time decreased by >5%. The combination of visitor talking, visitor walking and car stopped was nearly significant (X^2=11.04, df=5, p=0.05057); fleeing increased

Table 11. Chi square analysis of behavioral response patterns for combinations of two stimulus occurring simultaneously and percentage of time moose fled or were feeding for observations made from the viewing blind in Dixville Notch, New Hampshire summer 1997-1999.

Stimuli	No. Of Observa-tions	Chi-Square	df	p-value	% time fled	% time feeding
Standard Visitor					4.2	33.6
Car Stopped-Human Out of Car	47	5.48	5	0.360	6.6	27.2
Car Passing-Truck Passing	304	2.36	5	0.79	7.8	27.2
Car Passing-Car Stopped	357	6.71	5	0.242	7.5	28.6
Truck Passing - Car Stopped	236	15.3	5	**0.002**	11.1	25.5
Visitor Walking-Truck Passing	102	12.12	5	**0.033**	13.6	26.7
Visitor Walking-Car Passing	289	3.96	5	0.055	6.9	29.8
Visitor Walking-Car Stopped	207	18.9	5	**0.002**	10.9	25.3
Visitor Talking Visitor Walking	149	1.59	5	0.901	4.7	32.1
Visitor Talking Visitor Loud	56	8.32	5	0.138	8.5	30.8

Table 12. Chi square analysis of behavioral response patterns for three way combinations of stimuli occurring simultaneously and percentage of time moose fled or were feeding for observations made from the viewing blind in Dixville Notch, New Hampshire summer 1997-1999.

Stimuli	No. Of Observations	Chi-Square	df	p-value	% time fled	% time feeding
Standard Visitor					4.2	33.6
Car Passing-Car Stopped-Truck Passing	387	8.57	5	0.127	8	28.2
Visitor Walking-Truck Passing-Car Stopped	255	19.58	5	**0.001**	11.4	25.6
Truck Passing-Car Stopped and Human Out of Car	239	18.32	5	**0.002**	11.1	25.6
Car Passing-Car Stopped and Human Out of Car	359	6.81	5	0.234	7.6	28.6
Visitor Walking-Car Stopped-Human Out of Car	77	7.47	5	0.187	7.9	28.8
Visitor Walking-Truck Passing - Car Passing	323	1.59	5	0.901	8.0	28.8
Visitor Talking-Visitor Walking-Car Passing	355	3.55	5	0.615	6.2	29.8
Visitor Talking-Visitor Walking-Truck Passing	204	8.73	5	0.415	9.0	29.8
Visitor Talking-Visitor Walking-Visitor Loud	154	2.35	5	0.798	4.9	31.2
Visitor Talking-Visitor Walking-Car Stopped	299	11.04	5	**0.050**	8.4	27.6

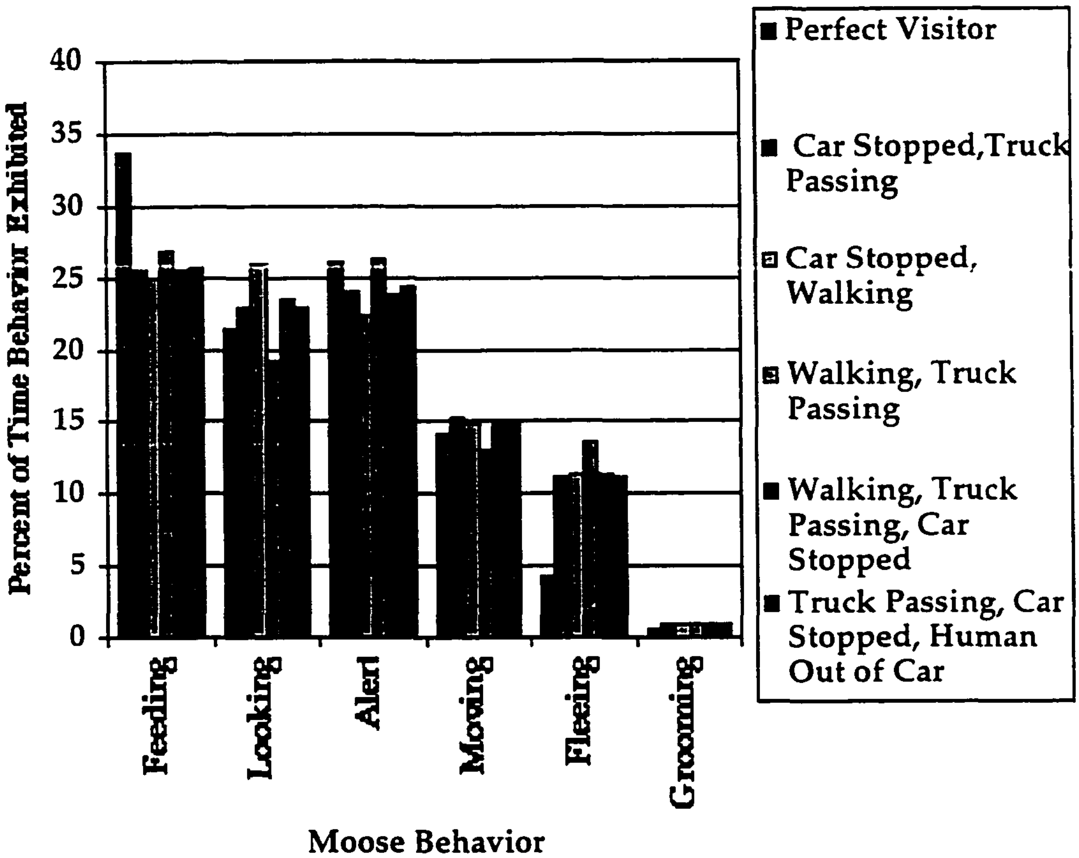

Figure 16. Moose behavioral responses to various two and three way combinations of stimuli occurring simultaneously including: visitor walking-truck passing; truck passing- car stopped; car stopped-visitor walking visitor walking, car stopped, truck passing; truck passing, car stopped, human out of car.

>4 %, feeding decreased >5% and looking increased >4% relative to the standard visitor. In the combination of visitor walking, car stopped, and human out of car, the narratives indicated that if a moose didn't flee when the car stopped, it fled when the person approached too closely.

Differences existed in four-way combinations of stimuli that included truck passing, car stopped, and visitor walking stimuli (Table 13): visitor talking, visitor walking, truck passing and car stopped (X^2=13.19, df = 5, p=0.022); visitor walking, car passing, truck passing and car stopped (X^2=11.97, df=5, p=0.031); visitor walking, truck passing, car stopped, and human out of car (X^2=16.02, df =5, p<0.006). In the other four way combinations of stimuli, moose were alert >25% of the time, their feeding time remained relatively stable, and they fled 5-8% of the time. When the combination of visitors talking, visitor walking, car stopped and human out of the car occurred, the moose response pattern was similar to that of the standard visitors.

Table 13. Chi square analysis of behavioral response patterns for four way combinations of stimuli occurring simultaneously and percentage of time moose fled or were feeding for observations made from the viewing blind in Dixville Notch, New Hampshire summer 1997-1999..

Stimuli	No. Of Observations	Chi-Square	df	p-value	% of time fled	% of time feeding
Standard Visitor					4.2	33.6
Visitor Talking-Visitor Walking - Car Passing-Truck Passing	386	5.91	5	0.314	7.3	29.0
Visitor Talking-Visitor Walking-Truck Passing-Car Stopped	341	13.19	5	**0.021**	12.5	27.2
Visitor Walking-Car Passing-Truck Passing - Car Stopped	400	11.97	5	**0.031**	8.2	28.2
Car Passing- Truck Passing-Car Stopped-Human Out of Car	328	7.38	5	0.193	7.7	28.2
Visitor Walking-Truck Passing-Car Stopped-Human Out of Car	137	16.02	5	**0.006**	11.6	26.6
Visitor Talking-Visitor Walking-Car Stopped-Human Out of Car	182	4.319	5	0.504	5.3	30.9

Discussion

In general, reactions of moose to humans at the Dixville Notch Wildlife Viewing Area indicated a high tolerance of human stimuli. In no situation did moose flee the lick >15% of the time and feeding occurred
<20% of the time except when visitors were loud (Fig. 15). Similar tolerance was found in park situations by McMillan (1954), deVos(1958) and Cobus (1972b).

Wildlife viewing sites have several purposes, including offering a viewing opportunity. Consequently, it was necessary to determine whether the act of viewing may reduce the opportunity to view moose. The data indicate that viewing from the blind did not cause the moose to flee the licks. Moose did not flee the site when visitors walked to or from the site, talked in normal tones or when viewed from the blind. Visitors in the blind had been exposed to proper viewing behaviors through educational signs placed along the trail. This information may have caused them to exhibit better viewing behaviors in the blind than they otherwise would have. Visitor behavior in the blind may also have been influenced by the presence of the observer (standard visitor). The incidence of loud visitors was low, however, they had the greatest effect on any one behavior. Although moose did not flee in these situations and the overall change in pattern from the standard visitor was not different, feeding declined and looking measurably increased. This indicates the importance of identifying and educating wildlife viewers to proper viewing techniques.

While there was minimal change in moose response to viewers in the viewing blind, responses related to specific stimuli on the highway were more pronounced. Trucks passing and cars stopping elicited a stronger response.

Although observers in parks (McMillan 1954, Cobus 1972a) found little response to traffic, moose at this site fled at >3 times the rate when a car stopped or a truck passed relative to responses to the standard visitor. Moose sighting decreased in Denali National Park when traffic on the park road increased by 50% over a ten year period (Signer and Beattie 1985). In the case of Dixville Notch, it should be emphasized that traffic volume on Route 26 is >3000 cars a day with a speed limit of 55 mph, unlike parks with slow moving traffic. Logging and semi-tractor trailer trucks were audible at considerable distances as they gained speed entering and leaving the Notch. At least one moose each summer was struck by a vehicle at the study site. This finding has implications in terms of where to locate future moose viewing sites in order to increase successful viewing opportunities.

The incidence of wildlife viewing is also greater in parks than at Dixville Notch. Further, moose in parks are continuously subjected to viewing and presumably are more habituated to stopped cars. Given that the Dixville Notch Wildlife Viewing Area was established in 1997 and the site is on a well-travelled highway, the proportion of stopped cars to cars passing is relatively small. Consequently, moose in Dixville are not as habituated to stopped cars as moose in park situations, and respond with measurable behavioral changes including decreased feeding and increased fleeing.

Moose showed differences in behavioral response patterns with combinations of stimuli that included stimuli associated with the highway and visitors in the blind. Since the singular stimulus of a truck passing or car stopped evoked an increased in fleeing response, presumably the response attributed to a combination of stimuli was probably indicative of the strongest single stimuli evoking a fleeing response. There appeared to be additive effects when combinations of stimuli were combined with truck passing or car stopped. For example, when a car stopped and a visitor was walking, moose fled twice as often as when the visitor was walking. When three-way combinations of stimuli occurred this phenomena continued. In the case where visitors were talking, walking and a car stopped, the moose fled twice as often as when visitors were walking or talking.

One exception to this occurred with the combination of visitor talking, walking, car stopped, and humans out of cars. Moose fled only 5.3% of the time with feeding, looking, alert and moving responses similar to those associated with the standard visitor. In this instance, the moose that stayed in the lick appeared extremely tolerant of any human-caused stimuli and was considered a highly tolerant moose.

Moose that are less tolerant of people may use the site, but at times of minimal human presence. It should be noted that most human visitation occurred during midday and in the early evening when moose visitation was relatively low. To determine whether individual moose use the lick relative to human visitation would require marked moose. Individual moose could be monitored to determine their frequency and time of visitation, and whether individual, age, or gender patterns exist.

Conclusions/Implications for Management

Observations of moose behavior at the Dixville Notch Wildlife Viewing Area suggested that behaviors were influenced by certain human caused stimuli.

The presence of the viewing blind with quiet well-behaved visitors had minimal effect on the activities of moose in the lick. Feeding activities occurred approximately a third of the time while fleeing occurred a < 4% of the time, and was caused by no observable stimuli.

The situation was somewhat different on the few occasions when loud visitors were present. The resulting decline in feeding behavior undoubtedly had little effect because the incidences were short, lasting less than five minutes. Substantial impact on feeding behavior could influence use of salt licks on a daily or long term scale. If disturbances were more frequent of longer duration, moose may alter their visitation time and duration, or conversely, become habituated to the presence of noisy visitors. It is an area which bears further investigation.

In the case of human caused stimuli unrelated to the viewing blind, measurable changes occurred in several instances, particularly in the case of trucks passing and cars stopping. In both these situations or in combination with other stimuli, fleeing increased and feeding decreased. While these behavioral changes occurred, the overall effect may not be meaningful in the context of necessary time spent in the lick to fulfill nutritional requirements. Since truck traffic is a constant stimuli, it can be assumed that there is minimal effect on the moose population. Certainly little could be done to decrease the type and amount of truck traffic on this stretch of highway. In the case of cars stopping, this behavior can possibly be curbed through educational and regulatory activities.

Several recommendations for managing wildlife viewing sites can be inferred from these findings: 1) wildlife viewing areas with viewing blinds can be erected in such a way as to minimize moose behavior responses; 2) building viewing sites away from heavily trafficked roads would enable visitors to view moose with less outside disturbance caused by traffic and cars stopping in inappropriate places, and, 3) if sites are built along the roadway such as the one in Dixville Notch, "No Stopping" signs should be posted to help prevent cars from stopping and disturbing the moose and reducing viewing opportunities.

Wildlife viewers need to be educated about behavioral responses of moose to human behaviors. They need to know that moose alter their behavior when people stop their cars along the road, and that approaching moose has an immediate effect on the moose's behavior. In both instances viewing opportunities are reduced as a consequence of increased fleeing. A moose viewing ethic can be developed through education and can be instilled in viewers at viewing sites such as Dixville Notch, to help ensure successful viewing of moose with minimal effect on their behavior.

Literature Cited

Altmann, M. (1958). The flight distance in free-ranging big game. Journal of Wildlife Management. Vol. 22:2:207-209.

Cobus, M.W. (1972a). Moose as an aesthetic resource and their summer feeding behavior. 8th North American Moose Workshop Proceedings. pp. 244-275

_______. (1972b). Moose (Alces alces) and campers in Sibley Provincial Park: a study of wildlife aesthetics. M.S. Thesis, University of Guelph, Guelph Ontario.

deVos, A.(1958). Summer observations on moose behavior in Ontario. Journal of Mammalogy 39(1): 128-139.

Duffus, D.A. and P. Dearden. (1993). Recreational use, valuation and management, of killer whales (Orcinus orca) on Canada's Pacific coast. Environmental Conservation. Vol. 20:2:149-156.

Fraser, J.D., L.D.Frenzel, and J. E. Mathiesen. (1985) The impact of human activities on breeding bald eagles in north-central Minnesota, Journal of Wildlife Management 49:585-592.

Hicks, L.L. and J.M. Elder. (1979) Human disturbance of Sierra Nevada bighorn sheep. Journal of Wildlife Management 43:909-915.

Knight R.L. and S.K. Knight. (1984). Responses of wintering bald eagles to boating activity. Journal of Wildlife Management 48:999-1004.

______ and S.A.Temple. (1995). Origin of wildlife responses to recreationists. Wildlife and Recreationists ,Coexistence Through Management and Research,. R.L. Knight and K.J. Gutzwiller (eds.) Island Press, Washington D.C.

Lehner, Philip N.(1979). Handbook of Ethological Methods. Garland STPM Press. New York, New York.

MacArthur, R.H., V. Geist, and R.H. Johnston. (1982). Cardiac and behavioral responses of mountain sheep to human disturbance. Journal of Wildlife Management 46: 351-358.

McMillan, J.F. (1954). Some observations on moose in Yellowstone Park. American Midland Naturalist 52 (2): 392-399.

Signer, F.J. and J.B. Beattie. (1986). The controlled traffic system and associated wildlife responses in Denali National Park. Arctic: 195-203.

Van der Zande, A.N., J.C.Berkhuizen, H.C. vanLatesteijn, W.J. ter Keurs and A.J. Poppelaars. (1984). Impact of outdoor recreation on the density of number of breeding bird species in woods adjacent to urban residential areas. Biological Conservation 30:1-39.

Zar,J.H. (1996). Biostatistical analysis. Prentice Hall Inc. New Jersey.

CHAPTER FOUR

INTEGRATING SOCIAL SCIENCE AND BIOLOGY-AN INTERDISCIPLINARY APPROACH TO NATURAL RESOURCES MANAGEMENT

An overall goal of this study was to use multiple disciplines to integrate sociological and biological data related to wildlife viewing, wildlife viewers, and viewed wildlife to measure interrelationships and develop recommendations for a wildlife viewing management plan. As in traditional research, biological and sociological data were collected separately and inferences were made about their interrelationships. While this multiple disciplinary approach was useful in developing a program to manage wildlife viewing (Chapter 5), deficiencies in this approach were apparent. During the research, insights into accomplishing an interdisciplinary approach and the potential of using integrated biological and sociological data became evident. This chapter examines the history of human dimensions and its use in resource management, discusses difficulties encountered in this research, and proposes an interdisciplinary approach in order to develop a comprehensive plan for wildlife viewing management.

Historical Perspective of Human Dimensions

Aldo Leopold was one of the first natural resource managers to express the need to take natural resource management beyond the biological sciences in his essay entitled a Land Ethic:

> A land ethic, then, reflects the existence of an ecological conscience, and this in turn reflects a conviction of individual responsibility for the health of the land. Health is the capacity of the land for self-renewal. Conservation is our effort to understand and preserve this capacity.
> (Leopold 1949)

Similarly, King (1948) expressed that even though game managers were not sociologists, they should be able to study man's relationship with game management problems.

However, it wasn't until the late 1960s and early 1970s that active interfacing of human and natural resources information began in earnest. One primary catalyst was the passage of the National Environmental Policy Act in 1969 which required that a federal agency conduct an environmental impact statement (EIS) before taking actions that could significantly affect the quality of the human environment. One component of the EIS was a social assessment requiring an applied field of social science and an approach to information gathering and analysis to optimize decisions having environmental implications (Burdge 1994).

Human dimensions is the complex interrelationship among the individual (with specific motivations, attitudes, values and knowledge), the population, community, economic and social issues, and the resource. In its simplest form, the human dimensions approach can be described as the acquisition of information using the concepts and methods of social science that predict and explain human thought and action regarding natural resources, and the determination of how that information is used in decision-making (Manfredo et al. 1995). Ewert (1996) defined human dimensions research as the scientific investigation of the physical, biological, sociological, psychological, cultural, and economic aspects of natural resource utilization at the individual and community levels. Within the context of his definition are three basic research issues: 1) What are the human sources of environmental change and resource impacts? 2) What are the impacts these environmental changes have had on people and communities? 3) What have been and will be the mitigation and/or adaptive actions that social units respond to resource scarcities and conflict? Human dimensions should be recognized as a tool to effectively channel resources and human actions toward meeting the larger goal of conservation (Duda et al. 1998).

In its infancy, most human dimensions research focused on how economics related to human behavior and natural resource management, however, economics is only one influence on human behavior (Ewert 1995). Ecological, economic, political, and socio-cultural components need consideration within the management environment during decision-making (Krueger et al. 1986). The ecological component sets the limits or boundaries on potential resource productivity and use. Ecological research utilizing acceptable scientific practices provides the basis for this aspect of the decision-making process. The economic component includes the processes of the marketplace and nonmarket forces (unpriced values) that influence valuation of natural resources. Actual dollar amounts are assigned to various aspects of the environment to be managed and the willingness of users to pay. The political component includes established laws and codes, policies of various government agencies and the values of government employees who interpret laws and policies; this last aspect is dynamic and often undocumented. The socio-cultural component includes traditions, values, norms, religions, and philosophies of various segments measured with a variety of social science research techniques. Because these four components are not independent, human dimensions work is conducted in disciplines as diverse as anthropology, economics, geography, mass communication, marketing, political science, psychology, recreation, sociology, and social psychology (Manfredo et al. 1995).

Decker et al. (1992) built on Krueger et al. (1986) work and created a natural resources management decision-making model that incorporated human dimensions. Their 10 element model and other aspects of human dimensions are used currently in a variety of state and federal agencies to develop policy. The first three elements are: 1) broad policy emerges from the management environment and reflects society's recognition of the value of natural resources and establishes a relative priority for management of natural resources, 2) goals which include broad statements of intent are determined by federal and state policy, and 3) specific policies are set from these goals within the institutional bounds of the organizations.

Objectives are established within the bounds of policy from the first three elements. Opportunity or problem identification determines the avenues available to facilitate achievement of objectives and barriers likely to impede success. Basic and applied biological and sociological research builds an information base used to understand opportunities and problems, and to develop actions. Actions may include manipulation of the ecological component of the environment or people's behavior. Response is an important concept because it is the short-term, immediate outcome of management actions.

Evaluation measures the response of the management environment to the actions implemented from objectives. These elements contribute to, and are supported by, the information bases that include research findings, collective experience, and theory from biological and social sciences. This allows for a certain amount of dynamic complexity in the policy setting model (Decker et al. 1996).

Other examples of using social sciences in problem solving and policy formation were presented by Clark (1992, 1997). He detailed how a social mapping process, originally developed by Lasswell and Kaplan (1950), can be used to actively involve the public in endangered species recovery and provide an understanding of the social processes at work. People involved in recovery programs realize how their decisions and actions are perceived by other participants and consequently can better understand actions of others. Case studies on monk seal (*Manachus schauinslandi*) recovery in the Hawaiian Islands and grizzly bear (*Ursus arctus horriblis*) management in the Yellowstone region demonstrated how management actions lead to intractable negative public perceptions when social dimensions of management are ignored (Clark and Wallace 1998).

Questions asked in the social mapping process of a specific endangered species recovery problem include:

1) Who are the participants both individuals and groups? Who should participate and who demands to participate?

2) What are the perspectives of the participants including demands and expectations.

3) In what situation do participants interact?

4) What are the base values including enlightenment, wealth, well being, skill, affection, respect, and rectitude.

5) What strategies are employed?

6) What outcomes (changes in distribution of values) are achieved in the ongoing, continuous flow of interaction among participants?

7) What are the effects of the effort?

This approach requires that the social dimensions process involve a public actively supporting species conservation when biological issues are addressed.

Thirty years ago, Hendee and Potter (1971) identified research needs for incorporating the human element into wildlife work including hunter satisfaction, nonconsumptive uses of wildlife, economics, and issues in wildlife policy. Efforts have occurred in all these areas, with the largest body of work aimed at using human dimensions research in wildlife management decisions and hunter satisfaction (Hendee 1974, Heberlein 1982, Decker and Connelly 1989, Peyton 1989, Applegate 1989, Purdy and Decker 1989, Decker et al 1992, Duda et al. 1998). The wildlife management profession has, for the most part, realized the importance of the human element. However, this element is often based on speculation, supposition, and conjecture (Duda et al. 1998) The major challenge is wide-scale implementation of human dimensions and related research into wildlife management programs.

Natural resource managers must continue to integrate human dimensions into natural resource management, as has occurred in decision- making processes albeit in a rather mechanistic way, and must also understand and recognize that people are embedded in and cannot be separated from nature (Booth and Kessler 1996). The ultimate goal of natural resource management is conservation to maintain biodiveristy and ecosystems (Duda et al. 1998). This can not be accomplished without understanding human values and expanded recognition of the human dependence on diverse experiences with natural resources (Kellert 1996). Consequently, this means the resource can not be managed without emphasis on managing for biological diversity and accounting for sociological diversity.

Models involving the full integration of people and the resource are beginning to develop within resource management approaches and are as diverse as ecosystem management on public lands to global environmental change issues. Driver et al. (1995) developed an ecosystem management approach for the USDA Forest Service that integrated biophysical and social components in management planning. Stern (1995) included two environmental sciences in his model addressing global environmental change; one dealt with environmental systems and the other human dimensions. Interdisciplinary teams of biologists, ecologists, resource managers, and human dimensions researchers are needed to effectively accomplish these management approaches.

Current work in human dimensions primarily focuses on gathering information based on social science and biological disciplines, looking at each data set separately, interpreting the data in the context of the resource management issue, and making decisions based upon that information. Wildlife management examples of human dimensions research conducted in this manner include hunter and angler satisfaction (Duda et al. 1998), suburban deer management (Chase et al. 1999), and attitudes of constituency groups (Vittersø et al. 1999).

Clark et al. (1999) advocated the use of multiple methods in endangered species conservation including: 1) biological methods that focus on the species and its ecosystem; 2) social science methods that examine the decision and how social processes work, including the values and perspectives of participants and the situation affect recovery efforts; and 3) interdisciplinary methods that systematically integrate biological and social research. It differs from a multidisciplinary approach in that diverse methods are integrated, rather than conducted in isolation.

The first requirement of interdisciplinary problem solving is a conceptual and practical framework that can accommodate diverse data, epistemologies, and disciplines (Clark 1998). With regard to endangered species recovery, Clark (1997) recommended a decision seminar that requires a group effort to address problem orientation, social process mapping, decision process mapping, and standpoint clarification. Problem orientation clarifies goals, describes trends, analyzes conditions, projects trends, and invents alternatives. Social process mapping helps to understand the social context through identifying participants, determining perspectives, identifying base values, strategies to employ how outcomes are achieved and the effects of the effort.

The decision process is the course of action for how participants will determine policy. Steps in this process include intelligence (gathering information), open debate, setting guidelines for the process, compliance with the guidelines, how disputes will be resolved, review of the process, and termination of the process when decisions are made or problems are unresolvable (Lasswell 1971). Standpoint clarification consists of recognizing a person's value orientations and biases. Later in this chapter, Clark's (1998) approach will be re-examined with refinements for use in creating a wildlife viewing management plan.

This type of interdisciplinary approach would achieve a better understanding of the effect of humans on natural resources and the effect the resource has on humans. This approach requires a major shift in the paradigm of how interactions between humans and natural resources are interpreted, and may result in new and different strategies in wildlife management.

Research Scope

The integration of sociological and biological data in this study was accomplished by collecting information about the experience of wildlife viewing, wildlife viewers, and viewed wildlife. This information was used to determine impacts of wildlife viewing and to develop strategies for management of wildlife viewing. Chapters 1, 2, and 3 described the collection, analysis, and interpretation of biological and sociological data. This information was then combined in a multi-disciplinary approach to develop recommendations for a wildlife viewing management program in Chapter 5.

Discussions about utilizing a different approach that provided an integrated data set analyzed with an interdisciplinary filter occurred at several stages during this research. It is worthwhile to examine the research conducted at Dixville Notch Wildlife Viewing Area in the context of how the research could be improved with an interdisciplinary approach that effectively integrates biological and social science methods.

One of the specific problems with this research was that there was no vision of a basic framework upon which concepts, analyses, and philosophies would be combined and utilized in an interdisciplinary approach. Ultimately, data were collected within the separate disciplines with traditional methods rather than across disciplines. In retrospect, one objective of this research should have been to develop a framework for an interdisciplinary approach using the Dixville Notch Wildlife Viewing Area as a case study in order to evaluate the effectiveness of the framework.

From the perspective of wildlife viewing, the interaction that occurs between wildlife and people is an interface that can influence the broader goal of wildlife conservation. This interface is complex and dynamic, varies individually, and should influence wildlife viewing management programs to provide consistent high quality experiences that increase stewardship of the viewer. A multidisciplinary approach is required to gather adequate information to understand this.

Original discussion centered around the idea of an integrated data set at the interface between viewers and wildlife. Alternative ideas for collecting data were discussed including placing an observer in a tree where they would not be detected, or using cameras to record observations. Neither was utilized due to limitations on the site, cost, and ethical problems with the use of non-consenting human subjects. The decision to gather information on the cause- effect relationship between viewer behavior and moose response ultimately limited this study to a more traditional approach.

The use of an observational study presented many challenges including gathering a large enough sample size, multiple dependent and independent variables that could not be controlled or eliminated, and determining whether different moose were present during each observational period. A better approach to determine the cause-effect relationship of viewer behavior and moose response would have been to use an experimental design where the variables could have been controlled. The researcher could cause specific stimuli, such as being loud in the viewing blind, leaving the blind, or approaching the animal thereby eliminating multiple causal variables. In addition, marking or identifying the moose that used the lick would have eliminated the problem of pseudo-replication.

Certainly a different experimental design would have made the biological impact portion of this study easier to analyze. In the scheme of an interdisciplinary approach, however, experimental methods like the one described above still would provide only one dimension of the viewer-moose interaction. While this may give credence to managing visitor behavior based upon moose response, it tells little about viewer response. Further viewer survey data is limited because it provides after the fact information. It is at the interface that there is an opportunity to design, collect, and analyze an integrated data set to provide a more complete picture of cause and effect relationships between the viewer and wildlife. These relationships include but are not limited to: viewer reaction to seeing a moose, viewer behavior and moose response, viewer response to moose response, and interaction between viewers. A number of methods would be necessary to gather this kind of information including use of a camera system to monitor both the lick and viewing blind. A camera system would provide baseline/control moose behavior and eliminate the potential bias on viewer behavior caused by the observer in the blind. Viewer reaction to seeing a moose could be examined by looking at facial expressions, body language, and listening to comments. The ethical obstacle of using a camera to record human behavior could be eliminated by posting a sign explaining that viewers were being recorded. Viewer thoughts and feelings could be verified by using a post-viewing interview.

An Interdisciplinary Approach and Wildlife Viewing

The goal of a wildlife viewing program is to provide positive viewing experiences that have a number of outcomes. These outcomes hopefully include a memorable, enjoyable, and educational experience leading the viewer to want to learn more and take informed action on the behalf of wildlife. Positive outcomes for viewed wildlife include unaltered habitat and daily activities of feeding, resting, and nesting without stress or interference from wildlife viewing (Overbillig 2000). The complexity of developing a wildlife viewing management program to meet these premises is multidimensional requiring in-depth biological and sociological information.

A traditional method of creating a wildlife viewing management plan involves separate data collection in different disciplines. After data analysis, results from each discipline are reported and then used by a manager in developing a plan. The problem with this approach is that there is an inherent risk that the plan will be fragmented and disregard aspects of the experience which could be detrimental to wildlife or be counter productive to effective wildlife viewing. Use of an interdisciplinary approach provides a different paradigm, systematically integrating biological and sociological research in greater depth and diversity in the plan. Wildlife viewing plans should incorporate biology, education, sociology, and economic disciplines.

Clark and Wallace (1999) provided an integrated four element framework for developing endangered species recovery plans: problem orientation, social process mapping, decision process mapping, and standpoint clarification. This framework uses an approach developed by Lasswell (1971) for a continuing decision seminar to help users find, analyze, store, recall, and relate important information. While this framework was developed specifically as a problem solving method, it also has application as a planning method.

The primary difference in using this framework to develop a wildlife viewing management program is that there is no problem per se, rather, there are desired outcomes for wildlife conservation (Fig. 17). These outcomes, like problems, must be thoroughly understood by examining historic and future trends; potential methods to achieve the outcomes must be developed, evaluated, and selected for use. The following is a description of an interdisciplinary approach for developing a wildlife viewing management plan.

Developing the interdisciplinary team

A challenge in integrated interdisciplinary planning is to find common ground among multiple disciplines which requires acceptance of analytical methods and interpretation across disciplines. While the biological, ecological, educational, and sociological disciplines involved in human dimensions have

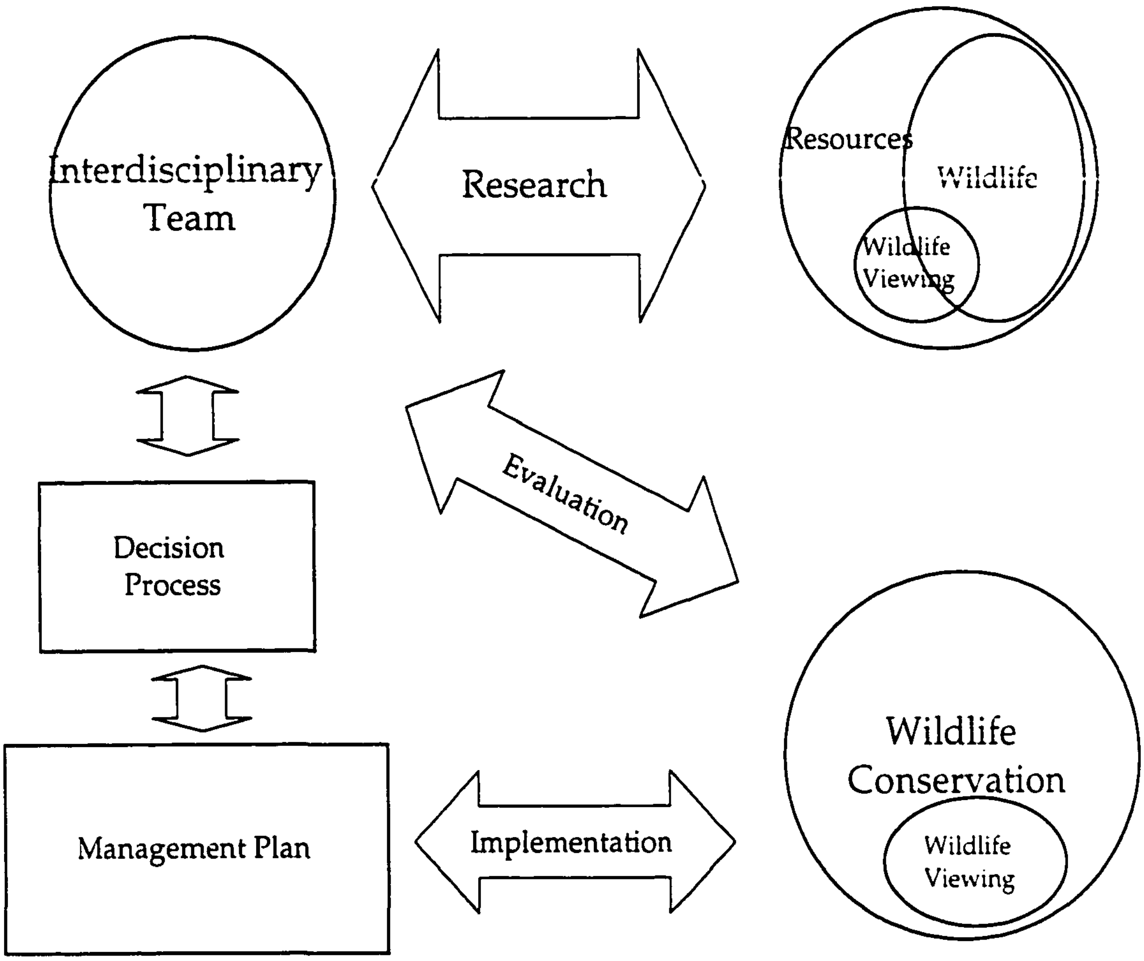

Figure 17. A framework to develop an interdisciplinary approach for creating a wildlife viewing management plan. This approach is complex and dynamic with a number of activities occurring simultaneously.

inherent separations because of their areas of knowledge, they need to be blended rather than compartmentalized to achieve effective integration. This requires a team of social science (sociologists and economists) and natural resources researchers (wildlife biologists, ornithologists, zoologists), as well as wildlife and recreational managers (perhaps policy makers), educators (or people knowledgeable about techniques to change human behavior), and viewers. The exact make up of the team depends upon a number of considerations including the region of the country and viewing subjects.

An interdisciplinary team could be used in developing a wildlife viewing plan for northern New Hampshire. This team should include a wildlife biologist, ornithologist, zoologist (these first three may be one person with expertise in all these areas), sociologist, economist, a wildlife manager, a park manager, wildlife educator, member(s) of the regional chamber of commerce, wildlife viewers, and perhaps a few interested local citizens. These team members must be willing to work within the challenges of using an interdisciplinary approach by communicating and thinking outside their disciplines.

Define Outcomes

An initial task of this team would be to define the desired outcomes. Essentially, this is no different from a regular planning process, except for the scope of the interdisciplinary team and their interactions. The team may establish preliminary outcomes based on historic information or future trends. In the case of wildlife viewing, the major outcome related to wildlife conservation is a given, however, the team may define more specific desired outcomes related to this the larger goal. For example, construction of a viewing blind will not alter use patterns of moose using the salt lick.

Defining research needs and methods

Research design and integrated frameworks-For the planning process to continue, specific information is required that is gained through empirical study using multiple quantitative and qualitative, observational and experimental, intensive and extensive, and contemplative and manipulative methods (Clark et al. 1999). The types of information desired would be multidisciplinary including biological impacts, state of knowledge, sociological (e.g., motivations, values, and attitudes), economic, and others. The difference between the traditional approach and interdisciplinary approach is that this data gathering process would not happen in a disciplinary vacuum.

Multiple methods provide a comprehensive approach to fully understand and address biological and sociological elements of wildlife viewing. The team would define the specific hypothesis and areas of study and develop acceptable research protocols that produce integrated data sets. If it is possible to collect an integrated data set such as when wildlife viewers are actively interfacing with the resource, the team will need to devise novel methods to collect this information. For example, at Dixville Notch the team could devise a camera system to record viewers actively interfacing with the resource, then use follow up post-visit interviews accurately evaluate their emotions or feelings at the time.

This blending of data collection from biological and sociological disciplines creates inherent difficulty because of the multivariates involved. Creating an integrated research model that explains wildlife-human interaction may require a less traditional focus on statistical differences defined by p-values versus the significance of the findings (Cherry 1998). Perhaps a combination of qualitative and quantitative data elements may better reflect the interaction.

For example, information collected at the interface of the wildlife-viewer using a camera combined with a post-visit interview can be analyzed both quantitatively (e.g., behavior frequency) and qualitatively (e.g., a narrative describing behavior and the related response) providing a different perspective. The quantitative approach might indicate that talking loudly caused a moose to stop feeding and increase staring. The narrative may indicate that the visitors became so excited about seeing a moose that they increased their noise level and reduced their own viewing opportunity. The two sets of data provide a more accurate depiction of the interface than either single approach.

Other viewer reactions not measured accurately with quantitative methods include feelings, emotions, and actions. While measurement of knowledge change can be quantified, attitude change is more qualitative. These changes are measurable, but information needs to be gathered using unstructured interviews, observing reactions, and verifying such through discussions with the viewer. It may mean involving wildlife viewers in a longitudinal study to determine if behavior, attitudes, or knowledge level change with continued wildlife-human contact gained through multiple experiences.

Social Process Mapping-Social process mapping must occur simultaneously with the data collection phase to understand the social context of wildlife viewing. The social process is the interaction of people as they influence the actions, plans, or policies of other people (Clark and Wallace 1998). The social process mapping method provides a practical method of accounting for a myriad of differences among participants, is a vehicle for explaining their dynamics, and provides insights for preventing or correcting weaknesses to clarify and secure common interests.

There are seven categories of questions used during this process: 1) who are the participants, 2) what are their perspectives, 3) in what situation do they interact, 4) what are their base values (power, enlightenment, wealth, well-being, skill, affection , respect, and rectitude), 5) what strategies do participants use in their efforts to achieve their goals, 6) what outcomes are achieved in the interaction among participants, and 7) what are the effects on values or institutions?

To illustrate the value of social process analysis in creating a wildlife viewing management plan, it would be necessary to know who the participants are (not just the viewers but the local business people like moose tour operators, community members, and others), and who would be affected by a wildlife viewing management plan. Part of the process would involve learning about their perspectives, expectations, and demands and how they view themselves participating in the wildlife viewing management plan. For example, in the case of a moose tour operator do they think that the plan contributes to or harms their livelihood. The base values of power, enlightenment, wealth, well-being, skill, affection, respect, and rectitude of the various participants plays an important role in developing strategies that not only meet their outcomes as individuals, but meet the outcomes of the management plan. The overall effect on changes in practices or outcomes must be continually evaluated. Social mapping is a continual process during the planning and implementation phase of a project because the interplay between participants, strategies, and their values may shift and change throughout the process.

__Decision Process__

The decision process (Lasswell 1971, Clark and Brunner 1996) determines how decisions are made for inclusion in the plan. Decision making requires a successful pattern of thought and action and is necessary in order for an interdisciplinary team to develop a plan. It is also a process for reconciling or at least managing conflicts among the interdisciplinary team to secure a common interest. A working specification of the common interests takes the form of rules, both substantive and procedural (e.g., what is to be achieved and how it will be achieved?). The rules are necessary for any group of people to coordinate the expectations and actions of its members. Seven functions can be distinguished in every decision process (Lasswell 1971) and can be described in seven general questions:

1. How is information about the management plan gathered, processed, and brought to the attention of decision makers?
2. Based on this information, how are recommendations promoted and made?
3. How are general rules prescribed?
4. How are the rules invoked against challengers?
5. How are disputes decided or resolved?
6. How are the rules and the decision process appraised?

7. How are the rules and the process terminated or modified?

In the case of an interdisciplinary wildlife viewing planning team, answering the seven questions needs to occur shortly after team formation. Through determining the rules to be used during the planning process, the team will be better able to meet the challenges of working together in an integrated fashion. When contentious discussions take place over issues such as whether the biological impacts at a particular site are offset by the viewers experiences, the team will have a road map for resolving different points of view.

Standpoint Clarification

All people have standpoints, including those involved in worthwhile causes (Clark and Wallace 1999). A person's standpoint consists of their values and biases and stems from personality, professional training, universal experiences, epistemological assumptions, organizational allegiances, reference groups, and other sources. The team members must consciously interact with one another throughout all the processes asking for and clarifying their own standpoint and that of others. This will help eliminate personal and inherent biases in their thinking. For example a wildlife biologist might continually emphasize that the resource comes first based on her scientific training.

Management Plan and Evaluation

Finally, the team will have gathered the data needed and have the decision-making process in place to determine the specific outcomes and strategies for inclusion in a management plan. A management plan prepared by an interdisciplinary team will undoubtedly be a comprehensive piece of work taking into account the wide variety of issues and needs of all those involved.

However, the role of the team does not end with the development of a plan. They will need to be involved in the evaluation of whether the plan outcomes have been achieved. This is the feedback loop and will continually drive the management planning process until such time as the outcomes have been achieved.

Hypothetical Case of Using An Interdisciplinary Team for Developing A Designated Viewing Site

The following is a hypothetical situation of one issue and how it was resolved by an interdisciplinary team using the framework described in Figure 17. The team's goal was to prepare a management plan for a new wildlife viewing site.

The site was salt lick on a side road off a major highway that was already a specific destination included in a local moose tour. The master plan included the development of permanent viewing facilities at the lick.

Members of the interdisciplinary team include a wildlife biologist, sociologists, educator, area manager, economist, the moose tour operator, a member of the chamber of commerce and an avid moose watcher.

The defined outcomes stated that the new site was to have minimal disturbance on moose behavior, viewers would learn about moose and moose management at the site, and the local economy would benefit from a tourist activity.

Decision Process- The team addressed the seven general questions in the decision process and determined that information for the management plan would be gathered and processed using a variety of research methods. Recommendations for managing the site could be made by any of the participants as long as the recommendations supported reaching the defined outcomes. The group would use an open communication process with decisions made by consensus. Disputes within the group would be resolved by compromise and mediation if necessary. The team would periodically examine their progress and make needed modifications.

Research- The social mapping process helped participants to understand the social context by determining why they were involved and what their expectations were. The wildlife viewer was included because she liked to view wildlife, and the wildlife biologist wanted to ensure minimal impacts on moose behavior. The moose tour operator was afraid the new facility would impact his business, whereas, the economist wished to increase tourism revenue. The sociologist could provide viewer profiles and expectations that would assist the educator in increasing awareness and knowledge of moose. The chamber of commerce representative wanted to be involved in community activities.

The interdisciplinary team defined a number of research questions to assist their decision process, including what the site would mean to the local economy, expectations of wildlife viewers, potential impacts on moose, interactions of people and moose, and knowledge levels of viewers. Research methods included surveys, interviews, focus groups, behavioral monitoring, and habitat impacts. An integrated biological and sociological data set was collected at the proposed site regarding moose reaction to viewers and viewer reaction to moose. A mixture of quantitative and qualitative data was analyzed using acceptable protocols and methods.

Standpoint Clarification All members of the team clarified their point of view. For example the wildlife biologist expressed that there should be minimal impact on moose. The tour operator spoke about their need to have a viable business and the economic impacts if the lick wasn't included in the tour.

Management Plan- The moose tour became a more complicated issue when the research indicated that the practice of stopping the bus along the road caused moose to reduce feeding time and, in many cases, flee the lick, essentially ending the viewing opportunity for all. Interrelated issues were the biological impact, the personal economic issues of the operator, and the fact that many people were viewing for free in a state facility. Thus, new strategies were required to provide reasonable use by the tour operator.

To effectively address these issues, the team needed to understand that the moose tour operator had a different base value than other members of the team. However, by using the decision process the team was able to move forward with a new plan. One management option to prevent stopping along the road was to create permanent reserved parking space for the van. Further research indicated that the tours could be enhanced by utilizing the educational material available at the site. And, research also indicated that employing a naturalist on the tour could create a greater satisfaction in his customers. The state wildlife biologist and educator agreed to conduct a training session for tour naturalists. Because of this added value, the economist determined that the moose tour operator could raise his fees. The team then instituted an evaluation process to gauge the level of knowledge and satisfaction of tour customers and other viewers to monitor the effectiveness of the plan.

Conclusion

Using an interdisciplinary approach in planning is a complex and diverse undertaking. In the case of wildlife viewing management, this is a logical approach because wildlife viewing has both biological and social ramifications. It will undoubtedly take longer to create a wildlife viewing management plan with an interdisciplinary approach than a traditional one, however, the depth and comprehensiveness of the plan will, in all likelihood, end with the desired outcome of a positive wildlife viewing experience.

Literature Cited

Applegate, J.E.(1989). Patterns of early desertion among New Jersey hunters. Wildlife Society Bulletin 17:476-481

Booth A.L. And W.B. Kessler. (1996). Understanding the linkages of people, natural resources and ecosystem health. Natural Resource Management The Human Dimension. Westview Press. Boulder CO.

Burdge,R.J.(1994). A Conceptual Approach to Social Impact Assessment. Social Ecology Press. Middleton, WI.

Chase, L.C., W.F. Siermer, and D.J. Decker. (1999). Suburban deer management:a case study in the village of Cayuga Heights, New York. Human Dimensions of Wildlife 4(2):59-60.

Clark, T.W. (1992). Practicing natural resources management with a policy orientation. Environmental Management 16:423-433.

_______. (1997). Conservation biologists in the policy process. Principles of Conservation Biology 2nd Edition. G.K. Meefe and C.R. Carroll (eds.) Sinauer Associations Publishers. Sunderland, Massachusetts.

______. (1999). Research in endangered species conservation:an introduction to multiple methods. Endangered Species UPDATE 16(5)96-102.

_______ and R.D. Brunner. (1996). Making partnerships work: introduction to decision process. Endangered Species UPDATE 13(9)1-5.

_______ and R.L. Wallace. (1998). Understanding the human factor in endangered species recovery: An introduction to human social process. Endangered Species UPDATE 15 (1)2-9.

______ and ______. (1999). The professional in endangered species conservation: An introduction to standpoint clarification. Endangered Species UPDATE 16(1):9-13.

Decker, D.J., T.L. Brown, N.A. Connelly, J.W. Enck, G.A. Pomerantz. K.G. Purdy, and W.F.Siemer. (1992). Toward a comprehensive paradigm of wildlife management:integrating the human and biological dimensions. American Fish and Wildlife Policy: The Human Dimension.W.T.Mangun (ed), Southern Illinois University, Carbondale, IL.

______, T.L. Brown and R.J. Gutierrez.(1980). Further insights into the multiple satisfaction approach for hunter management. Wildlife Society Bulletin 8(4): 323-331

______, T.L. Brown and B.A. Knuth. (1996). Human dimensions research:its importance in natural resource management. Natural Resource Management: The Human Dimension. A.W. Ewert (ed). Westview Press, Boulder CO.

______ and N.A. Connelly.(1989). Motivations for deer hunting:implications for anterless deer harvest as a management tool. Wildlife Society Bulletin. 17:455-463.

______ and G. R. Goff.(eds.). (1987). Valuing Wildlife: Economic and Social Perspectives. Westview Press. Boulder CO.

______ and K.G. Purdy.(1988). Toward a concept of wildlife acceptance capacity in wildlife management. Wildlife Society Bulletin 16:53-57.

Driver,B.L., C.J. Manning and G.L. Peterson. (1996). Toward better integration of the social and biophysical components of ecosystem management. Natural Resource Management The Human Dimension. Westview Press. Boulder CO.

Duda, M.D., S.J. Bissell and K.C.Young. (1998). Wildlife and the American Mind-Public Opinion on and Attitudes toward Fish and Wildlife Management. Responsive Management. Harrisburg, VA.

Ewert, B.W. (1996). Human dimensions research and natural resource management. Natural Resource Management The Human Dimension. Westview Press. Boulder CO.

Heberlein, T.A.,(1982). The influence of hunter density on firearm deer hunters' satisfaction: A field experiment. Transactions of the 47th North American Wildlife Conference. 47:665-675.

Hendee, J.C., 1974. A multiple satisfaction approach to game management. Wildlife Society Bulletin 2(3):104-113.

______. (1969). appreciative versus consumptive uses of wildlife refuges:studies of who gets what and trends in use. Transactions of the 34th North American Wildlife Conference. 34:252-264.

______, R.P.Gale, and W.R. Catton Jr. (1971). A typology of outdoor recreation activity preferences. Journal of Environmental Education 3(1):28-34

______, and C.Schoenfeld, eds. (1973). Human dimensions in wildlife programs. Washington D.C.

Kellert, S.R.(1996). The Value of Life:Biological Diversity and Human Society. Island Press, Washington D.C.

King, F.H. (1948). The management of man. Wisconsin Conservation Bulletin 13(9):9-11.

Krueger, C.C., D.J. Decker and T.A.Gavin.(1986). A concept of natural resources management: an application to unicorns. Transactions of the Northeast Section of the Wildlife Society 43:50-56.

Lasswell, H.D. (1971). The continuing decision seminar as a technique of instruction. Policy Sciences 2:43-57.

______, and A.Kaplan. (1950). Power and society: A framework for political inquiry. Yale University Press. New Haven, Connecticut.

Leopold,A. (1949). A Sand County Almanac and Sketches Here and There. Oxford University Press. New York, NY.

Manfredo, M., J.J. Vaske and D.J. Decker. (1995). Human Dimensions of wildlife management: basic concepts. Wildlife and Recreationists: Coexistence Through Management and Research. R.L. Knight and K.J. Gutzwiller eds., Island Press, Washington D.C.

Oberbillig, D.R. (2000). Providing positive wildlife viewing experiences. Watchable Wildlife Inc. Denver, CO.

Peyton, B.(1989). A profile of Michigan bear hunters and bear hunting issues. Wildlife Society Bulletin. 17:494-500.

Purdy, K.G. and D.J. Decker. (1989). Applying wildlife values information in management: the wildlife attitudes and values scale. Wildlife Society Bulletin 17:494-500.

Vittersø, J., R.Bjerke and B.P, Kaltenborn. (1999). Attitudes toward large carnivores among sheep farmers experiencing different degrees of depredation. Human Dimensions of Wildlife 4(1):20-35.

CHAPTER FIVE

ELEMENTS OF A WILDLIFE VIEWING MANAGEMENT PLAN

This chapter begins with a summary of the findings of this research. Elements of a wildlife viewing management plan utilizing research, management techniques, and education are presented with application examples from the research at Dixville Notch. Emphasis is placed on information gained through multiple disciplines necessary to create a wildlife viewing management plan that results in a positive wildlife viewing experience promoting a conservation ethic.

Summary of Findings

1. The visitation rate of moose at the Dixville Notch salt lick did not change after the construction of the wildlife viewing area.

2. There was no significant change in the time of day moose visited the Dixville Notch salt lick after construction of the wildlife viewing area.

3. Moose predominantly used Dixville salt licks nocturnally with the highest diurnal visitation occurring at 0400-0800h.

4. Travel patterns immediately adjacent to the viewing blind changed after construction of the site.

5. Quiet viewers in the blind had minimal effect on moose behavior.

7. Moose were generally tolerant of human-caused stimuli exhibiting the greatest percentage of behavioral changes when cars stopped and trucks passed.

8. Wildlife viewers to Dixville Notch were predominately families and couples visiting northern New Hampshire.

9. The majority of Dixville Notch wildlife viewers did not belong to a conservation organization.

10. Viewers expected wildlife viewing sites to include educational opportunities.

10. Knowledge levels of viewers increased after their visit presumably because of educational signs.

11. Education and income level were not related to viewer knowledge of moose.

13. Viewers were amenable to regulations.

14. Viewers were less accepting of wildlife management techniques that created artificial situations.

15. There was a slight discrepancy between viewers' understanding of moose habitat requirements and acceptance of forestry management for habitat enhancement for moose.

16. Dixville Notch viewers were motivated by a variety of factors categorized as general, creative, experiential, and occasional.

17. Satisfaction regarding the viewing experience in Dixville Notch was not related to viewing moose but was related to the general, experiential, and occasional motivation factors.

An Overview of Wildlife Viewing

Wildlife viewing programs combine education, wildlife management, and viewing to address the public's growing interest in viewing wildlife in natural settings. They also help meet the demand for outdoor recreation by providing opportunities for people to experience nature. The premise of watchable wildlife programs is based on the assumption that if we fail to provide a sufficient amount of high quality habitat, our children and grandchildren will not have the

same opportunities to enjoy wildlife
(Hudson 1992). With this is mind, the ultimate goal of wildlife viewing programs is the development of a conservation ethic amongst viewers.

High quality wildlife viewing experiences include providing non-residential wildlife viewing opportunities, limiting potential impacts on wildlife being viewed, and instilling an understanding of wildlife and wildlife management to a broad constituency willing to act on behalf of wildlife and the land (Oberbillig 2000). Part of manager's ability to reach these goals is to recognize that wildlife watchers are not a generic group. It is essential that managers have an understanding of the beliefs, attitudes, and values of different viewers in different viewing situations in order to provide and manage for a quality viewing experience.

A management plan not only includes the basic components of biological research, wildlife management techniques, and education, but also information from human dimensions. Generally, wildlife managers focus on specific goals for wildlife populations, acres of habitat, and providing consumptive recreational opportunities, whereas recreational managers focus on the number of people recreating in an area, the necessary recreational amenities, and providing multiple recreational experiences. Educators focus on the processes of increasing awareness, knowledge, skills, and actions related to wildlife resources. These management components are too often considered separately and rarely integrated in a management plan. Wildlife viewing managers cannot be compartmentalized in their approach when managing a viewing experience. They need to be well versed in integrating biology, sociology, resource management, recreation management, and educational approaches in order to develop and define optimal viewing experiences (Duda et al. 1998).

Components And Recommendations for a Wildlife Viewing Management Plan

A management plan for moose viewing in northern New Hampshire should incorporate biological and sociological data from this research. Factors to be considered in developing a wildlife viewing management plan are presented in Table 14. The overall goals of any viewing plan need to include how to minimize viewer impacts on wildlife, provide viewing opportunities, and develop knowledge and understanding of wildlife and the resource amongst viewers.

Research

Understanding Biological Impacts -There is a body of research focused on recreational impacts on wildlife, however, limited studies have addressed the effects of people observing and photographing wildlife. Wildlife viewers actively seek and approach wildlife, unlike other recreationists excluding hunters and anglers, who mostly encounter wildlife accidentally. Their encounters with wildlife are potentially more disturbing, because they are purposeful, more frequent and of longer duration (Boyle and Samson 1985). While information on the impacts of a variety of recreational activities is useful to wildlife viewing managers, specific research needs to measure impacts when wildlife viewing is the primary recreational activity. This research must consider the viewing activity, viewers, their behavior, and their interaction with viewed wildlife and the surrounding habitat (Knight and Temple 1995).

Managers must know whether viewing activities influence a species temporarily, the magnitude of potential biological impacts, the behavioral impact, and the potential impact on population. For example, bald eagles in winter require undisturbed forage and roosting sites to conserve energy reserves (Stalmaster and Newman 1978).

This study provides two examples of biological research valuable for development of moose viewing areas. In Dixville Notch moose behavior was negatively affected by stopped cars along the road, but not by people in the viewing blind. Although both groups actively sought a viewing experience, people in stopped cars increased the likelihood of moose leaving the lick. However, the strongest reaction by moose was caused by truck traffic which neither type of viewer could control. Consequently, choice moose viewing sites should have minimal outside influences associated with roads. Future locations of viewing facilities/sites must be examined judiciously before development. Data from Dixville Notch suggested that moose abandoned a major trail proximate to the viewing blind indicating the need to account for established behavioral patterns of wildlife.

Understanding The Wildlife Viewer-Understanding wildlife viewers is key to creating a comprehensive wildlife viewing management plan that enhances viewing experiences. There is probably no such thing as the general wildlife viewer, because wildlife viewing entails everything from moose to butterflies. Wildlife viewers may be interested in all types of wildlife, specializing in large mammals like moose, or be dedicated birdwatchers working on a life list. Wildlife viewers can be segmented with surveys and this study identified four dimensions of viewer motivation including general, creative, experiential, and

Table 14. Multi-disciplinary information to consider when developing a wildlife viewing management plan. Overlap is expected within components, especially in the management and education disciplines.

Management Components	Disciplines	Considerations For Planning
Research		
	Biological	
		Site conditions Specific requirements of dominate species of wildlife to be viewed How does the viewing area fit into the life cycle needs of the animal Potential biological impacts Levels of viewing opportunity
	Social Science	
		Potential viewers Motivation of viewers Knowledge level of viewers Conflicting recreational activities Impact on local residents Economics Attitudes toward the resource and its management
Management		
	Wildlife	
		Wildlife population management Strategies to minimize potential impacts: visual, spatial, temporal and behavioral Habitat enhancement Regulations Wildlife health and safety issues
	Recreational	
		Expected and desired behaviors of the viewer Facilities and amenities Regulations Strategies to minimize potential impacts Human health and safety issues
Education		
		Selection of appropriate educational or interpretive techniques Site specific information Natural history information Wildlife health and safety issues Desired behaviors Rules and regulations Management techniques used to manage population for viewing Management techniques used at site Opportunities for conservation action

opportunist. Understanding motivations allows managers to enhance specific aspects that may lead to higher quality viewing experiences.

For example, those with an interest in being with family may value educational signs specifically geared for children. They may also appreciate modifications in a viewing blind such as lower viewing slits or steps to accommodate children's viewing. Providing photography tips on interpretive signs or in brochures would be important to those viewers who are motivated by doing something creative. Many viewers at Dixville Notch were told it was a good place to stop, thus managers could inform local tourism service providers of wildlife viewing opportunities in the area. A variety of social science methods including focus groups, interviews, and observing viewers in different situations can help managers understand the motivations, knowledge, and attitudes toward the resource.

An understanding of moose viewers in northern New Hampshire allows for development of specific programs to improve wildlife viewing opportunities. Approximately two-thirds of the viewers who stopped at the Dixville Notch Wildlife Viewing Area were staying in the region. They were predominately white, with their family, and desired and appreciated educational information. As part of a comprehensive management plan, educational materials could be provided to guests at resorts, motels, and campgrounds. These materials should focus on tips for proper wildlife viewing and optimal viewing sites and times. In addition, materials specifically designed to involve the entire family in the learning process could increase knowledge levels about wildlife and wildlife management for children and adults.

Demographic information can be used to identify groups that do not participate in wildlife viewing. These groups could be surveyed to determine their potential as viewers and perhaps specific programs could be designed to engage them in viewing activities.

In northern New Hampshire, the chamber of commerce and hospitality group has renamed the area "The Great North Woods." This name indicates the importance of natural resources to the area and signifies a new marketing approach to attract visitors to the region. It is necessary to understand the impacts that wildlife viewing facilities have on the local economy. This study did not measure the importance of wildlife viewing to the economy, however, such information should be considered when developing a wildlife viewing management plan. There are implications regarding tourists' expectations for viewing wildlife that may be tied to their overall level of satisfaction when visiting the area.

Management Strategies

A goal of a wildlife viewing program should be coexistence of wildlife and the wildlife viewers. Traditional wildlife management techniques including population management, habitat enhancement, and law enforcement theoretically ensure that wildlife exists for viewing. But beyond having wildlife for viewing, managing the viewing experience is somewhat complicated by protecting habitat and minimizing behavioral and biological impacts. The management of any particular site requires an understanding of the requirements and interactions of wildlife viewers, their activities, and wildlife.

Habitat enhancement is a management technique that obviously has an impact on viewing opportunities. Attitudes of viewers toward different enhancement activities may affect how viewer's feel about the experience. Viewers at Dixville felt very strongly that managers should not create an artificial situation by placing additional salt in the lick. They were more ambiguous about forestry management practices; 60% felt it was acceptable to maintain the adjacent forest in an early successional stage to help attract moose. Specific habitat enhancement activities may affect the quality of experience, however, it may also provide a prime opportunity to educate viewers about wildlife management techniques.

Knight and Temple (1995b) listed four categories of restrictions that may be used in site management to minimize impacts: spatial, temporal, visual, and behavioral. Spatial restrictions are perhaps the most common management technique used to control recreational disturbance. Wildlife viewers and wildlife are spatially separated by buffer zones that isolate wildlife from disruptions. Temporal restrictions are an appropriate management tool when wildlife use critical resources at certain times. The role of visual buffers preventing wildlife from seeing viewers is an important concept as it can result in reduced spatial restrictions separating critical wildlife use areas from disturbance. Behavioral management of people is also a viable technique.

Use of spatial restrictions and visual buffers such as those at the Dixville Notch Wildlife Viewing Area should be used at other moose viewing sites. The road and corridor of trees served as an effective buffer between moose in the lick and viewers walking to and from the blind. The viewing blind shielded viewers from moose and served as a barrier to prevent viewers from approaching a moose. Quiet wildlife viewers in the blind had minimal effect on moose behavior.

Of the four categories, behavioral management is probably under-utilized because it requires training and knowledge in disciplines not normally held by wildlife managers. Human behavior can be changed with a variety of techniques including educational information and promulgating regulations. In order to use human behavioral management effectively, it is essential to understand the attitudes, values, norms, motivations, and satisfaction of wildlife viewers (Knight and Temple 1995b). Educational material at this site contributed to the satisfaction level of viewers.

A desired behavioral change at Dixville Notch would be to prevent people from stopping their cars at the edge of the road. A reduction in stopped cars may improve the quality of the viewing experience because moose would be less likely to flee. No parking signs may induce change but is unlikely to eliminate stopping altogether. The difficulty lies in motivating people to visit the site for a prolonged period versus stopping alongside the lick. Strategies might include specific education materials disseminated at places they are staying, signs along the road to prevent stopping and encourage visiting the site. Use of a short range radio frequency would allow viewers to receive information in their cars when driving near a lick.

Dixville Notch wildlife viewers indicated a willingness to accept regulations which would impose changes in their behavior. In particular they felt that the distance one could approach moose should be limited, and some areas of habitat should be off limits to people. If regulations of this type are employed, educational information could explain the need for such regulation, and the majority of viewers would readily accept them.

Preferred wildlife viewing experiences can be managed for at remote or developed viewing sites. Management choices are based upon understanding the motivations and outcomes desired by viewers. Over a third of the viewers at Dixville Notch Wildlife Viewing Area thought there should be remote undeveloped sites. Incorporating varied experiences is important to satisfy viewer goals.

Management considerations not addressed in this study but necessary to contemplate in a management plan include human and wildlife health and safety issues. For example, people need to be kept at a distance from wildlife to prevent bodily harm. In other cases, managers may have to control traffic to ensure the safety of both wildlife and visitors stopping along roadways. Such concerns are particularly relevant in moose viewing given the potential of fatal accidents.

Education

The educational component is considered as a separate piece rather than incorporated into management techniques because of the desired outcome for viewers to increase knowledge and be willing to take action on behalf of wildlife. Wildlife viewing provides new and different experiences, a chance to get away, opportunities to learn more about our natural resources or to do something exciting. No matter what motivates people to view wildlife, the common factor is the wildlife. Most feel excitement or something not easily explained when viewing wildlife. The fascination people have for wildlife is especially valuable because it fosters a consideration of the natural world (Gray 1993).

The educational value of viewing wildlife is that it allows us to teach more than just natural history facts (Hair and Pomerantz 1987). People need to learn about the connection between human life and the natural world in both a cognitive and emotional sense, to develop a value system to ensure wildlife conservation (Kellert 1996). Wildlife viewing sites have an opportunity to provide a direct connection between humans, wildlife, and land. They offer something that cannot be learned from a book, but rather something that can be experienced and in a sense touched. The cultivation of an emotional appreciation through affective learning is an important step in reaching the desired outcomes. These emotions are somewhat reflected in viewers' motivations to enjoy a quiet time in the north woods, to relax, and to experience something new and different. However, additional research is needed to determine the importance of this aspect of learning relative to wildlife viewing sites, and how experiences at viewing sites influence this appreciation.

This study indicated that viewers want and expect to have cognitive educational opportunities when viewing wildlife. Learning about nature was a primary motivation for certain viewers. Surveys indicated that knowledge levels about moose, wildlife management, and habitat increased after visiting the site. Presumably, educational signs at the site provided an opportunity for viewers to gain new information.

Although this study did not specifically ask which types of educational techniques would be most effective, techniques need to be based on the learning styles, motivations, values, and attitudes of the viewers. The key to success is to focus the viewing experience on the connection between the individual learner and viewed wildlife. For some individuals, personal interaction with an expert will help to make a connection, while for others an informative book or pamphlet may be the primary vehicle. Other techniques include special programs conducted in their home communities either before or after a viewing experience, interpretive signs at the site, or examining photographs taken at the site.

Informed and appreciative viewers are not enough to reach the goal of wildlife conservation. Wildlife viewers should have a commitment and be willing to take action. Filion et al. (1993) noted that participation in wildlife conservation by nonconsumptive users is primarily through voluntary donations to nongovernment organizations, memberships in these organizations, and maintaining or improving habitat. While this study did not specifically examine conservation activities of viewers, less than half of the Dixville viewers belonged to any conservation organization. If membership is used as a criteria to measure taking action, it is evident that Dixville Notch viewers have not fully realized this goal of wildlife viewing management.

Techniques to increase the number of viewers actively involved in aspects of conservation need to be considered. Moving people towards a commitment requires synthesizing appreciative and cognitive learning opportunities to focus on attitudes and beliefs consistent with a deep appreciation of the role of wildlife in a viewer's life (Kellert 1998). Many of the formal and informal techniques used in environmental education could be applied in a wildlife viewing management program. For example, providing a hands-on learning experience for viewers to improve observational skills would enhance their ability to discern wildlife behavior, ultimately leading the viewer to better understand wildlife and reduce potential viewing impacts. Thought provoking questions in brochures could lead viewers through a critical thinking process about the relationship of wildlife to habitat and the need for habitat protection.

Conclusion

The approaches presented in this chapter and Chapter 4 illustrate how data and strategies from different disciplines can be used to develop a wildlife viewing management plan. It is evident that professionals face a task of balancing protection of wildlife with a critical and increasing need to offer places for people to view and cultivate a value for wildlife. This personal connection with nature combined with knowledge should lead to a conservation commitment. The development of wildlife viewing management plans integrated with biological and sociological research, wildlife and recreational management techniques, and education will benefit the wildlife resource, viewing public, and public commitment to wildlife.

Literature Cited

Boyle, S.A. and F.B. Samson.(1985). Effects of nonconsumptive recreation on wildlife: a review. Wildlife Society Bulletin 13:110-116.

Duda M.D., S.J. Bissell and K.C. Young. (1998). Wildlife and the American mind- public opinion on attitudes toward fish and wildlife management. Responsive Management. Harrisonburg VA.

Gray, G.G. (1993).Wildlife and People: The Human Dimensions of Wildlife Ecology. University of Illinois Press. Urbana IL.

Filion,F., E. Duwors, P. Boxall, P. Bouchard, R. Reid, P.A. Gary, A. Bath, A. Jacquiemot and G. Legere. (1993). The importance of wildlife to Canadians: highlights of the 1991 survey. Environment Canada. Ottawa, ON.

Hair, J.D. and G.A. Pomerantz. (1987). The educational value of wildlife. In Valuing Wildlife: Economic and Social Perspectives. D.J. Decker and F.R. Goff (eds). Westview Press. Boulder CO

Hudson, W. (1992). NatureWatch. Falcon Press, Helena, Montana. 199 pp.

Kellert, S.R. (1996)The Value of Life: Biological Diversity and Human Society. Island Press. Washington D.C.

Knight, R.I and S.A. Temple. (1995). Wildlife and Recreationists: Coexistence through Management. Wildlife and Recreationists: Coexistence Through Management and Research. R.I. Knight and K.J. Gutzwiller (eds.). Island Press.Washington D.C.

Oberbillig, D.R. (2000). Providing Positive Wildlife Viewing Experiences. Watchable Wildlife Inc. Denver, CO.

Stalmaster, M.V. and J. R. Newman. (1978). Behavioral responses of wintering eagles to human activity. Journal of Wildlife Management 42(3):506-513.

LIST OF REFERENCES

Adams, K.P. (1995). Evaluation of moose population monitoring techniques and harvest data in New Hampshire. MS Thesis. University of New Hampshire.

Altmann, M. (1958). The flight distance in free-ranging big game. Journal of Wildlife Management. Vo.22:2:207-209.

Ambuel, B. and S.A. Temple. (1983). Area-dependent changes in the bird communities and vegetation of southern Wisconsin forests. Ecology 64(5):1057-1068.

Applegate, J.E., and E.E. Clark. (1987). Satisfaction levels of birdwatchers: an observation on the consumptive-non-consumptive continuum. Leisure Science. 9:129-134.

Bart, J. (1977). Impact of human visitation on avian nesting success. Living Bird 16:187-192.

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

Bem, D.J. (1970). Beliefs, attitudes and human affairs. Brooks-Cole, Belmont CA.

Blakesley, J.A. and K.P.Reese. (1988). Avian use of campground and noncampground sites in riparian zones. Journal of Wildlife Management 52(3):399-402.

Bond, M. (1997). Who really wears the (adventure travel)pants? Adventure Travel Business. August 1997. Pp 13-15.

Booth A.L. And W.B. Kessler. (1996). Understanding the linkages of people, natural resources and ecosystem health. Natural Resource Management The Human Dimension. Westview Press. Boulder CO.

Boyle, S.A. and F.B. Samson.(1983). Nonconsumptive outdoor recreation: An annotated bibliography. U.S. Department of Interior, Fish and Wildlife Service Special Report.

_____, and_______.(1985). Effects of nonconsumptive recreation on wildlife: a review. Wildlife Society Bulletin 13:110-116.

Brown, P.J.(1982). Recreation Opportunity Spectrum with implications for wildlife oriented recreation. Transactions 47th North American Wildlife Conference. 47:705-711.

Buchanan, T. (1983). Toward an understanding of variability in satisfactions within activities. Journal of Leisure Research 15(1):39-51.

Burdge,R.J.(1994). A Conceptual Approach to Social Impact Assessment. Social Ecology Press. Middleton, WI.

Buist, L.J. and T.A. Hoots. (1982). Recreation opportunity spectrum approach to resource planning. Journal of Forestry 80: 84-86

Burger, J. (1995). Beach recreation and nesting birds. Wildlife and Recreationist Coexistence through Management and Research. R.L. Knight and K.J. Gutzwiller (eds.) Island Press, Washington D.C.

Bultena, G.L. and L.L. Klessig. (1969). Satisfaction in camping: a conceptualization and guide to social research. Journal of Leisure Research 1(4):348-354.

Cassirer, E.F., D.J. Freddy, and E.D. Ables. (1992). Elk responses to disturbance by cross-country skiers in Yellowstone National Park. Wildlife Society Bulletin 20:375-381.

Chase, L.C., W.F. Siemer, and D.J. Decker. (1999). Suburban deer management: a case study in the Village of Cayuga Heights, New York. Human Dimensions of Wildlife. 4:2:59-60.

Clark,R.N., J.C.Hendee, and F.L. Campbell. (1971). Values,behavior and conflict in modern camping culture. Journal of Leisure Research 3(3): 143-159.

Clark, T.W. (1992). Practicing natural resources management with a policy orientation. Environmental Management 16:423-433.

______. (1997). Conservation biologists in the policy process. Principles of Conservation Biology 2nd Edition. G.K. Meefe and C.R. Carroll (eds.) Sinauer Associations Publishers. Sunderland, Massachusetts.

______. (1999). Research in endangered species conservation:an introduction to multiple methods. Endangered Species UPDATE 16(5)96-102.

______ and R.D. Brunner. (1996). Making partnerships work: introduction to decision process. Endangered Species UPDATE 13(9)1-5.

______ and R.L. Wallace. 1998. Understanding the human factor in endangered species recovery: An introduction to human social process. Endangered Species UPDATE 15 (1)2-9.

Clevenger, G.A. and G.W. Workman. (1977). The effects of campgrounds on small mammals in Canyonlands and Arches National Parks, Utah. Transactions of 42nd North American Wildlife Conference 42:473-484.

Climatological data- Berlin Airport 1996, 1997, 1998.http://www. noaa.gov.

Cobus, M.W. (1972a). Moose as an aesthetic resource and their summer feeding behavior. 8th North American Moose Workshop Proceedings. pp. 244-275

______. (1972b). Moose (*Alces alces*) and campers in Sibley Provincial Park: a study of wildlife aesthetics. M.S. Thesis, University of Guelph, Guelph Ontario.

Cole, D.N. and R.L. Knight.(1990). Impacts of recreation on biodiversity in wilderness. Procedures of a Symposium on Wilderness Areas Their Impact. Utah State University, Logan. pp 34-40.

______ and_____. (1991). Wildlife preservation and recreational use: conflicting goals of wildland management. Transactions of 56th North American Wildlife and Natural Resources Conference 56:233-237.

Colescott, J.H. and M.P. Gillingham. (1998). Reaction of moose (*Alces alces*) to snowmobile traffic in the Greys River Valley, Wyoming. Alces 34(2):329-338)

Connor, R.N., and J.G. Dickson. (1980). Strip transect sampling and analysis for avian habitat studies. Wildlife Society Bulletin 8(1):4-10.

Cooke, A.S. (1980). Observations on how close certain passerine species will tolerate an approaching human in rural and suburban areas. Biological Conservation 18:85-88.

Cooperider, A.Y. , R.J. Boyd and H.R. Stuart (eds.).(1986). Inventory and monitoring of wildlife habitat. US Department of Interior, Bureau of Land Management. Service Center. Denver, Co.

Crandall,R. (1980). Motivations for leisure. Journal of Leisure Research 12(1):45-54.

Dale, D. and T.Weaver. (1972). Trampling effects on vegetation of the trail corridors of North Rocky Mountain forests. Journal of Applied Ecology. 11: 767-772

Decker, D.J., and N.A. Connelly.(1989). Motivations for deer hunting: implications for anterless deer harvest as a management tool. Wildlife Society Bulletin. 17:455-463.

______ and G. R. Goff.(eds.). (1987). Valuing Wildlife: Economic and Social Perspectives. Westview Press. Boulder CO.

______ and K.G. Purdy.(1988). Toward a concept of wildlife acceptance capacity in wildlife management. Wildlife Society Bulletin 16:53-57.

______, T.L. Brown, N.A. Connelly, J.W. Enck, G.A. Pomerantz. K.G. Purdy, and W.F.Siemer. (1992). Toward a comprehensive paradigm of wildlife management: integrating the human and biological dimensions. American Fish and Wildlife Policy: The Human Dimension.W.T.Mangun (ed). Southern Illinois University, Carbondale.

______,______, B.L. Driver and P.J. Brown. (1987). Theoretical developments in assessing social values of wildlife:toward a comprehensive understanding of wildlife recreation involvement. Pages 76-95 in D.J. Decker and G.R.Godd, eds., Valuing wildlife: economic and social perspectives. Westview Press Inc., Boulder, Colorado.

______,______, and R.J. Gutierrez.(1980). Further insights into the multiple satisfaction approach for hunter management. Wildlife Society Bulletin 8(4): 323-331.

______,______, and B.A. Knuth. (1996). Human dimensions research:its importance in natural resource management. Natural Resource Management: The Human Dimension. A.W. Ewert (ed). Westview Press, Boulder CO.

Denniston, R.H. (1956), Ecology, behavior and population dynamics of the Wyoming or Rocky Mountain moose. Zoologica (NY) 41: 105-118.

de Vos, A.(1958). Summer observations on moose behavior in Ontario. Journal of Mammalogy 39(1): 128-139.

Dillman, Don A. (1978). Mail and telephone surveys: the total design method. Washington State University. Pullman, Washington.

Ditton, R., A. Fedler and A. Graefe. (1981). Recreational satisfactions at Buffalo National River: Some measurement concerns. Some Recent Products of River Recreation Research. USDA forest Service General Technical Report NC-63.

______,D.K. Loomis, and S. Choi. (1992). Recreation specialization: re-conceptualization from a social world's perspective. Journal of Leisure Research 24:33-51.

Dorfman, P.W. (1979). Measurement and meaning of recreation satisfaction: a case study in camping. Environment and Behavior 11(4):483-510.

Dorrance, M.J., P.J. Savage , and D.E. Huff. (1975). Effects of snowmobiles on white-tailed deer. Journal of Wildlife Management 39:563-569.

Driver, B.L., (1976). Toward a better understanding of outdoor recreation participation. Proceedings Southern States Recreation Resources Application Workshop. USDA Forest Service General Technical Report. SE-9. pp. 163-189.

_____, (1983), Master list of items for recreation experience preference scales and domains. U.S. Dept. Agric. Rocky Mt. Forest and Range Experiment Station. Fort Collins, Colorado. 11 pp.

_____, P.J. Brown and G.L. Peterson.(1992). Research on Leisure Benefits: an Introduction to this Volume. Benefits of Leisure 2nd Ed. pp. 3-10.

_____ and R.C. Knopf (1977). Personality, outdoor recreation and expected consequences. Environment and Behavior 9(2):169-193.

______, C.J. Manning and G.L. Peterson. (1996). Toward better integration of the social and biophysical components of ecosystem management. Natural Resource Management The Human Dimension. Westview Press. Boulder CO.

_____, H.E.A. Tinsley, M.J. Manfredo, (1992). The Paragraphs about Leisure and recreation experience preference scales: results from two inventories designed to assess the breadth of the perceived psychological benefits of leisure. Benefits of Leisure, 2nd(ed). pp. 263-286.

Duda, M.D. And K.C.Young. (1993). Wildlife viewing in Maryland: participation, opinions and attitudes of adult maryland residents toward a watchable wildlife program. Responsive Management, Harrisburg, VA.

_____, S.J. Bissell and K.C. Young. (1998). Wildlife and the American mind-public opinion on attitudes toward fish and wildlife management. Responsive Management. Harrisonburg VA.

Duffus, D.A. and P.Dearden. (1990). Non-consumptive wildlife-oriented recreation: a conceptual framework. Biological Conservation 53:213-231.

______ and P. Dearden. (1993). Recreational use, valuation and management, of killer whales (Orcinus orca) on Canada's Pacific coast. Environmental Conservation. Vol.20:2:149-156.

Eckstein, R.G., T.F. O'Brien, O.J. Rongstad, and J. G. Bollinger. (1979). Snowmobile effects on movements of white-tailed deer: a case study. Environmental Conservation 6:45-51.

Emlen, J.T. (1971). Population densities of birds derived from transect counts. The Auk 88 323-342.

_______,D.C.Freeman, M.B.Bain, and J. Li. (1992). Interaction assessment II: a tool for population and community management. Journal of Wildlife Management 56(4):708-717.

Eubanks,T.L., R.B.Ditton, J.R. Stoll. (1998). Platte River nature recreation study: the economic impacts of wildlife watching on the Platte River in Nebraska. Fermata Inc. Austin, Texas.

Ewert, B.W. (1996). Human dimensions research and natural resource management. Natural Resource Management The Human Dimension. Westview Press. Boulder CO.

Falk, J.H., and L.D. Dierking. (1992). The Museum Experience. Whaleback Books, Washington.

Filion,F., E. Duwors, P. Boxall, P. Bouchard, R. Reid, P.A. Gary, A. Bath, A. Jacquiemot and G. Legere. (1993). The importance of wildlife to Canadians.: highlights of the 1991 survey. Environment Canada. Ottawa, ON.

Fishbein, M., and I. Ajzen. (1975). Belief, attitudes, intention, and behavior: an introduction to theory and research. Addison-Wesley, Reading, MA.

Flather, C. H. and H.K.Cordell. (1995). Outdoor recreation:historical and anticipated trends. Wildlife and Recreationists: Coexistence Through Management and Research. R.L. Knight and K.J. Gutzwiller (eds.). Island Press, Washington D.C.

Foin, T.C. , E.O. Garton, C.W. Bowen, J. M. Everingham, and R.O. Schultz. (1977). Quantitative studies of visitor impacts on environments of Yosemite National Park, California, and their implications for park management policy. Journal of Environmental Management 5:1-22.

Fraser, D. (1979). Sightings of moose, deer and bears on roads in northern Ontario. Wildlife Society Bulletin 7:181-184.

Franzmann, A.W. And C.C.Schwartz (eds).(1997). Ecology and management of the North American moose. Smithsonian Institution Press. Washington D.C.

Geist, V.(1963). On the behavior of the North American moose (Alces alces andersoni Peterson 1950) in British Columbia. Behavior 20:377-416.

_____. (1978). Behavior. In Big Game of North America:Ecology and Management. J.L. Schmidt and D. L. Gilbert (eds). Stackpole Books. Harrisburg, PA. pp. 283-296.

Goldsmith, F.B. (1974 Ecological effects of visitors in the countryside. Conservation In Practice, A.Warren and F.B. Goldsmith (eds.). John Wiley and Sons. London. pp. 217-231.

Gotmark, F.(1992). The effects of investigator disturbance on nesting birds, Current Ornithology, R.F. Johnson, ed. Plenum Press, NY Vol. 9: 63-104

Graefe,A.R., J.J. Vaske, and F.R.Kuss. 1984. Social carrying capacity: an integration and synthesis of twenty years of research. Leisure Sciences, 6(4):395-431.

Gray, G.G. (1993).Wildlife and People: The Human Dimensions of Wildlife Ecology. University of Illinois Press. Urbana IL.

Griffiths, M. And C.P. VanSchaik. (1993). The impact of human traffic on the abundance and activity periods of Sumatran rain forest wildlife. Conservation Biology. Vol.7:3:623-626.

Groves, D.L., C.T.Cushwa and J.S.Lindzey. (1973). A method of utilizing personal value information for assessing administrative changes on public lands. Transactions of the 38th North American Wildlife Conference 38:158-169.

Gutzwiller, K. J. (1991). Assessing recreational impacts on wildlife: the value and design of experiments. Transactions of 56th North American Wildlife and Natural Resources Conference 56:248-255.

______. (1993). Serial management experiments: an adaptive approach to reduce recreational impacts on wildlife. Transactions of the 58th North American Wildlife and Natural Resources Conference 58: 528-536.

______. (1994). Effects of intrusion and singing behavior. Auk 111:29-37.

Hair, J.D. And G.A. Pomerantz. (1987). The educational value of wildlife. In Valuing Wildlife: Economic and Social Perspectives. D.J. Decker and F.R. Goff (eds). Westview Press. Boulder CO

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

Hawes,D.K. (1979). Satisfactions derived from leisure time pursuits: an exploratory nationwide survey. Journal of Leisure Research 10(4): 247-264.

Heberlein, T.A. (1973). Social psychological assumptions of user attitude surveys: the case of the wildernism scale. Journal of Leisure Research 5(summer): 18-22.

______. (1982). The influence of hunter density on firearm deer hunters' satisfaction: A field experiment. Transactions of the 47th North American Wildlife Conference 47:665-675.

Hendee, J.C. (1974). A multiple satisfaction approach to game management. Wildlife Society Bulletin 2(3):104-113.

______. (1969). Appreciative versus consumptive uses of wildlife refuges: studies of who gets what and trends in use. Transactions of the 34th North American Wildlife Conference 34:252-264.

______, R.P.Gale, and W.R. Catton Jr. (1971). A typology of outdoor recreation activity preferences. Journal of Environmental Education 3(1):28-34.

______ and C.Schoenfeld,(eds). (1973). Human dimensions in wildlife programs. Washington D.C.

Heyer, W.R., M.A. Donnelly, R.W. McDiarmid, L.C. Hayek and M.S. Foster. (1994). Measuring and monitoring biological diversity: standard methods for amphibians. Washington,D.C., Smithsonian Institution Press.

Hicks, L.L., J.M. Elder. (1979). Human disturbance of Sierra Nevada bighorn sheep. Journal of Wildlife Management 43(4): 909-915.

Hudson, W. (1992). NatureWatch. Falcon Press, Helena, Montana. 199 pp.

Kelly, J.R. (1992). Sociological perspectives on recreation benefits. Benefits of Leisure 2nd ed. pp. 419-422.

Kellert, S.R.(1980). American's attitudes and knowledge of animals. Transactions of the 45th North American Wildlife Conference 45:111-124.

______.(1996). The Value of Life:Biological Diversity and Human Society. Island Press, Washington D.C.

______ and M.O.Westervelt. (1982). Historical trends in American animal use and perception. Transactions of the 47th North American Wildlife Conference 47:649-664.

Kelly, J.R. (1992). Sociological perspectives on recreation benefits. Benefits of Leisure 2nd ed. pp. 419-422.

Kerlinger, P.T., T.L. Eubanks, and R.H. Payne. (1994). The economic impact of birding ecotourism on the Sabal Palm Grove Sanctuary, Texas, 1993-1994. A report to the U.S. Fish and Wildlife Service.

______ and D.S. Weidner. (1991). The economics of birding at Cape May, New Jersey. In Ecotourism and Resource Conservation, A collection of papers. Second International Symposia Ecotourism and Resource Conservation, 191, Miami, Florida. Island Press, Washington, D.C., Vol. 1:271-280

King, F.H. (1948). The management of man. Wisconsin Conservation Bulletin 13(9):9-11.

Knight R.L. and S.K. Knight. (1984). Responses of wintering bald eagles to boating activity. Journal of Wildlife Management 48:999-1004.

______ and D.N. Cole. (1991). Effects of recreational activity on wildlife in wildlands. Transactions of 56th North American Wildlife and Natural Resources Conference 56:238-247.

______ and ______. (1995). Wildlife responses to recreationists. Wildlife and Recreationists: Coexistence Through Management and Research. R.L. Knight and K.J. Gutzwiller (eds.), Island Press, Washington D.C.

______and_____. (1995). Factors that influence wildlife responses to recreationists.Wildlife and Recreationists: Coexistence Through Management and Research. R.L. Knight and K.J. Gutzwiller (eds.). Island Press, Washington D.C.

______ and R.E.Fitzner. (1983). Human disturbance and nest site placement in black-billed magpies. Journal of Field Ornithology 56(2):153-157.

______ and S.A.Temple. (1986a). Why does intensity of avian nest defense increase during the nesting cycle. Auk 103:318:327.

______ and_____. (1986b). Nest defence in the American goldfinch. Animal Behavior 34:887-897.

______ and ______. (1995). Origin of Wildlife Responses to Recreationists.Wildlife and Recreationists: Coexistence Through Management and Research. R.L. Knight and K.J. Gutzwiller (eds.). Island Press, Washington D.C

Krueger, C.C., D.J. Decker and T.A.Gavin.(1986). A concept of natural resources management: an application to unicorns. Transactions of the Northeast Section of the Wildlife Society 43:50-56.

Kucera, T.E. and R.H. Barrett. (1993). The trailmaster camera system for detecting wildlife. Wildlife Society Bulletin 21:505-508.

Kuss, F.R., A.R. Graefe and J.J. Vaske.(1990), Visitor Impact Management, a review of the research. Vol 1 and 2, National Parks and Conservation Association, Washington, D.C.

Larson, R.A. (1995). Balancing wildlife viewing with wildlife impacts: a case study. Recreationists.Wildlife and Recreationists: Coexistence Through Management and Research. R.L. Knight and K.J. Gutzwiller (eds.). Island Press, Washington D.C.

Lasswell, H.D. (1971). The continuing decision seminar as a technique of instruction. Policy Sciences 2:43-57.

_____, and A.Kaplan. (1950). Power and society: A framework for political inquiry. Yale University Press. New Haven, Connecticut.

Lehner, Philip N.(1979). Handbook of Ethological Methods. Garland STPM Press. New York, New York.

Leopold,A. (1949). A Sand County Almanac and Sketches Here and There. Oxford University Press. New York, NY.

Lime,D.W. (1974). Moose as a nongame recreational resource. 10th North American Moose Conference and Workshop. 110-134.

Lyons, J.R. (1982). Nonconsumptive wildlife-associated recreation in the U.S.: identifying the other constituency. Transactions of the 47th North American Wildlife Conference 47:677-685.

MacArthur, R.A., V. Geist, and R.H. Johnston. (1982). Cardiac and behavioral responses to human disturbance. Journal of Wildlife Management 46(2):351-358.

Major, R.E. (1990). The effect of human observers on the intensity of nest predation. Ibis 132:608-612.

Manfredo, M. (1984). The comparability of onsite and offsite measures of recreation needs. Journal of Leisure Research 16(3):245-249

Manfredo,M. (1989). Human dimensions of wildlife management. Wildlife Society Bulletin 17:447-449

______, B.L. Driver, and P.J. Brown. (1983). A test of concepts inherent in experience based setting management for outdoor recreation areas. Journal of Leisure Research 15(3):263-283.

______ and R. A. Larson. (1993). Managing for wildlife viewing recreation: an application in Colorado. Wildlife Society Bulletin 21(3):226-237.

______, J.J. Vaske and D.J. Decker. (1995). Human Dimensions of wildlife management: basic concepts.Wildlife and Recreationists: Coexistence Through Management and Research. R.L. Knight and K.J. Gutzwiller (eds.). Island Press, Washington D.C.

Mangun, J.C., J.T.O'Leary and W.R. Mangun. (1992) Nonconsumptive recreation in the United States identity and dimension. American Fish and Wildlife Policy: The Human Dimension. W.R. Mangun (ed.). University of Southern Illinois. Carbondale IL.

Manning, R. (1986). Studies in Outdoor Recreation: Search and Research for Satisfaction. Oregon State University Press. Corvallis, Or.

Maslow, A. (1970). Motivation and personality. 2nd ed. Harper and Row, New York, NY.

Mathieson, F.E. (1968). Effects of human disturbance on nesting of bald eagles. Journal of Wildlife Management 32(1):1-6.

McFarlane, B. (1994). Specialization and motivations of birdwatchers. Wildlife Society Bulletin 22:357-370.

______. (1996). Socialization influences of specialization among birdwatchers. Human Dimensions of Wildlife 1(1):35-50.

McMillan, J.F. (1954). Some observations on moose in Yellowstone Park. American Midland Naturalist 52 (2): 392-399.

Miller, B.K. And J.A.Litvaitis. (1992). Use of roadside salt licks by moose, *Alces alces*, in northern New Hampshire. Canadian Field Naturalist 106:112-117.

More, T.A.(1979). The demand for nonconsumptive wildlife uses: a review of the literature. USDA Forest Service General Technical Report NE-52, Broomall, PA.

National Survey on recreation and the Environment. (1996). University of Georgia Survey Research Center.

New Hampshire Office of State Planning. (1994).New Hampshire Outdoors 1994-1999: Statewide Comprehensive Recreation Plan. Concord, NH.

Oberbillig, D.R. (2000). Providing positive wildlife viewing experiences. Watchable Wildlife Inc. Denver, CO.

Payne, R. H. (1991). Potential economic and political impacts of ecotourism: a research note. Texas Journal of Political Studies 13: 65-77.

Peterson, George L. (1974). Evaluating the quality of the wilderness environment, congruence between perception and aspiration. Environment and Behavior 6(2): 169-193.

Peyton, B.(1989). A profile of Michigan bear hunters and bear hunting issues. Wildlife Society Bulletin. 17:494-500.

Pierce, R.C. (1980). Dimensions of Leisure I: satisfactions. Journal of Leisure Research 11(1):5-19.

Profera, J. (1985). Development of Sage Grouse Viewing Tours in North Park Colorado. Nonconsumptive use of Wildlife Project Report N-5-R.

Pomerantz, G.A., D.J. Decker, G.R.Goff and K.G.Purdy. (1988). Assessing impact of recreation on wildlife:a classification scheme. Wildlife Society Bulletin 16:58-62.

Potter, D.R., J.C. Hendee and R.N. Clark. (1973). Hunting satisfaction: game,guns or nature. Transactions of the 38th North American Wildlife Conference. 38:220-229.

Purdy, K.G. and D.J. Decker. (1989). Applying wildlife values information in management: the wildlife attitudes and values scale. Wildlife Society Bulletin 17:494-500.

______, D.J. Decker and T.L. Brown. (1983). Identifying the attitudinal basis for Bureau of Wildlife/wildlife interest group" perceptual disparity in wildlife values attributes. Outdoor Recreation Research Unit. Cornell University.

Ream, C.H. (1980). Impact of backcountry recreationists on wildlife: an annotated bibliography. USDA Forest Service, General Technical Report INT-8.

Rosenthal, D.H., D.A.Walman, and B.L.Driver. (1982). Construct validity of instruments measuring recreationists' preferences. Leisure Sciences 5(2):89-108.

Schwartz, C.C. And L.A. Renecker. (1997) Nutrition and energetics. Ecology and management of North American moose. Franzmann, A..W. And C.C. Schwartz (eds) . Smithsonian Institution Press, Washington D.C. p. 475.

Shaw, W.W., and D.A. King, (1980).Wildlife management and non-hunting wildlife enthusiasts. Transactions of the 45th North American Wildlife Conference 45:219-225.

______, and W. R. Mangun. (1984). Non-consumptive use of wildlife in the United States. U.S. Department of the Interior: Fish and Wildlife Service, Resource Publication 154. Washington, D.C.

______, and E.H.Zube, eds. 1980. Wildlife values. Center for Assessment of Noncommodity Natural Resource Values, Institutional Series Report 1.

Shelby, B., J.J. Vaske. (1991). Using normative data to develop evaluative standards for resource management: a comment on three recent papers. Journal of Leisure Research 23(2): 173-187.

Silverberg, J.K. (1992).A New Hampshire watchable wildlife concept paper. Report prepared for NH Fish and Game Department. Concord. NH.

Signer, F.J. And J. B. Beattie. (1986). The controlled traffic system and associated wildlife responses in Denali National Park. Arctic: 195-203.

Skagen, S.K., R.L. Knight and G.H. Orians.(1991). Human disturbance of an avian scavenger guild. Ecological Applications 1(2):21-225.

Stalmaster, M.V. And J. R. Newman. (1978). Behavioral responses of wintering eagles to human activity. Journal of Wildlife Management 42(3):506-513.

Taylor, J., and T.Lee. (1994). General ecology laboratory manual. "Unpublished Manuscript". University of New Hampshire.

Tinsley, H.E.A., T.C. Barrett and R.A.Kuss. (1977). Leisure activities and needs satisfaction. Journal of Leisure Research 9(2):110-120.

United States Census Data 1990. http://venus.census.gov/cdrom

United State Department of Interior, Fish and Wildlife Service and US Department of Commerce, Bureau of Census. (1997). 1996 national survey of fishing, hunting and wildlife associated recreation. Washington D.C.

van der Zande, A.N., J.C.Berhuizen, H.C. van Latesteijn, W.J. Ter Keurs and A.J. Poppelaars. (1984a). Impact of outdoor recreation on the density of a number of breeding bird species in woods adjacent to urban residential areas. Biological Conservation 30:1-39.

_____ and P.Vos. (1984b). Impact of a semi-experimental increase in recreation intensity on the densities of birds in groves and hedges on a lake shore in the Netherlands. Biological Conservation 30:237-259.

Vaske, J.J. and D.J. Decker and M.J. Manfredo. (1995). Human Dimensions of Wildlife Management: An integrated framework for coexistence. Wildlife and Recreationists: Coexistence Through Management and Research. R.L. Knight and K.J. Gutzwiller (eds.). Island Press, Washington D.C.

_____ and M.P. Donnelly. (1982). Differences in reported satisfaction ratings by consumptive and nonconsumptive recreationists. Journal of Leisure Research 14(3):195-206.

______and ______. (1993). Establishing management standards: selected examples of the normative approach. Environmental Management 17(5): 629-643.

______, B. Shelby, A. Graefe and T.A. Heberlein. (1986). Backcountry encounter theory methods and empirical evidence. Journal of Leisure Research 18:137-153.

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

Verner, J. (1992). Assessment of counting techniques. Current Ornithology, R.F. Johnson, (ed.). Plenum Press, NY Vol. 9: 247-302.

Vickerman, S. (1989). Watchable wildlife: a new initiative. Defenders of Wildlife. 17 pp.

Vittersø, J., R.Bjerke and B.P, Kaltenborn. (1999). Attitudes toward large carnivores among sheep farmers experiencing different degrees of depredation. Human Dimensions of Wildlife 4(1):20-35.

Wall, G., and C. Wright. (1977). The environmental impact of outdoor recreation. University of Waterloo. Department of Geography. Publication Series No. 11. Ontario, Canada.

Whittaker, Douglas. (1997). Capacity norms on bear viewing platforms, Human Dimensions of Wildlife. Vol 2:No. 2:37-49

Wiedner,D. And P.T., Kerlinger. (1990) Economics of birding: a national survey of active birders. American Birds. 44:209-213.

Wight, P.A. (1996). North American Ecotourists: Market provide and trip characteristics. Journal of Travel Research. Spring 1996. 2-10.

Wilkes, B. (1977). The myth of the nonconsumptive user. Canadian Field Naturalist 91:343-349.

Yamasaki, Mariko. (1996). Personal Correspondence.

Zar, J.H. (1996). Biostatical analysis. Prentice Hall Inc. New Jersey.

APPENDIX I

Moose-Viewer Stimulus Response Form

Observer Initials___________ Date___________Weather________________ Sex _____
Observation Time Period ___________________________

Time	Fe	Lo	Al	Mo	Fl	Gr	#M	DM	Cp	Tp	Cs	CHO	VW	VB	VT	VD	#V	Comments

Fe- feeding, Lo- looking at people, Al- alertness, Mo- move one or two steps in lick, Fl- fleeing, Gr-grooming, #M-number of moose in lick, DM-distance of people to moose,CP- car passing, Tp-truck passing, Cs- car stops, CHO- car with human outside, VW- visitor walking to or from blind,VB- visitor in the blind, VT-visitor talking, VD- visitor very loud or doing disturbing behavior, #V- number of visitors in the blind.

APPENDIX II

Interview Questions With Frequency of Response

Data To Be Completed by Interviewer Identification No.________

Date ________________________ Male Female

Time of Day ________________

n=number of respondents
Bold- combined responses from 1997-1998
Regular- responses from 1998
Italics- responses from 1997

Weather Conditions	Sunny	Partly Cloudy	Cloudy	Rain
n=427	**47.1**	**23.7**	**19.7**	**9.4**
n=221	48	24.9	15.4	11.8
n=206	*46.1*	*22.8*	*24.3*	*6.8*

recode Temperature		40-50	58-69	70	71-75	76-80		81-88
n=430	**2.4**	**22.6**	**22.1**	**23.0**	**21.9**		**8.1**	
n=203		*4.9*	*21.6*	*14.3*	*22.2*	*27.6*		*4.9*

Mosquito Conditons		None		Light		Moderate	Heavy
n=430		**60.7**		**27.0**		**12.1**	**.2**
n=222	65.3		27.9		6.8		
n=208		*55.8*		*26*		*17.8*	*.5*

Black Fly Conditions	None	Light	Moderate	Heavy
n=430	**38.6**	**43.5**	**16.5**	**1.4**
n=222	32	47.7	18	2.3
n=208	*45.7*	*38.9*	*14.9*	*.5*

Number in Group

	1	2	3	4	5	6	more than 6
n=425	**10.4**	**57.2**	**15.5**	**11.8**	**2.1**	**2.6**	**.5**
n=219	9.1	56.2	17.4	11.9	1.8	3.7	
n=206	*11.7*	*58.3*	*13.6*	*11.7*	*2.4*	*1,5*	*1.0*

Type of Group	Individuals	Couples	Family	Friends	Tour
n=424	**10.4**	**47.6**	**32.3**	**9.2**	**.5**
n=218	9.6	48.6	33.5	7.8	.5
n=206	*11.2*	*46.6*	*31.1*	*10.7*	*.5*

Gender

	Male	Female
n=429	**43.1**	**56.9**
n=220	46.4	53.6
n=209	*39.2*	*59.8*

Age: Interviewer guessed age, it was not asked
Begin Interview Here
Hello my name is ______________. Welcome to the Dixville Notch Wildlife Viewing Area. The New Hampshire Fish and Game Department is currently developing a wildlife watching program including developing sites like this one. As part of this program we are conducting research on the impacts of viewing wildlife as well as trying to gather information about people who are interested in watching wildlife. Would the person who is over eighteen with the birthday closest to today be willing to take less than five minutes to speak with me. Your answers are voluntary and confidential.

1. Where do you live?________________City ____________Zipcode

(If they live out of Coos County ask the following:)
Are you on a day trip? Yes No

Where are you staying in the area? ________________________

Recoded

Town	Private Home	Campground	Motel	Resort	Travelling
32.6	**1.1**	**11.9**	**2.6**	**19.5**	**1.4**
63.6	.7	4.6	.7	27.8	2.6
39.6	*1.5*	*20.1*	*7.5*	*31.3*	

2. Have you ever visted this site?

	0	1	2	3	4	5	6 or more
n=431	**45.5**	**41.5**	**5.1**	**2.1**	**1.9**	**2.6**	**1.2**
n=221	88.7	5.9	.9		3.2	1.4	.5
n=209	*79.4*	*9.6*	*4.3*	*.5*	*3.8*	*2.4*	

How many times have you visted this year?

	0	1	2	3	4	5	6 or more
n=431	**46.9**	**45.2**	**4.4**	**.7**	**.9**	**1.6**	**.2**
n=221	91.4	4.1	1.4		1.4	1.8	
n=209	*89.0*	*7.7*	*1.4*	*.5*	*1.4*		

3. Before stopping at this wildlife viewing site were you actively looking for wildlife? Wildlife meaning any mammal, bird, reptile or amphibian.

	Yes	No
n= 429	**75.9**	**23.7**
n=220	75.5	24.5
n=209	*77.0*	*23.0*

small mammals, birds reptiles amphibians

How many moose have you seen in the wild?

	0	1	2	3	4	5	6 or more
n=430	**13.9**	**8.6**	**7.7**	**3.9**	**3.5**	**4.2**	**58**
n=221	8.1	5.9	5.9	3.2	2.3	4.1	70.6
n=209	*20.1*	*31.6*	*9.6*	*4.8*	*4.8*	*4.3*	*44.0*

How many moose have you seen today?

		0	1	2	3	4	5	6 or more
n=430	**76.6**	**10.4**	**4.9**	**3.5**	**.9**	**2.1**	**1.4**	
n=221		71.9	11.3	6.8	3.6	1.4	3.2	1.8
n=209		*81.8*	*9.6*	*2.9*	*3.3*	*.5*	*1*	*1*

Why did you stop at this site?
Recode
n=425
n=222
n=203

sign	looking for moose	curiosity	saw blind	word of mouth	mixture of reason	seen before	other
26.2	**24**	**13.6**	**6.7**	**7.7**	**6.5**	**3.0**	
11.5							
34.2	11.3	12.2	11.3	8.6	12.6	2.7	
7.2							
18.2	*37.9*	*15.3*	*2.0*	*6.9*	*0*	*3.4*	
16.3							

Have you seen other wildlife today besides moose?

	Yes	No
small mammals	**23.9**	**75.9**
	17.6	82.4
	30.6	*69.4*
birds	**50.2**	**49.8**
	29.9	70.1
	71.8	*28.2*

reptiles	**2.3**	**97.4**
	2.3	97.7
	2.4	*97.6*
amphibians	**2.6**	**97.2**
	1.4	98.6
	3.8	*96.2*
large mammals	**13.5**	**86.5**
	17.6	82.4
	9.1	*90.9*

4. How would you rank your knowledge about moose on a scale from one to five where one is very little to five is quite knowledgeable.

	1	2	3	4	5
n=430 mean 2.54	**28.1**	**20.9**	**28.5**	**13.5**	**8.8**
n=221 mean 2.7	26.7	18.6	26.2	14.9	13.6
n=209 mean 2.36	*29.7*	*23.4*	*31.1*	*12*	*3.8*

5. A full grown moose primarily eats

	n=431	n=222	*n=211*
a. Twigs and buds	**48.0**	42.8	*53.6*
b. Other animals	**.2**	.5	
c. Grasses	**45**	46.8	*43.1*
don't know	**3.0**	4.1	*3.3*
mixed answer	**3.0**	5.9	

6. Moose are found in muddy areas along the side of the road because

	n=431	n=222	*n=209*
a. They are escaping insects	**3.7**	5	*2.4*
b. Looking for a specific food	**23.4**	22.1	*24.9*
c. Water source	**11.4**	8.1	*14.8*
d.eating salt deposits	**46.5**	43.7	*49.3*
e. Don't know	**10.7**	12.6	*8.6*
f. Mixed answer	**4.4**	8.6	

7. The best time to view wildlife is

	n=431	n=222	*n=211*
a. Mid morning	**10.9**	6.8	*15.3*
b. Dusk to dawn	**83.8**	87.4	*79.9*

c. Mid day	**.9**	.9	*1.0*
d. After midnight	**.9**	1.4	*.5*
don't know	**2.8**	2.3	*3.3*
mixed answer	**.7**	1.4	

8. Forestry practices determine what kind of wildlife found in an area?

	True	False	Don't Know
n=431	**85.6**	**9.3**	**5.1**
n=222	91.9	5.4	2.7
n=209	*78.9*	*13.4*	*7.7*

Moose grow new antlers every year.

	True	False	Don't Know
n=430	**71.5**	**11.8**	**16.5**
n=222	75.2	10.4	14
n=209	*67.5*	*9.6*	*23*

How much does an average adult moose weigh?

9. What would make stopping here a highlight of your day?
Recode

See a moose	See a deer speaking to	See a bear	See 1,2,3	other	guide
65.4	**.2**	**2.1**	**9.5**	**18.4**	**1.2**
67.3	1.8	4.1	24.9	24.9	1.8
69.7	*.5*	*2.4*	*15.4*	*11.3*	*.5*

Are you willing to fill out a questionnaire regarding wildlife viewing, if one was sent to you in the mail?

	Yes	No
	81.9	**18.1**
n=431		
n=221	97.3	2.7
n=211	*65.6*	*34.4*

APPENDIX III

Mail Questionnaire with Frequency Responses

Dear Survey Participant,

You recently visited a wildlife viewing site on Route 26 in Dixville Notch, New Hampshire. This questionnaire is a follow up to your visit. Your identity is strictly confidential. The responses to this survey will be used in planning for additional wildlife viewing areas and developing management policies for these kinds of sites.
Thank your for your prompt response.

Judy Silverberg
Watchable Wildlife Coordinator
N.H. Fish and Game Department

n= number of respondents

Bold= combined responses from 1997-1998. Note the combined response numbers vary <4 from the 1997-1998 data, as questionaires were returned after the 1998 data was run separately but before the combined data was run. All analyses were done using the combined total.

Regular=responses from 1998

Italics=responses from 1997

SECTION I - *Please circle one response for each question.*

1. How many moose did you see at the Dixville Notch wildlife viewing site?

	0	1	2	3	4	5	over 6
n=207	**66.7**	**15.5**	**5.3**	**5.3**	**3.4**	**0**	**3.9**
n=133	67.7	15.8	5.3	4.5	3.0	0	3.8
n=73	*64.3*	*15.7*	*5.7*	*5.7*	*4.3*	*0*	*4.3*

2. Did you see other kinds of wildlife at the Dixville Notch site? *(check all that apply)*

n=206
n=132
n=70

	yes	no
Birds	**80.6**	**18.9**
	79.5	20.5
	1.4	*82.9*
Small mammals	**51.2**	**48.3**
	51.9	48.1
	51.4	*48.6*
Large mammals	**8.2**	**91.3**

	6.0	94
	12.9	*87.1*
Amphibians	**10.1**	**89.4**
	8.3	91.7
	14.3	*85.7*
Reptiles	**2.9**	**96.6**
	3.0	97
	2.9	*97.1*

3. How many other people were in the viewing blind besides those in your group?

N=207
n=133
n=70

None	1-5	6-10	over 10
45.9	**49.8**	**3.4**	**1.0**
48.9	49.6	.8	.8
38.6	*51.4*	*8.6*	*1.4*

4. What was the noise level caused by people in the viewing blind?

N=193
n=120
n=70

Quiet				Very Loud
1	2	3	4	5
77.2	**15.5**	**5.7**	**1.6**	
80	13.3	5.0	1.7	
72.5	*18.8*	*7.2*	*1.4*	

5. How much did these other people detract from your experience?

N=177
n=109
n=66

Not at All				Extremely annoyed
1	2	3	4	5
83.1	**10.2**	**2.3**	**4.0**	**.6**
86.2	7.3	2.8	2.8	.9
77.3	*13.6*	*1.5*	*6.1*	*1.5*

6. How many days in the last twelve months have you spent time watching, photographing wildlife or other doing other activities that directly involved the enjoyment of wild (free living) animals and fish?

N=204
n=131
n=69

0	1-2	3-4	5-7	8-14	15-21	more than 21 days
.5	**5.8**	**6.4**	**11.3**	**13.7**	**10.8**	**45.1**
0	10.7	6.1	13	12.2	11.5	46.6
1.4	*14.5*	*7.2*	*7.2*	*15.9*	*10.1*	*43.5*

7. In what other states have you visited wildlife viewing sites:

____

____

Recode to number of states
n=200
n=124
n=73

0	**29**	29	*28.8*
1	**24**	54.8	*21.9*
2	**17.5**	18.5	*15.1*
3	**4.5**	3.2	*5.5*
4	**5.5**	7.3	*2.7*
5	**4.0**	2.4	*5.5*
6	**3.5**	4.8	*6.8*
7	**2.5**	4.0	
8	**1.0**	1.6	
9	**3.5**	1.6	*5.5*
10	**2.5**	.8	*1.4*
11	**.5**	.8	
14	.5		*1.4*
15	**.5**		*1.4*
20	**.5**		*1.4*
50	**.5**		*1.4*

8. What types of wildlife viewing sites have you visited? (e.g. along the road, remote, with informational signs, developed.)

____

____

Recode

Site along road	yes	no
n=187	**69**	**30.5**
n=127	68.5	31.5
n=56	*71.4*	*26.8*
site remote	yes	no
n=186	**44.6**	**55.4**
n=127	37	63
n=55	*61.8*	*38.2*

site info	yes	no
n=187	**28.9**	**71.1**
n=127	18.9	81.1
n=56	*46.4*	*53.6*

site developed	yes	no
n=187	**27.3**	**72.7**
n=127	18.1	81.9
n=56	*48.2*	*51.8*

other	yes	no
n=139	**24.5**	**75.5**
n=128	23.4	76.6
n=11	*36.4*	*63.6*

10. Based on your experience at the Dixville Notch wildlife viewing site, how would you recommend it to your friends? On a scale from 1-5, with 5 being strongly recommend.

	Don't Bother 1	2	3	4	Strongly Recommend 5
n=208	**1.9**	**5.8**	**30.8**	**25.5**	**36.1**
n=133	2.3	5.3	30.1	26.3	36.1
n=71	*1.4*	*7*	*29.6*	*23.9*	*38*

Section II - Now we would like to know more about why you stopped at the Dixville Notch Wildlife Viewing Site. Please circle one response for each statement.

		Not Important 1	2	Moderately Important 3	4	Extremely Important 5
11. To see what was there.		1	2	3	4	5
n=209	**Mean 3.99**	**1.4**	**1.9**	**28.2**	**33.0**	**35.4**
n=133	Mea5n 32.939			27.1	33.8	35.3
n=72	*Mean 3.9*	*1.4*	*1.4*	*30.6*	*31.9*	*34.7*
12. To experience a quiet time in the north woods.		1	2	3	4	5
n=208	**Mean3.45**	**10.6**	**11.5**	**26.9**	**24**	**26.9**
n=132	Mean 3.31	12.1	13.6	26.5	26.5	21.2
n=72	*Mean 3.64*	*8.3*	*6.9*	*27.8*	*20.8*	*36.1*
13. To get away from the usual demands of home and office.		1	2	3	4	5
n=205	**Mean 3.37**	**20.5**	**9.3**	**15.6**	**22.0**	**32.7**
n=129	Mean 3.16	22.5	10.9	20.2	20.9	25.6
n=72	*Mean 3.77*	*15.3*	*6.9*	*8.3*	*23.6*	*45.8*

14. To experience new and
different things. 1 2 3 45
n=207 Mean 4.02 1.9 5.8 18.8 34.3 39.1
n=131 Mean 4.0 2.3 4.6 19.1 38.9
35.1
n=72 Mean 4.08 1.4 8.3 18.1 25.0 47.5

15. To learn or study about nature.
1 2 3 45
n=207 Mean 3.84 2.4 7.7 24.6 33.3 31.9
n=131 Mean 3.79 3.8 9.9 26.7 33.6 29.8
n=72 Mean 3.95 11.1 19.4 31.9 37.5

16. To experience excitement. 1 2 3 45
n=204 Mean 3.13 15.2 15.2 27 26.5 16.2
n=129 Mean 3.01 16.3 16.3 28.7 27.1 11.6
n=71 Mean3.35 12.7 12.7 25.4 25.423.9

17. To do something with my family.
1 2 345
n=203 Mean 3.59 11.3 9.9 20.7 24.6 33.5
n=129 Mean 3.41 13.2 11.6 23.3 24.8 27.1
n=70 Mean 3.94 7.1 7.1 15.7 24.345.77

18. To be with my friends. 1 2 3 45
n=195 Mean 2.49 37.4 17.9 16.9 12.8 14.9
n=122 Mean 2.32 38.5 23 17.2 9.8 11.5
n=70 Mean 2.81 34.3 10 17.1 17.1 21.4

19. To get exercise. 1 2 3 45
n=204 Mean 2.65 29.9 17.2 23.0 17.2 12.7
n=128 Mean 2.61 32 14.8 23.4 18.810.9
n=72 Mean 2.72 26.4 20.8 22.2 15.315.3

20. To develop my wildlife viewing
skills and abilities.
1 2 345
n=204 Mean 3.17 17.2 12.3 27.9 21.6 21.1
n=129 Mean 3.11 19.4 11.6 25.6 24.818.6
n=71 Mean 3.29 12.7 14.1 31 15.5 26.8

21. Because someone told me
it was a good place to stop.
1 2 345
n=189 Mean 2.17 54.5 7.9 16.9 11.6 9.0
n=119 Mean 1.94 59.7 8.4 16.8 8.46.7
n=67 Mean 3.9 44.8 7.5 14.9 17.913.4

22. To share my outdoor knowledge with others.

		1	2	3	4	5
n=197	**Mean 2.27**	**41.6**	**19.3**	**18.3**	**11.7**	**9.1**
n=124	Mean 1.28	41.9	17.7	19.4	12.18.9	
n=69	*Mean 2.33*	*37.7*	*23.2*	*17.4*	*11.610.1*	

23. To have a personal spiritual experience.

		1	2	3	4	5
n=198	**Mean 2.27**	**43.4**	**16.7**	**18.7**	**11.6**	**9.6**
n=124	Mean 2.23	43.5	15.3	22.6	11.3	7.3
n=70	*Mean 2.41*	*40*	*20*	*12.9*	*12.9*	*14.3*

24. To do something creative, such as sketch, paint or take photographs

		1	2	3	4	5
n=198	**Mean 2.18**	**51.0**	**11.4**	**17.8**	**3.7**	**5.6**
n=128	Mean 2.20	48.4	12.5	21.1	6.3	11.7
n=70	*Mean 2.21*	*52.9*	*10*	*12.9*	*11.4*	*12.9*

SECTION III - Please indicate your level of agreement or disagreement with the following statements. Please circle one response for each statement.

Strongly Disagree **NeutralStrongly Agree**

25. I thoroughly enjoyed my visit to the Dixville Notch wildlife viewing area.

		1	2	3	4	5
n=209	**Mean 4.16**	**.5**	**1.9**	**21.5**	**32.5**	**43.5**
n=133	Mean 1.58	1.5	21.1	31.6	45	
n=72	*Mean 4.11*	*1.4*	*2.8*	*20.8*	*33.3*	*41.7*

26.Moose are tame.

		1	2	3	4	5
n=207	**Mean 1.561.56**	**72.5**	**11.1**	**7.7**	**5.3**	**3.4**
n=132	Mean 1.58	72.7	9.8	8.3	4.5	4.5
n=72	*Mean 1.54*	*70.8*	*13.9*	*6.9*	*6.9*	*1.4*

27.A successful wildlife viewing trip is measured by how many animals I see.

		1	2	3	4	5
n=207	**Mean 2.80**	**17.9**	**22.2**	**30.4**	**20.8**	**8.7**
n=132	Mean 2.88	12.1	25.1	31.1	22.0	8.3
n=72	*Mean 3.91*	*29.2*	*16.7*	*27.8*	*16.7*	*8.3*

28.I enjoy viewing wildlife with no other people around.

		1	2	3	4	5
n=205	**Mean 3.50**	**8.3**	**9.3**	**33.2**	**22.0**	**27.3**
N=130	Mean 3.51	6.2	10.8	33.8	23.1	26.2
N=71	*Mean 3.46*	*12.7*	*7.0*	*31.0*	*19.7*	*29.6*

29. It is allright to talk loudly when looking for wildlife.

		1	2	3	4	5
n=209	**Mean 1.13**	**91.4**	**4.8**	**2.9**	**.5**	**.5**
n=130	Mean 1.13	91.7	5.3	1.5	.8	.8
n=72	*Mean 1.15*	*90.3*	*4.2*	*5.6*		

30.Wildlife includes birds, mammals, reptiles and amphibians.

		1	2	3	4
n=208	**Mean 4.76**	**2.4**	**2.4**	**8.7**	**86.5**
n=133	Mean 4.72	3.0	3.0	9.0	85
n=71	*Mean 4.8*	*1.4*	*1.4*	*7*	*90.1*

31.The N.H. Fish and Game Department should provide more wildlife viewing opportunities.

		1	2	3	4	5
n=208	**Mean 4.05**	**1.4**	**1.9**	**30.3**	**22.6**	**43.8**
n=132	Mean 4.00	1.5	1.5	32.6	23.5	40.9
n=69	*Mean 4.12*	*1.4*	*2.8*	*26.4*	*20.8*	*48.6*

32.Visiting the Dixville Notch Wildlife Viewing Area was worth the money I spent getting there.

		1	2	3	4	5
n=201	**Mean 3.91**	**2.5**	**6.0**	**32.8**	**14.9**	**56.2**
n=128	Mean 3.93	1.6	4.7	36.7	13.3	43.8
n=69	*Mean 3.95*	*4.3*	*5.8*	*26.1*	*17.4*	*46.4*

33.I can increase my chances of seeing wildlife by sitting quietly and patiently.

		1	2	3	4	5
n=209	**Mean 4.77**	**.5**	**1.0**	**2.9**	**12.0**	**83.7**
n=133	Mean 4.76	.8	1.5	2.3	11.3	84.2
n=72	*Mean 4.79*		*4.2*	*12.5*	*83.3*	

34.A wildlife viewing area like this may have an adverse impact on wildlife.

		1	2	3	4	5
n=208	**Mean 2.25**	**37.5**	**20.7**	**26.0**	**10.6**	**5.3**
n=132	Mean 2.29	32.6	25.0	28.8	7.6	6.1
n=72	*Mean 2.1*	*47.2*	*13.9*	*19.4*	*15.3*	*4.2*

Strongly Disagree **Neutral** **Strongly Agree**

35. Seeing a toad is as satisfying to me as seeing a moose or an eagle.

		1	2	3	4	5
n=205	**Mean 2.49**	**28.3**	**26.3**	**22.4**	**13.2**	**9.8**
n=134	Mean 2.51	26.1	27.6	24.6	11.9	9.7
n=68	*Mean 2.45*	*33.8*	*22.1*	*19.1*	*14.7*	*10.3*

36.I cannot imagine a better wildlife viewing experience than the one I had at the Dixville Notch wildlife viewing area.

		1	2	3	4	5
n=204	**Mean 2.54**	**21.6**	**21.6**	**42.2**	**10.3**	**4.4**

		1	2	3	4	5
n=133	Mean 2.53	20.3	23	42.2	9.8	3.8
n=68	*Mean 2.5*	*23.5*	*17.6*	*41.2*	*11.8*	*5.9*

37.You are too close if an animal looks at you or turns its back towards you.

		1	2	3	4	5
n=204	**Mean 3.43**	**9.8**	**13.7**	**27.5**	**21.6**	**27.5**
n=133	Mean 3.44	9.8	11.3	29.3	24.1	25.6
n=68	*Mean 3.38*	*10.3*	*17.6*	*25*	*17.6*	*29.4*

38.Forestry practices will determine the wildlife I may see in an area.

		1	2	3	4	5
n=204	**Mean 4.31**	**1.5**	**2.0**	**13.2**	**29.9**	**53.4**
n=133	Mean 4.31	1.5	.7	11.9	36.6	49.3
n=67	*Mean 4.34*	*1.5*	*4.5*	*14.9*	*16.4*	*62.7*

39.I was disappointed with some aspects of my visit to the Dixville Notch wildlife viewing area.

		1	2	3	4	5
n=204	**Mean 3.52**	**26**	**20.6**	**30.9**	**15.7**	**3.2**
n=133	Mean 2.64	22.6	22.6	30.8	15.8	8.3
n=68	*Mean 2.38*	*33.8*	*17.6*	*29.4*	*14.7*	*4.4*

40.The N.H. Fish and Game Department should provide more educational materialfocusing on wildlife and wildlife management at wildlife viewing sites.

		1	2	3	4	5
n=204	**Mean 3.52**	**7.4**	**6.4**	**35.3**	**28.9**	**22.1**
n=133	Mean 3.41	5.3	7.5	39.8	28.6	18.8
n=68	*Mean 3.6*	*11.8*	*4.4*	*25*	*29.4*	*29.4*

41.Knowing an animal is in the area is as important to me as actually seeing it.

		1	2	3	4	5
n=205	**Mean 3.31**	**8.8**	**12.7**	**33.7**	**28.3**	**16.6**
n=135	Mean 3.33	6.7	13.3	36.3	27.4	16.3
n=67	*Mean 3.26*	*13.4*	*11.9*	*26.9*	*29.9*	*17.9*

42.My behavior can affect the wildlife I see.

		1	2	3	4	5
n=205	**Mean 4.68**		**.5**	**5.4**	**18.5**	**75.6**
n=134	Mean 4.66	.7		6.7	17.2	75.4
n=68	*Mean 4.75*			*2.9*	*19.1*	*77.9*

43.I would be willing to make a voluntary contribution to the wildlife viewing program.

		1	2	3	4	5
n=206	**Mean 3.15**	**9.0**	**10.9**	**47.8**	**20.4**	**11.9**
n=131	Mean 3.06	10.7	11.5	48.1	20.9	9.2
n=67	*Mean 3.31*	*6.0*	*10.4*	*46.3*	*20.9*	*16.4*

44.I want to come back and visit the Dixville Notch wildlife viewing area.

1 2 3 4 5

n=206	**Mean 3.89**	**2.4**	**4.9**	**27.7**	**30.6**	**34.5**
n=135	Mean 3.77	3.0	5.2	31.1	33.3	27.4
n=68	*Mean 4.17*	*1.5*	*4.4*	*19.1*	*25*	*50*

SECTION IV - Please complete this section to the best of your ability. *Circle one answer for each question.*

44. A full grown moose primarily eats
n=204
n=133
n=68

a. Twigs and buds	**70.1**	69.9	*70.6*
b. Other animals	**0**	0	*0*
c. Grasses	**27.5**	28.6	*25*
d. Insects	**.5**	.8	
e. Don't Know	**2.0**	.8	*4.4*

45. Moose are primarily attracted to muddy areas along the side of the road because
n=202
n=134
n=65

a. They are escaping insects	**2.0**	2.2	*1.5*
b. They are finding specific foods.	**8.4**	10.4	*9.2*
c. They are using it as a water source.	**1.5**	11.9	*1.5*
d. They are using the salt deposits.	**86.1**	88.1	*83.1*
e. Don't know	**2.0**	.7	*4.6*

46. The best time to view wildlife is
n=204
n=134
n=67

a. Mid-morning	**.5**		.7
b. Early morning and evening	**96.1**	97.8	*94*
c. Mid-day			
d. After midnight	**1.5**	.7	*3.0*
e. Don't know	**2.0**	1.5	*3.0*

47. Roadside salt licks are caused by man.
n=205
n=135
n=67

True	False	Don't know
87.8	**5.4**	**6.8**
89.6	5.2	5.2
85.1	*4.5*	*10.4*

48. The Dixville Notch wildlife viewing area forest will look different 20 years from now.
N=206

n=135
n=68

True	False	Don't know
82.0	**4.9**	**13.1**
80	4.4	15.6
85.3	*8.8*	*5.9*

49. Two animals that might be seen at the Dixville Notch wildlife viewing area are cottontail rabbit and white-tailed deer.
N=206
n=135
n=64

True	False	Don't know
74	**15**	**11**
72.9	12.8	14.3
76.6	*6.3*	*17.2*

50. Moose grow a new set of antlers each year.

N=206
n=135
n=68

True	False	Don't know
88.3	**4.9**	**6.8**
93.3	2.2	4.4
77.9	*10.3*	*11.8*

51. A typical weight of an adult male moose is about ________ lbs.

SECTION V - If you were responsible for taking care of wildlife in this area, please indicate how you feel about the following management options. *Please circle one response for each statement.*

Totally Unacceptable **NeutralTotally Acceptable**

52. The number of people who visit this site should be limited.

		1	2	3	4	5
n=208	**Mean 3.00**	**18.8**	**13.9**	**32.3**	**18.3**	**16.8**
n=133	Mean 2.99	19.5	12.8	33.1	18	16.5
n=71	*Mean 3.05*	*16.9*	*16.9*	*28.2*	*19.7*	*18.3*

53. People should be allowed to get as close to amoose as they want.

		1	2	3	4	5
n=209	**mean 1.44**	**73.2**	**16.7**	**5.7**	**1.4**	**2.9**
n=134	mean 1.44	73.1	15.7	7.5	1.5	2.2
n=71	*mean 1.46*	*71.8*	*19.7*	*2.8*	*1.4*	*4.2*

54.There should be a wildlife expert (naturalist) on this site to answer questions.

		1	2	3	4	5
n=208	**Mean 3.35**	**7.2**	**8.7**	**41.8**	**26**	**16.3**
n=134	Mean 3.32	8.2	15.7	42.5	26.9	14.9
n=70	*Mean 3.4*	*5.7*	*11.4*	*40.0*	*22.9*	*20*

55.Salt should be placed in the lick to ensure wildlife sightings.

		1	2	3	4	5
n=209	**Mean 2.09**	**45.5**	**19.1**	**23.4**	**4.8**	**7.2**
n=134	Mean 2.0	48.5	19.4	21.6	4.5	6.0
n=71	*Mean 2.25*	*40.8*	*18.3*	*25.4*	*5.6*	*9.9*

56.People should be arrested for harassing wildlife.

		1	2	3	4	5
n=209	**Mean 4.38**	**6.7**	**4.3**	**3.8**	**13.9**	**71.3**
n=133	Mean 4.42	6.7	2.2	4.5	14.9	71.6
n=71	*Mean 4.33*	*7.0*	*7.0*	*2.8*	*11.3*	*71.8*

57.Wildlife that injures visitors should be put to death.

		1	2	3	4	5
n=206	**Mean 1.97**	**49**	**17.5**	**23.8**	**6.8**	**2.9**
n=133	Mean 2.04	42.9	20.3	27.8	7.5	1.5
n=69	*Mean 1.84*	*60.9*	*11.6*	*15.9*	*5.8*	*5.8*

58.The forest should be kept in this stage to ensure moose will always be here.

		1	2	3	4	5
n=207	**Mean 3.74**	**7.7**	**9.7**	**23.2**	**18.8**	**40.6**
n=133	Mean 3.69	5.3	12	25.3	21.8	35.3
n=70	*Mean 3.84*	*12.9*	*4.3*	*8.6*	*1 4.3*	*50*

60. There should be no hunting zones around wildlife viewing sites.

		1	2	3	4	5
n=207	**Mean 4.35**	**7.2**	**4.3**	**6.8**	**9.2**	**72.5**
n=132	Mean 4.3	5.3	5.9	6.8	9.8	72
n=71	*Mean 4.33*	*9.9*	*1.4*	*7.0*	*8.5*	*73.2*

61.All wildlife viewing sites should be as developed as this.

		1	2	3	4	5
n=206	**Mean 3.25**	**10.7**	**13.6**	**37.4**	**16.5**	**21.8**
n=132	Mean 3.33	6.8	15.2	37.9	18.2	22
n=71	*Mean 4.47*	*18.3*	*9.9*	*33.8*	*14.1*	*22.5*

62.Educational information should be presented at wildlife viewing sites.

		1	2	3	4	5
n=208	**Mean 4.38**	**.5**	**1.9**	**13.5**	**26.9**	**57.2**
n=133	Mean 4.33	.8	2.2	15	27.1	54.9
n=71	*Mean 4.46*		*1.4*	*11.3*	*26.8*	*60.6*

63.The distance people are allowed to approach wildlife should be controlled.

		1	2	3	4	5
n=209	**Mean 4.03**	**5.3**	**7.2**	**13.9**	**25.8**	**47.8**
n=134	Mean 3.96	7.5	6.0	14.2	27.6	44.8
n=71	*ean4.15*	*1.4*	*9.9*	*14.1*	*21.1*	*53.5*

64.Wildlife should be held captive at sites like this so people can see it.

		1	2	3	4	5
n=209	**Mean 1.12**	**92.8**	**4.3**	**1.4**	**1.0**	**.5**
n=134	Mean 1.12	91	6	2.2	.7	
n=71	*Mean 1.13*	*95.8*	*1.4*		*1.4*	*1.4*

65.If wildlife is negatively impacted by people at viewing sites, the site should be closed.

		1	2	3	4	5
n=207	**Mean 4.15**	**6.8**	**7.7**	**7.2**	**19.8**	**58.5**
n=133	Mean 4.09	6.8	7.5	9.8	21.1	54.9
n=70	*Mean 4.21*	*7.1*	*8.6*	*2.9*	*18.6*	*62.9*

66.Some wildlife habitat should be off-limits to people.

		1	2	3	4	5
n=208	**Mean 4.31**	**5.3**	**2.3**	**9.1**	**14.4**	**66.3**
n=133	Mean 4.26	6	3	12.8	15	63.2
n=71	*Mean 4.38*	*4.2*	*8.5*	*2.8*	*14.1*	*70.4*

Section VI - We would like to find out more about you. *Please complete the following section.*

67. How many years have you lived in the state you currently reside in?__________

n= 206 Mean 32.956
n=131 Mean 34.397
n=71 Mean 29.9

68. How many people are in your household? ______________________
n=210
n=134
n=73

1 **7.6** 8.2 *5.5*

2	**43.8**	47.8	*37.0*
3	**18.6**	16.4	*20.5*
4	**19.5**	19.4	*20.5*
5	**6.2**	5.2	*8.2*
6	**1.2**	2.2	*2.7*
7	**1.0**	.7	*1.4*
9	**.5**		
31	**.5**		*1.4*

69. What race or ethnic background do you consider yourself? *Circle one.*
n=207
n=134
n=70

a.	Black	**.5**		*1.4*
b.	Hispanic	**.5**		*1.4*
c.	White	**96.1**	97.8	*91.4*
d.	Native American	**2.9**	2.2	*4.3*
e.	Asian/Pacific			
f.	Don't know			

70.Which of these broad categories best describes your household income in 1994? *Circle one.*
N=187
n=120
n=66

a.	Less than 10,000	**1.6**	1.7	*1.5*
b.	10,000-19,999	**5.9**	8.3	*27.3*
c.	20,000 to 39,999	**25.7**	25	*28.8*
d.	40,000 to 59,999	**26.7**	25	*15.2*
e.	60,000 to 79,999	**19.8**	22.5	*13.6*
f.	80,000 to 99,999	**9.6**	6.7	*10.6*
g.	100,000 or more	**10.7**	10.8	*3.0*
h.	Don't know			

71. What age category do you fall into? *Circle one.*
N=205
n=132
n=71

a.	18-29	**10.1**	6.8	*16.9*
b.	30-39	**15.9**	15.9	*15.5*
c.	40-49	**30.9**	27.3	*36.6*
d.	50-59	**25.6**	27.3	*23.9*
e.	60-69	**14.0**	18.9	*4.2*
f.	70-Over	**3.4**	3.8	*2.8*

72.What is the highest grade level you have completed in school? *Circle one.*
N=205
n=130

n=71

a.	No High School Diploma	**3.4**	1.5	*7.0*
b.	High School	**22.9**	23.	*22.5*
c.	Some college, trade or business school	**24.4**	21.5	*28.2*
d.	College graduate	**29.3**	32.3	*22.5*
e.	Graduate or Professional Degree	**20**	20.8	*19.7*

73.Do you belong to conservation organizations? *Circle all that apply.*

n=208
n=133
n=71

		Yes	no
a.	Fish and Game Club	**11.6**	**88.4**
		12.9	87.1
		9.9	*90.1*
b.	National Audubon	**12**	**88**
		13.5	86.5
		9.9	90.1
c.	Society for the Protection of New Hampshire Forests	**3.8**	**96.2**
		4.5	95.5
		2.8	*97.2*
d.	Appalachian Mountain Club	**8.2**	**91.8**
		9.0	91
		7.0	93
e.	National Wildlife Federation	**8.2**	**91.8**
		6.8	93.2
		11.3	*88.7*
f.	The Nature Conservancy	**10.1**	**89.9**
		11.3	88.7
		8.5	*91.5*
g.	Nature/Environmental Education Center	**1.4**	**98.6**
		2.3	97.7
		0	*100*
h.	New Hampshire Audubon Society	**3.8**	**96.2**
		5.3	94.7
		1.4	*98.6*
i.	New Hampshire Wildlife Federation	**2.4**	**97.6**
		3.8	96.2
		0	*100*
j.	Other	**17.3**	**82.7**
		19.5	80.5
		12.7	*87.3*

74. What types of outdoor recreation activities have you participated in during the last five years. *Check all that apply.*

Auto sightseeing	**83.2**	**16.8**	Kayaking	**11.5**	**88.5**
	85	15		9	91
	78.9	*21.1*		*15.5*	*84.5*
Camping	**61.5**	**38.5**	Backpacking	**27.9**	**72.1**
	63.9	36.1		25.6	74.4
	59.2	*40.8*		*33.8*	*66.2*
Hiking	**78.8**	**21.2**	Wildlife viewing	**88**	**12**
	75.2	24.8		89.5	10.5
	85.9	*14.1*		*84.5*	*15.5*
Hunting	**24**	**76**	Bowhunting	**7.7**	**92.3**
	26.3	73.7		9	91
	21.1	*78.9*		*5.6*	*94.4*
Fishing	**55.8**	**44.2**	Mountain biking	**27.4**	**72.6**
	58.6	41.4		23.3	76.7
	50.7	*49.3*		*33.8*	*66.2*
Bird watching	**63.0**	**37.0**	Rock climbing	**6.7**	**93.3**
	65.4	34.6		4.5	95.5
	59.2	*40.8*		*11.3*	*88.7*
Boating	**54.3**	**45.7**	Nature programs	**30.0**	**69.2**
	57.1	42.9		30.1	69.9
	49.3	*50.7*		*32.4*	*67.6*
Canoeing	**52.9**	**47.1**	Cross country skiing	**32.2**	**67.8**
	53.4	46.6		29.3	70.7
	53.5	*46.5*		*35.2*	*64.8*
Snowmobiling	**19.7**	**80.3**	Snowshoeing	**25**	**75**
	18.8	81.2		21.1	78.9
	22.5	*77.5*		*32.4*	*67.6*

Section VI - Are there any further comments or information thing you would like to tell us about your experience at the Dixville Notch Wildlife Viewing Area?

comments	yes	no
n=210	**46.7**	**53.3**
n=135	50.4	49.6
n=71	*38*	*62*

APPENDIX IV

NARRATIVE DESCRIPTION OF MOOSE/VIEWER OBSERVATIONS

Date: June 9, 1997
Weather: Partly Cloudy
Moose Present At Beginning of Observation Time: yes
Moose Present At End of Observation Time:yes
Sex: Male

Observation Period: 1900-2100

Observations: 2025, taken every two minutes until too dark to see at 2053 Moose walked from approximately fifteen from the blind and then crossed road to wallow. The moose was looking and feeding. A car stopped on road and the moose continued to feed. Four visitors entered the blind and the moose was a looking alert and feeding. Visitors were talking, moose continued to feed, looking and was alert. One car passed, moose was feeding. A second car passed and the moose was alert and visitors were talking in the blind as well as two additional visitors entered the blind. After the second car passed and two minutes later another car passed. The moose was alert from the second car passing to two minutes after the third car passed. The moose returned to feeding followed by being looking and alert. Observations became too difficult due to darkness.

Date: June 12, 1997
Weather: Partly Cloudy
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time:no
Sex:

Observation Period: 1830-2030
No observations recorded

Date: June 15, 1997
Weather: Partly Cloudy
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time: no
Sex:

Observation Period: 1800-2000

No observations recorded

Date: June 19, 1997
Weather: Partly Cloudy
Moose Present At Beginning of Observation Time: yes
Moose Present At End of Observation Time:no
Sex: Male

Observation Period:1930-2100

Three visitors in the blind, moose was alert and moving into clearcut, disappeared from site.

Date: June 22, 1997
Weather:
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time Block:no
Sex:

Observation Period: 1600-1900
No observations recorded

Date: June 26, 1997
Weather:Cloudy
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time Block:yes
Sex: Female

Observation Period: 1900-2100

Observations began 2045 to 2059 when became too dark to see.
Cow moved in from behind the lick, there were two visitors in the blind. She became looking and alert but went back to feeding. She started to cross road, but car stopped and she became alert and went back into lick after car left she went back to feeding, and moved as a car passed. She continued to feed. Became alert for no apparent reason other than visitors were in the blind. Moose was looking at the people in the blind and sniffing are in direction of blind. As a car stopped she became alert and her ears went back. After car left she continued to feed. Darkness prevented further observations.

Date: June 28, 1997
Weather: Rain
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time Block:no
Sex:

Observation Period: 1830-2030

No observations recorded

Date: June 30, 1997
Weather: Partly Cloudy
Moose Present At Beginning of Observation Time: yes
Moose Present At End of Observation Time Block:yes
Sex: Male

Observation Period: 2033-2100

Moose was alert, as a car passed the moose was alert with ears back and moving. After car passed, moose was feeding, looking and alert and feeding. Car passing, moose was alert with ears back, was looking and alert. As truck was coming moose was fleeing and ran out in the road, almost got hit by the truck. A car stopped as the moose walked back toward the lick and crossed the road. A car stopped and the moose was alert. A car was coming and the moose was alert and looking toward the approaching car. The car passed the moose was feeding. A car stopped and shined a light on him and he fled back, the car was loud. After the car left the moose moved back into the lick., the car turned around and stopped again, the moose was alert and then fled . Another two cars stooped and the moose fled. Was at the back of the lick making noise but not visible. Each time the moose fed to the same stop and then waited for car to go before returning. Too dark for further observations.

Date: July 3, 1997
Weather: rainy
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time Block:no
Sex: young male

Observation Period 1948-2017

Young male was feeding and there were six visitors in the blind talking loudly. A car passed and the animal became alert, went back to feeding and became alert. The visitors talked more quietly. Moose continued to feed while one person left the blind. Moose became alert as a car passed and was smelling the area. Four visitors left. The moose continued to feed. A truck passed and the moose became alert. Went back to feeding and became alert when a car passed. The moose continued to feed. A car stopped and the moose fed.Four visitors walked to the blind and the moose continue to feed. The moose moved and then began to feed as car passed. A car stopped and the animal became alert but went back to feeding. The moose continued to feed. The moose became alert as a car and truck passed. The louder the vehicle the more he reacts alertly. Truck passed, he turned his back to the road and continued to feeding, moving off, so we couldn't see.

Date: July 7, 1997
Weather: clear
Moose Present At Beginning of Observation Time: no

Moose Present At End of Observation Time:no
Sex:

Observation Period: 1900-2100
No observations recorded

Date: July 10, 1997
Weather: sunny
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time:no
Sex: male

Observation Period: 1900-2100

As observers were walking to the blind they scared a young male away from the clearcut around 2005.
Moose was looking and alert, there were no visitors in the blind besides the observers. The moose fed and became alert when a car passed and a car stopped. When a truck passed, the moose fled. The truck just honked and he ran off. Moose returned to lick being alert, another truck passed and the animal fled. A car passed and the animal was alert and looking. Two cars stopped and the moose fled but then stopped and began feeding. Another car stopped and the moose was alert. A fourth and fifth car stopped and the moose was feeding. A car passed and the ;moose was alert. A truck passed and the moose fled to back of lick. Moose was at back of lick and looking and alert. Four visitors entered blind. The moose was alert a car passed and honked and the moose fled. After five minutes moose returned to lick and was feeding. Observation ended due to darkness.

Date: July 13, 1997
Weather: Clear
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time:no
Sex:
Observation Period: 1800-1930
No observations recorded

Date: July 16, 1997
Weather: Partly Cloudy
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time:no
Sex:
Observation Period: 1730-2000
No observations recorded

Date: July 20, 1997
Weather: Partly Cloudy

Moose Present At Beginning of Observation Time: yes
Moose Present At End of Observation Time:no
Sex: Female
Two calves

Observation: 1805-1915

Female and two calves, looking and alert, there are four visitors in the blind and they are talking. Moose are feeding. A car passed and a car stopped and the are alert and feeing. The moose are at the back of the lick. The visitors are talking loud, they moose are moving. Two additional visitors join the others in the blind. The female is standing at the back of the lick with the calves moving around. Visitors are talking and they moose are moving and fleeing.

Date: July 23 1997
Weather: Partly Cloudy
Moose Present At Beginning of Observation Time: yes
Moose Present At End of Observation Time:no
Sex: Female

Observation Time:2012-2023

The moose is feeding, there are four visitors in the blind, talking. The moose is moving. She is alert as a car passes and visitors are talking. She is feeding as a car stops at side of road. She continues to feed. Another car stops and she flees. Ran behind the blind, is not visible but you can still hear her talking and moving. The visitors are talking loudly. She does not reappear.

Date: May 30, 1998
Weather: Sunny
Moose present at Beginning of Observation Time: yes
Moose Present At End of Observation Time: no
Sex:Male
Observation Time: 1425-1600

Moose was present at beginning of observation period. A car passed and then three car stopped, the moose was feeding, it became alert and moved and then fled into the woods. Came back to feed, a truck passed and then fled. Moose came back. A car beeped horn when passing, moose jumped up and turned around- was alert. Moose was looking became alert when a car stopped and kids whistled. Moose was feeding, another car stopped became alert and was moving. Walked into back of lick. Cars left and moose went back into lick and was feeding. A car passed and the moose became alert, went back to feeding. A car stopped, back up and a lady was yelling moosy, a man revs the car and moose fled a away. The moose was feeding, looked at the cars and then continued to feed. Two cars stopped, the car backed right up to moose and the moose ran away into the woods. The moose looked at the cars from the woods.

Four cars had stopped and the moose fled into the woods. The cars left and the moose came back, looking around. Moose moved back into the lick to feed. A truck passed and beeped its horn, the moose was alert and spun around quickly. Two cars passed and then backed up. A person got out of the car and the moose moved back further in to the lick. Moose moved back to feed after cars left. Paper fell out of blind, was retrieved by observer, the moose watched and then continued feeding. The moose continued to feed as two cars passed very fast. The moose stopped feeding and crossed the road, a car came and it ran in front of blind. Moved out of sight.

Date: May 30, 1998
Weather: Partly Cloudy
Moose Present At Beginning of Observation Time: yes
Moose Present At End of Observation Time:no
Sex: Male

Observation period: 1950-2010

Moose was entering lick, truck passed and scared it away. Moose entered lick, was alert and looking at observers in the blind. Moose fed, Two cars passed and the moose was alert and moving. Moose is feeding at farthest point from the blind. Two cars passed and fled. Came back into lick but was alert. Heard car in distance and was alert, moving and fleeing.

Date: June 6, 1998
Weather: Drizzle
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time:no
Sex: Male

Observation period: 1855-1955

The moose was entering lick near the blind, saw observer and ran away Moose entered lick 25 minutes later, a car stopped and it fled into clear cut. Car stopped and kid was yelling out the window, moose ran off. A different male moose entered lick 23 minutes later was alert when a car passed. Looking and alert as three different car passed. Moved into the lick but was alert. Began to feed. The moose became alert as a car passed. A car was slowing down and two stopped, moose was alert, moving and fleeing. Tried to re enter lick, but another car stopped and fled. Two cars stopped and moose ran into deep woods.

Date: June 11, 1998
Weather: Sunny
Moose Present At Beginning of Observation Time: yes
Moose Present At End of Observation Time:no
Sex: male

Observation Time 1925-1941

Moose enters lick. Car beeps horn and moose is alert and moving. Moose is feeding, moose is alert as car is passing. Car passes fast and quietly, moose just looking up. Moose is feeding. Moose hears car in distance, becomes alert, but is still feeding. Car passes and he is alert. Moose continues to feeding, but is moving around. Moose looks at blind and goes back to feeding. Moose hears the truck and car coming, is alert and flees into woods. Moose in the woods is alert, moose flees deeper into woods.

Date: June 11, 1998
Weather: Clear
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time:no
Sex: unknown

Observation period 1900-2044

Moose enters lick and is feeding in back of lick. Moose is alert, moose is alert and fleeing as car passes. Moose left.

Date: June 12, 1998
Weather: Cloudy
Moose Present At Beginning of Observation Time: yes
Moose Present At End of Observation Time:no
Sex: Male

Observation Period: 1900-2100
Moose entered lick is feeding and then becomes alert as car passes. Feeding and alert as two more car passes. Moose is feeding in furthest part of lick. Moose is feeding, becomes alert when car passes and stopped. Continued feeding and moved further into lick and looked until car left. Moose was still alert. Car came up slowly and moose fled into the woods. The car stopped within twenty feet of the moose. Watched the car drive away, and stood alert as car passed by, was back into the woods. Moose feeding in grassy area behind lick. Became alert when heart truck. Moved off into the woods.

Date: June 13, 1998
Weather: Rain
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time Block:no
Sex: Female

Observation Period: 0830-1000

Moose was feeding, crossed road when car stopped. Feeding in the lick. Moose heard car, moose ran out in front of car, car stopped.

Moose tried to go back into lick but another car passed and she fled. Car stopped and truck passed and she fled further into the words. Nine minutes later moose entered lick again, very alert, ran across the road,in front of car as car and truck were passing.

Date: June 18, 1998
Weather: Sunny
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time:no
Sex: Male

Observation Period: 1030-1200

Moose enters lick in far back corner. Moose is feeding, lifts up head and becomes alert when car passes. Goes back to feeding, but becomes alert when truck passes. Feeding and didn't look when two cars passed, Moose is feeing and moves ears while feeding. Car based by fast and he continued to feed. Became alert when another car passed. Fed when two cars went by. Became alert when truck passed. Went back to feeding, didn't become alert as three cars passed. Became alert when two more cars passed. Continued feeding and sniffed the air, was alert. Moose was alert as truck passed and then moved across the road and left the lick.

Date: June 18, 1998
Weather: Partly Cloudy
Moose Present At Beginning of Observation Time: yes
Moose Present At End of Observation Time:no
Sex: Male (three)

Observation Period: 1909-2001

Moose entered lick, feeding in back corner. Appears to be same moose as earlier in the day. Feeding but is alert when car passes. Looks at observer in the blind and is alert. Continues to feed, alert as two car pass. Another car pass and is alert, continues to feed, Is alert when two cars pass and truck pass. Alert while another truck passes. Continues to feed is alert when car passes, two move car passes and is alert. Car drives slowly by within 20 feet of moose and moose is alert. Two people enter blind and moose is alert. Moose is feeding, moose hears truck and is alert, moose feeds but doesn't look up as truck passes. Car passes and is alert, continues to feed, but becomes alert as car passes. Car sops and is alert. The moose continues to feed again after the car stopped. Visitors left and were talking moose is alert. A second moose enters, both moose are alert. Moose are feeding, become alert when car stops, person whistles, both moose flee into the woods Moose are in the woods alert. A third moose is entering the lick, they are all males, They are all alert as a truck passes. Moose continue to feed, Two are feeding and one is alert. A car passes, two are alert, one is feeding. A truck passes and two flee. Other is alert. Two are feeding as a car passes. Two car passes with two in the lick and one in the woods. They are all alert. Ten motorcycles rev up and stop. All moose flee.

Date: June 21, 1998
Weather:Sunny
Moose Present At Beginning of Observation Time: yes
Moose Present At End of Observation Time:no
Sex: Male

Observation Period: 1957-2004

Huge moose is in the woods next to blind. Crosses the road and goes into lick. Two cars pass and he flees.

Date: June 26,1998
Weather: Cloudy
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time:no
Sex:

Observation Period: 1830-2020

No observations recorded. Man is out side of car on side of road and is talking loudly.

Date: July 4, 1998
Weather: Rainy
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time:no
Sex:

Observation Period: 1930-2030

No observations recorded. Two people stop on the road and ask is the observe has seen any moose.

Date: July 7, 1998
Weather: Cloudy
Moose Present At Beginning of Observation Time: yes
Moose Present At End of Observation Time:no
Sex: unknown

Observation Period 0900-1100

Moose is trying to enter a lick. Car stopped, lady gets out and tries to take picture, three more cars stop and moose flees by running off into woods.

Date: July 9, 1998
Weather:Cloudy
Moose Present At Beginning of Observation Time: yes
Moose Present At End of Observation Time:yes
Sex: Female

Observation Time Period: 1900-2100

Moose enters lick. Car stopped and moose is alert. Person gets out to take picture, moose flees into woods. Moose stops and looks at person. Moos is alert in woods after car leaves. Car passes and is alert. Two visitors enter the blind, moose is alert looking at blind. Continues to look at blind from the woods. Moose is alert as two visitors are talking. Two more visitors enter the blind and are loud, moose flees. Moose returns 17 minutes later and tries to enter lick. There are five people in the blind. Starts to feed. Car stopped about 100 feet up road, moose is feeding and alert. Another car stops and moose is alert and feeding. Car passes and moose flees into the woods. Moose reenters the lick. Another moose enters the lick, two cars stop. A third car stops. Female moose is making noise toward second smaller female. Moose are alert and fled. Larger female flees, too dark to see.

Date: July 10, 1998
Weather:Cloudy
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time:no
Sex:

No observations recorded

Date: July 11, 1998
Weather: Cloudy
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time:no
Sex: Female with calf

Two visitors in the blind, moose enters with calf. Car passes, moose is alert, truck passes and car stops and flees into woods with young. 15 minutes later cow and calf trying to reenter lick when car stops and they flee into the woods again.

Date: July 17, 1998
Weather: Sunny
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time:no
Sex: Male

Observation Period: 1400-1530

Moose tried to enter lick. Moose in the road, almost hit by car as car skids to a halt. Moose tries to cross road again and car has to come to fast halt. In the buffer strip by blind. Moose finally is in the lick , but as more cars stopped, flees.

Date: July 17, 1998
Weather: Cloudy
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time:no
Sex: Male

Observation Period: 1430-1600

Moose is in far side of lick feeding. Feeding, but looks and comes alert as car passes. Car stops and person gets out, the animal flees. Reentered the far corner of the lick 25 minutes later, as a truck passes, becomes alert. Is feeding, but is alert when car and truck pass. Two cars pass and animal is alert and feeding. And looking. This continues of five minutes. MA car stops and three people get out, the moose flees.

Date: July 17, 1998
Weather: Cloudy
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time Block:no
Sex: Male

Observation Period: 1900-2100

The same moose as earlier, runs across in front of car and is in woods behind lick. The moose feeds and becomes looking and alert when car passes. The moose continues to feed. Moose becomes looking, alert and moose as car passes. The moose is feeding but as another car passes is looking and alert. A car stops and the moose is looking, alert, moving and flees into the woods. Moose is in the woods, looks and is alert before fleeing further into woods. At 2025 a female in woods waiting to enter lick. There are ten people in the blind, that are talking loudly. The moose is looking and alert. Visitors continue to be loud and moose flees.

Date: July 18, 1998
Weather Cloudy
Moose Present At Beginning of Observation Time: yes
Moose Present At End of Observation Time:no
Sex: Male

Observation Period: 1000-1130

Moose is feeding, looking, alert and moving as a car passes and car stops. The moose continues to feed and look and alert and move as two more car stops and human is out of car. Moose continues to feed although he is looking at human. Moose is feeding, looking and alert as two more cars stop and two cars pass. A truck passes and the moose flees. Moose returns and feeds, is looking and alert as car passes. The moose is feeing, looking, alert and moving as two cars stop. The Moose is looking and moving as one car is stopping. The car move and two more cars pass and the moose is still feeing, looking and alert. A car starts up and the moose is alert. A motorcycle passes and the moose is alert. The motorcycle stops and trucks beep horn as moose runs across the road and flees.

Date: July 18, 1998
Weather: Sunny
Moose Present at beginning of Observation Time: yes
Moose Present at End of Observation Time: no
Sex Male

Observation Period: 1530-1730

Moose enters lick from across the road. Moose is feeding, Moose is feeding, looking and alert as car stops and then leaves. A car passes but moose continue to feed look and be alert. A car passes and a guy yells, moose is alert. Four cars pass but moose is continuing to feed, look and be alert. Moose continues to feed as car stopped. Moose is again feeding, looking an alert as car passes, two cars stop and human is out taking a picture. Third car stops, motorcycle passes. The moose continues to feed, look, alert and move. Seven people are out of car but continues to feed. Continues to feed as seven cars are stopped and 11 people are out of car. Some are as close as eight feet and continues to feed as eight cars are stopped and thirteen people are out of car. Continues to feed as some cars move away. A visitor is within seven feet, moose is feeding, looking, alert and moving. Visitor within six feet and the moose is feeding, looking and alert. Another car stops now four are stopped and the moose continues to feed. Six cars are stopped and continues to feed, One car starts engine and moose is alert and moving. Three cars move and the moose flees.

Date: July 18, 1998
Weather: Cloudy
Moose Present At Beginning of Observation Time: yes
Moose Present At End of Observation Time:no
Sex: Male

Observation Period: 1930-2000

Male moose enters lick and is feeding. After ten minutes still continuing to feed, but three cars stop and one human is out of car. Still continues to feed. Truck passes, moose is alert, moving and fleeing.

Date: June 8, 1999
Weather: Clear
Moose Present At Beginning of Observation Time: yes
Moose Present At End of Observation Time:no

Observation Period: 1911-1933

Female moose in lick and is feeding, visitor walks to the blind. Moose continues to feed until truck passes, flees into woods behind lick. Moose reenters lick, but is looking, continues to feed. Moose feeding and looking, and alert. Visitor is talking loud, moose is looking. Moose continues to feed , crosses road and leaves lick.

Date: June 9, 1999
Weather: Clear
Moose Present at Beginning of Observation: no
Moose Present at end of Observation: no

Observation Period: 1830-2100

No observation recorded

Date: June 10, 1999
Weather: Clear
Moose Present At Beginning of Observation Time: yes
Moose Present At End of Observation Time: no
Sex: Female

Observation Period: 1830-2100

Three viewer present, as truck and car passed, moose fled to woods. Visitors were talking loudly and the moose looked. Moose crossed road, when visitors were talking quietly and walked by blind on moose trail into woods. Moose was present 22 minutes.

Date: June 11, 1999
Weather: Clear
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time:
Sex:

Observation Period: 18:30-21:00

No observations recorded

Date: June 14, 1999
Weather: Cloudy

Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time: no
Sex:

Observation Period: 20:30-21:00

No observations recorded

Date: June 17, 1999
Weather: Overcast
Moose Present At Beginning of Observation Time: Yes
Moose Present At End of Observation Time: no
Sex: Male

Observation Period: 2030-2100

One visitor in the blind. Cars stopped and people in the car were making noise, the moose fled. Moose returned and people were standing next to lick. Moose looked was alert and fled. Moose returned fed and looked. Car beeped moose fled.

Date:June 18, 1999
Weather: Clear
Moose Present At Beginning of Observation Time: yes
Moose Present At End of Observation Time: no
Sex: Male (Two)

Observation Period: 1800- 2100

Moose was in the lick, one visitor was in blind. Moose was feeding and moving. A car stopped and a person got out took a picture, moose moved, but did not flee. Moose in the lick was alert and looking into the woods. Another male entered the lick. The first moose butts head with the second. A truck passed and both moose moved. No visitor was present except observer. An owl hooted and both moose walked into the woods.

Date: June 22, 1999
Weather: Thundering/cloudy
Moose Present At Beginning of Observation Time:Yes
Moose Present At End of Observation Time: yes
Sex: Male

Observation Period: 1930-2030

Moose was in the lick looking. It thundered and moose was moving. A car stopped and a person got out and took picture. Moose urinated and then fled lick. Moose returned but was alert as trucks passed and car stopped. Another person got out of car and walked toward the lick. The moose walked toward the person and was alert and moving. Person left. Moose was alert. Three visitors came to blind, became too dark to see, but appeared moose left lick.

Date:June 26, 1999
Weather: clear
Moose Present At Beginning of Observation Time: yes
Moose Present At End of Observation Time: yes
Sex: Male and Female

Observation Period: 2000-2100

A male entered the lick and was moving and looking. A visitor walked down the road towards the moose, the moose was alert and moving. Three cars stopped and two people got out. The moose was standing in the woods behind the lick alert. A male moose came out of woods and walked along road for a short ways. Female was in back of lick. The two became aware of each other and were very alert. For five minutes. The cars left and female left lick. Male re-entered lick. The female re-entered licks, two moose were close together drinking. Motorcycles came by and shined lights, moose moved. It became too dark to observe.

Date: June 24, 1999
Weather: Sprinkles
Moose Present At Beginning of Observation Time: yes
Moose Present At End of Observation Time: no
Sex: male

Observation Period: 1930-2100

Moose was in the lick feeding, looking and moving as there were four people in the blind. Moose continued behavior. One visitor walked out to the road, the moose walked into the woods.

Date:June 25, 1999
Weather: Overcast
Moose Present at Beginning of Observation Time: yes
Moose Present at End of Observation Time: no
Sex: male

Observation Period: 1900-2000

Moose walked into the lick from the woods. There were four people in the blind that were very quiet. Moose generally fed and looked. Moose was alert when car passed. Moose looked when visitors walked away from blind. Moose walked into the woods.

Date: June 27, 1999
Weather: Partly cloudy
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time: no
Sex:

Observation Period: 1915-2115

No observation recorded

Date: June 26, 1999
Weather: Raining
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time: no
Sex:

Observation Period: 2000-2100

No observations recorded

Date:June 29, 1999
Weather: Clear
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time: no
Sex:

Observation Period: 2000-2100

No observations recorded

Date: July 1, 1999
Weather: Cloudy
Moose Present At Beginning of Observation Time: yes
Moose Present At End of Observation Time: no
Moose Gender: Female with calf

Observation Period: 1915-2015

Female with calf is in the lick. Car stopped and she looks. Two visitors enter blind. Truck passed, female and calf fled to back of lick. Moose left.

Date: July 2, 1999
Weather: Clear
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time: no
Sex:

Observation Period: 1830-2100

No Observation

Date:July 4, 1999
Weather: Partly cloudy
Moose Present At Beginning of Observation Time: yes
Moose Present At End of Observation Time: no
Sex: Male

Observation Period: 1915-2100

Young male is feeding in the lick. Looked as a car turned around and stopped. Was alert and moving. Looks when car goes by. Continues feeding, but looks every time a car goes by. Car stops and the moose is alert. Truck passes and moose is alert. There is a loud diesel and the moose flees. The moose returns and continues to feed/ Occasionally flicks flies from ears. Moose continues to feed and look even as car stops. When a car stops and a person gets out of car, moose moves. Moose flees as cars stop. Moose stands at back of lick and is very still. Moose re-enters and continues to feed. Two cars stop and moose leaves. A deer enters the lick. Moose does not return.

Date: July 5, 1999
Weather: Clear
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time: yes
Sex: Female

Observation Period: 1830-2100

Moose enters lick when almost dark is feeding and looking. Car stops and person gets out, the moose is alert. Moose continues to feed, car leaves. Too dark to observe.

Date: July 6, 1999
Weather: Partly cloudy
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time: no
Sex: Female

Observation Period: 1930-2100

Almost dark when the moose enters the lick. Dog is barking in a stopped car, moose is alert. Car leaves and moose feeds. A truck passes and moose is alert and moving. Car stopped and two people get out and take pictures. Moose is looking. Car leaves and moose continues to feed. Moose crosses road and enters woods.

Date: July 7, 1999
Weather: Light Rain
Moose Present At Beginning of Observation Time: yes
Moose Present At End of Observation Time: yes
Sex: Female

Observation Period: 1830-2030

Moose is feeding and looking and moving around lick, there are seven people in the blind. Three cars stop and moose is looking and moving. Three people get out of car and moose moves out of site. Cars leave and visitors leave, moose ere-enters lick and feed. Car beeps horn and moose looks. Too dark to observe.

Date:July 10, 1999
Weather: Raining
Moose Present At Beginning of Observation Time: yes
Moose Present At End of Observation Time: no
Sex: Male and Female

Observation Period: 1830-1930

Moose is in the lick, feeding, moving and looking toward blind. Truck passes and car stopped, moose fled. After ten minutes moose re-enters lick and is feeding. Car stops and horn sounded, moose fled. Moose come back and is feeding. Female enters moose is alert. Female is at back of lick. Cars stop and moose flee.

Date: July 12, 1999
Weather: Clear
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time: no
Sex:

Observation Period: 1900-2100

No observations recorded

Date: July 13, 1999
Weather: clear
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time: no
Sex:

Observation Period: 1930-2100

No observation recorded

Date: July 14, 1999
Weather: Clear
Moose Present At Beginning of Observation Time: yes
Moose Present At End of Observation Time: no
Sex: Male

Observation Period: 1830-2100

Moose is in the lick, feeding and visitors are in the blind. A truck passed, moose is alert goes back to feeding. Moose is feeding and alert. Visitor sneezed and moose is alert. Moose walked into woods behind lick after twenty minutes.
Date: 07/15/99
Weather: hazy
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time: no
Sex:

Observation Period: 1930-2100

No observations recorded

Date: July 19, 1999
Weather: clear
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time: no
Sex:

Observation Period: 19:00-21:00

No observations recorded

Date: July 20, 1999
Weather: clear
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time: no
Sex:

Observation Period: 19:00-21:00

No observations recorded

Date: July 21, 1999
Weather: Clear
Moose Present At Beginning of Observation Time: no

Moose Present At End of Observation Time: no
Sex: Male

Observation Period: 1900-2100

Almost dark and moose entered lick. Fled when car beeped its horn, returned after car left. People got out of car and moose went to back of lick and can't be seen. After 15 minutes when cars left moose returned. More cars stopped and moose fled into woods.

Date: July 23, 1999
Weather: Clear
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time: no
Sex: Female

Observation Period: 1830-2030

Moose entered lick and was feeding. Truck passed and moose moved. Moose fed and looked until a car stopped. Moose looked and moved. Moose left the lick.

Date: July 24, 1999
Weather: Foggy
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time: no
Sex: Female

Observation Period: 1830-2030

Moose entered lick looking. A second female entered the lick, the first one looked. Both were feeding and looking. People were talking in the blind, moose were looking and moving. Moose were feeding and alert when three cars passed. Car honked horn and one moose fled. A car stopped and the remaining moose was looking . More cars stop and moose backs up looking. Cars leave and moose resumes feeding. Another car stops and the moose if feeding and looking. Moose leaves the lick.

Date: July 25, 1999
Weather: Clear
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time: no
Sex: Female and calf

Observation Period: 1830-2030

Calf comes into the lick at almost dark,. Female enter and both are feeding and looking. A car stops and a person gets out. Female is looking and moving. More cars stop, calf moves into woods and female follows.

Date: July 26, 1999
Weather: Cloudy
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time: no
Sex: Female

Observation Period: 1845-2045

Almost dark and female enters the lick. She is alert and feeding. A truck passes she is alert. A car passed and she is alert and moving. Continued to feed. A car stopped and the moose is alert. The moose left when dog was barking in car.

Date: July 27, 1999
Weather: clear
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time: no
Sex: Female, Male

Observation Period: 1900-2100

Moose enters lick to feed. There are four viewers in the blind. Moose is feeding and looking. A car stopped and moose fled. Car moved and a truck passed, the moose fled again. Returned after car had left. And was feeding. A car stopped and the moose fled. Moose returned to feed, people talking loudly in blind and moose fled. Moose did not return.

Thirty minutes later another moose entered the lick. It was feeding. There were nine people in the blind and the male was alert. A female entered the lick. They were both feeding. When a truck passed they were both alert. The female is more alert than the male and flees first when a car stops. She then reenters the lick. Both moose flee when a car stop and a person gets out of the car. Twenty minutes later the male is back in the lick. He is feeding. When a truck passes becomes alert. Continues to feed until a car stops and a dog barks, the moose is alert and moving.

Date: July 28, 1999
Weather: Clear
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time:
Sex:

Observation Period: 1830-2030

No observations recorded

Date: July 29, 1999
Weather: Clear
Moose Present At Beginning of Observation Time: no
Moose Present At End of Observation Time:
Sex:

Observation Period: 1930-2100

No observations recorded

APPENDIX V

BIRD SURVEYS

As part of the study, the presence of birds were surveyed on the control and study site to determine if any changes occurred over the three years of the project.

Literature Review

Cole and Knight (1991) described how recreation could affect species diversity, depending on the severity of recreational disturbance, and the spatial scale and level of the biological hierarchy for which diversity is being described. Skagen et al. (1991) showed that human disturbance resulted in decreased species diversity in an avian scavenging guild.

Songbirds may alter their behavior after repeated interactions with humans (Knight and Cole 1995). Red-winged blackbirds (*Agelaius phoeniceus*), goldfinches(*Carduelis tristis*) and American robins (*Turdus migratorius*) became much more aggressive towards humans who repeatedly visited their nests (Knight and Temple 1986a, 1986b). Nesting red-winged blackbirds also learned to distinguish between people who visited their nests often, and people not seen previously; the blackbirds responded more aggressively to the familiar people (Knight and Temple 1986a)

In experiments conducted by Gutzwiller(1994), the singing behavior of certain songbirds was altered by low levels of human intrusion. Black-billed magpies (*Pica pica*), in response to people climbing to their nests, altered nest placement in subsequent years in an attempt to make nests less accessible to humans (Knight and Fitzner 1985). People who are visiting nests may decrease nest or nestling survivorship, provoke nest abandonment, or discourage renesting (Bart 1977, Major 1990, reviewed by Gotmark 1992). Studies conducted in the Netherlands showed a significant negative correlation between recreation intensities and bird densities for certain species (van der Zande et al. 1984a, 1984b). Beach nesting birds are affected by habitat loss due to recreation, by death, displacement, and reduced reproductive success (Burger 1995). Mathiesen (1968) noted that human disturbance could interfere with food gathering and cause unrest among eagles; Stalmaster and Newman (1978) found that bald eagles (*Haliaeetus leucocephalus*) were most sensitive to human interference while feeding.

Blakesley and Reese (1988) documented differences in avian community composition between campground and non-campground sites in riparian areas. Diversity appeared related to nesting substrate, cover, and foraging substrate changed due to camping activities. Analysis of bird population data collected in Yosemite National Park appears to indicate that camping activities enhanced the diversity of the bird populations found there, however, most of the differences could be attributed to large increases in a few species especially Brewer's blackbird (*Euphagus cyanocephalus*) and the mountain chickadee (*Parus gambeli*) (Foin et al. 1977).

Methods

Two transect lines one 200 meters long and the other 300 meters long will be established on the study site and the control site. Birds occurring within 25 meters on either side of the transect line will be counted (Figure 2 and 3). All male birds singing or sighted birds regardless of sex within the confines of the transects will be recorded. Each transect will be walked a minimum of 8 times annually within 3 hours of sunrise during June and early July (Foin et al. 1977 Conner and Dickson 1980). Census maps will be created denoting where birds sang.

Table 15. Bird species present on transect one of Dixville Notch Wildlife Viewing Area study site June 1996-1998.

American Robin *Turdus migratorius*
Golden Crowned Kinglet *Regulus satrapa*
Black and White Warbler *Miniotilta varia*
Dark-eyed Junco *Junco hyemalis*
Magnolia Warbler *Dendroica magnolia*
Winter Wren *Troglodytes troglodytes*
Northern Parula *Parula americana*
Black-throated Green *Dendroica virens*
Cedar Waxwing *Bombycilla cedrorum*
White-throated Sparrow *Zonotrichia albicoliis*
Hermit Thrush *Catharus guttatus*
Ruby-throated Hummingbird *Archilochus colubris*
Swainson's Thrush *Catharus ustulatus*
Brown Creeper *Certhia americana*
Red-eyed Vireo *Vireo olivaceus*
Red-breasted Nuthatch *Sitta candensis*
Black-capped Chickadee *Parus atricapillus*
Solitary Vireo *Vireo solitarius*
Ruffed Grouse *Bonasa umbellus*
Blackburnian Warbler *Dendroica fusca*
Canada Warbler *Wilsonia canadensis*
Black-throated Blue Warbler *Dendroica caerulescens*
Nashville Warbler *Vermivora ruficapilla*
Common yellowthroat *Geothlypis trichas*
Chestnut-sided Warbler *Dendorica pensylvanica*
Northern Saw Whet Owl *Aegolius acadicus*
American Woodcock *Scolopax minor*
Hairy Woodpecker *Picoides villosus*
Wood Thrush *Hylocicha mustelina*
Purple Finch *Carpodacus purpueus*
American Crow *Corvus brachyrhynchos*
Red-winged Blackbird *Agelalius phoeniceus*
Myrtle (yellow-rumped)Warbler *Dendroica coronata*
Evening Grosbeak *Coccothraustes vespertinus*

Table 16. Bird species present on transect two of Dixville Notch Wildlife Viewing Area study site June 1996-1998.

American Robin *Turdus migratorius*
Winter Wren *Troglodytes troglodytes*
Northern Parula *Parula americana*
Golden-crowned Kinglet *Regulus satrapa*
Common Yellowthroat *Geothlypis trichas*
White-throated sparrow *Zonotrichia albicollis*
Dark-eyed Junco *Junco hyemalis*
Chestnut-sided Warbler *Dendorica pensylvanica*
Swainson's Thrush *Catharus ustulatus*
Mourning Warbler *Oporornis philadelphia*
Cedar Waxwing *Bombycilla cedrorum*
Nashville Warbler *Vermivora ruficapilla*
Black and White Warbler *Miniotilta varia*
Red-winged Blackbird *Agelalius phoeniceus*
American Redstart *Setophaga ruticilla*
Black-throated Green Warbler *Dendroica virens*
Alder Flycatcher *Empidonax alnorum*
Rose Breasted Grosbeak *Pheucticus ludovicianus*
Black -capped Chickadee *Parus atricapillus*
American Woodcock *Scolopax minor*
Pileated Woodpecker *Dryocopus pileatus*
Blackburnian Warbler *Dendroica fusca*
Myrtle (yellow-rumped) Warbler *Dendroica coronata*
Purple Finch *Carpodacus purpueus*
Hairy Woodpecker *Picoides villosus*
Solitary Vireo *Vireo solitarius*
Wood Thrush *Hylocicha mustelina*
Spruce Grouse *Denddragapus canadenis*
Magnolia Warbler *Dendroica magnolia*
Blue Jay *Cyanociita cristata*
Brown Creeper *Certhia americana*
Red-eyed Vireo *Vireo olivaceus*

Table 17. Bird species present on transect three of Dixville Notch Wildlife Viewing Area control site June 1996-1998.

Common Yellowthroat *Geothlypis trichas*
American Redstart *Setophaga ruticilla*
Chestnut-sided Warbler *Dendorica pensylvanica*
Northern Parula *Parula americana*
White-throated Sparrow *Zonotrichia albicoliis*
Hairy Woodpecker *Picoides villosus*
Myrtle (Yellow rumped) Warbler
Winter Wren *Troglodytes troglodytes*
Red Breasted Nuthatch *Sitta candensis*
Wood Thrush *Hylocichla mustelina*
American Robin *Turdus migratorius*
Solitary Vireo *Vireo solitarius*
Mourning Warbler *Oporonis philadelphia*
Olive-sided Flycathcer *Contopus borealis*
Canada Warbler *Wilsonia canadensis*
Black-throated Blue Warbler *Dendroica caerulescens*
Blackburnian Warbler *Dendroica fusca*
Brown Creeper *Certhia americana*
Magnolia Warble *Dendroica magnolia*
Black and White Warbler *Miniotilta varia*
Golden-crowned Kinglet *Regulus satrapa*
Northern Waterthrush *Seiurus noveboracensis*
Purple Finch *Carpodacus purpueus*

Table 18. Bird species present on transect four of Dixville Notch Wildlife Viewing Area control site June 1996-1998.

White-throated Sparrow	*Zonotrichia albicoliis*
Common Yellowthroat	*Geothlypis trichas*
Winter Wren	*Troglodytes troglodytes*
American Robin	*Turdus migratorius*
Magnolia Warbler	*Dendroica magnolia*
Chestnut-sided Warbler	*Dendorica pensyivanica*
Cedar WaxWing	*Bombycilla cedrorum*
Canada Warbler	*Wilsonia canadensis*
American Redstart	*Setophaga ruticilla*
Golden-crowned Kinglet	*Regulus satrapa*
Purple Finch	*Carpodacus purpueus*
Black-capped Chickadee	*Parus atricapillus*
Song Sparrow	*Melospiza melodia*
Black and White Warbler	*Miniotilta varia*
Dark-eyed Junco	*Junco hyemalis*
Solitary Vireo	*Vireo solitarius*
American Crow	*Corvus brachyrhynchos*

Literature Cited

Bart, J. (1977). Impact of human visitation on avian nesting success. Living Bird 16:187-192.

Blakesley, J.A. and K.P.Reese. (1988). Avian use of campground and noncampground sites in riparian zones. Journal of Wildlife Management 52(3):399-402.

Burger, J. (1995). Beach recreation and nesting birds. Wildlife and Recreationist Coexistence through Management and Research. R.L. Knight and K.J. Gutzwiller (eds.) Island Press, Washington D.C.

Cole, D.N., and R.L. Knight. (1991). Wildlife preservation and recreational use: conflicting goals of wildland management. Transactions of 56th North American Wildlife and Natural Resources Conference 56:233-237.

Connor, R.N., and J.G. Dickson. (1980). Strip transect sampling and analysis for avian habitat studies. Wildlife Society Bulletin 8(1):4-10.

Foin, T.C. , E.O. Garton, C.W. Bowen, J. M. Everingham, and R.O. Schultz. (1977). Quantitative studies of visitor impacts on environments of Yosemite National Park, California, and their implications for park management policy. Journal of Environmental Management 5:1-22.

Gotmark, F.(1992). The effects of investigator disturbance on nesting birds, Current Ornithology, R.F. Johnson, ed. Plenum Press, NY Vol. 9: 63-104

Gutzwiller, K.J. (1994). Effects of intrusion and singing behavior. Auk 111:29-37.

Knight, R.L. and D.N.Cole. (1995). Wildlife responses to recreationists. Wildlife and Recreationists: Coexistence Through Management and Research. R.L. Knight and K.J. Gutzwiller (eds.), Island Press, Washington D.C.

______ and R.E.Fitzner. (1983). Human disturbance and nest site placement in black-billed magpies. Journal of Field Ornithology 56(2):153-157.
Knight, R.L. and S.A.Temple. (1986a). Why does intensity of avian nest defense increase during the nesting cycle. Auk 103:318:327.

______and S.A. Temple. (1986b). Nest defence in the American goldfinch. Animal Behavior 34:887-897.

Major, R.E. (1990). The effect of human observers on the intensity of nest predation. Ibis 132:608-612.

Mathieson, F.E. (1968). Effects of human disturbance on nesting of bald eagles. Journal of Wildlife Management 32(1):1-6.

Skagen, S.K., R.L. Knight and G.H. Orians.(1991). Human disturbance of an avian scavenger guild. Ecological Applications 1(2):21-225.

Stalmaster, M.V. And J. R. Newman. (1978). Behavioral responses of wintering eagles to human activity. Journal of Wildlife Management 42(3):506-513.

van der Zande, A.N., J.C.Berhuizen, H.C. van Latesteijn, W.J. Ter Keurs and A.J. Poppelaars. (1984a). Impact of outdoor recreation on the density of a number of breeding bird species in woods adjacent to urban residential areas. Biological Conservation 30:1-39.

_______ and P.Vos. (1984b). Impact of a semi-experimental increase in recreation intensity on the densities of birds in groves and hedges on a lake shore in the Netherlands. Biological Conservation 30:237-259.

APPENDIX VI

SMALL MAMMAL AND REPTILE AND AMPHIBIAN SURVEYS

As part of the overall study, presence of vertebrate wildlife inhabiting the wildlife viewing site and proximate habitat during pre-and post-construction was determined. The specific objectives for small mammals and reptile and amphibians were:

1. to determine the small mammal species present on the control and viewing site during pre-and post-construction.

2. To determine the amphibians and reptiles present on the control and viewing site during pre-and post construction.

Small and Medium Mammal Survey Methods

Live trapping was conducted to collect information on species presence on the viewing site and on the control site. Each site was trapped twice for five days during June-July 1996-1998 around the new moon when it was not raining. Pitfall traps with drift nets and Sherman box traps were utilized (Yamasaki 1996). A configuration of fifteen, 5 gallon and one gallon buckets were used in four locations. A drift fence connected and bisected each of the buckets. In addition fifteen Sherman box traps were used along side the drift fence and pitfalls (Fig. 18).

The procedure for trapping included monitoring the traps three times daily at 0600, 1200 and 1800h to reduce incidental mortality (Cooperider et al. 1986).Traps had bedding and seeds. This method allowed for sampling of nocturnal, crepuscular and diurnal species.

Soot pans and scent posts will be placed at the viewing and control site (Cooperider et al. 1986). Three soot pans, squares of aluminum coated with charcoal, will be placed at different locations on each site for a period of five days. A scent of rotten eggs will be used as the attractant. The results from this method, the photographs from the trail monitors, and scat will indicate presence of medium to large mammal species.

Amphibian and Reptile Methods

The pitfall traps utilized for the small mammal surveys were also used to survey amphibian presence. A drift fence will be established within 50 meters and parallel to a pool with known amphibian activity. Fifteen pitfall traps will be buried in the ground bisected by the drift fence (Fig. 18) allowing for capture of amphibians traveling from either side of the fence (Heyer et al. 1994). These pitfalls will be monitored on the same schedule as those for small mammals. Presence or absence of amphibian and reptile species will be determined.

Results

Even though every effort was made to find a control site similar to the study site, the control site had been cut one year after the study site. The vegetation of the control site differed slightly which may have accounted for a difference in numbers of species found on the study site versus the control

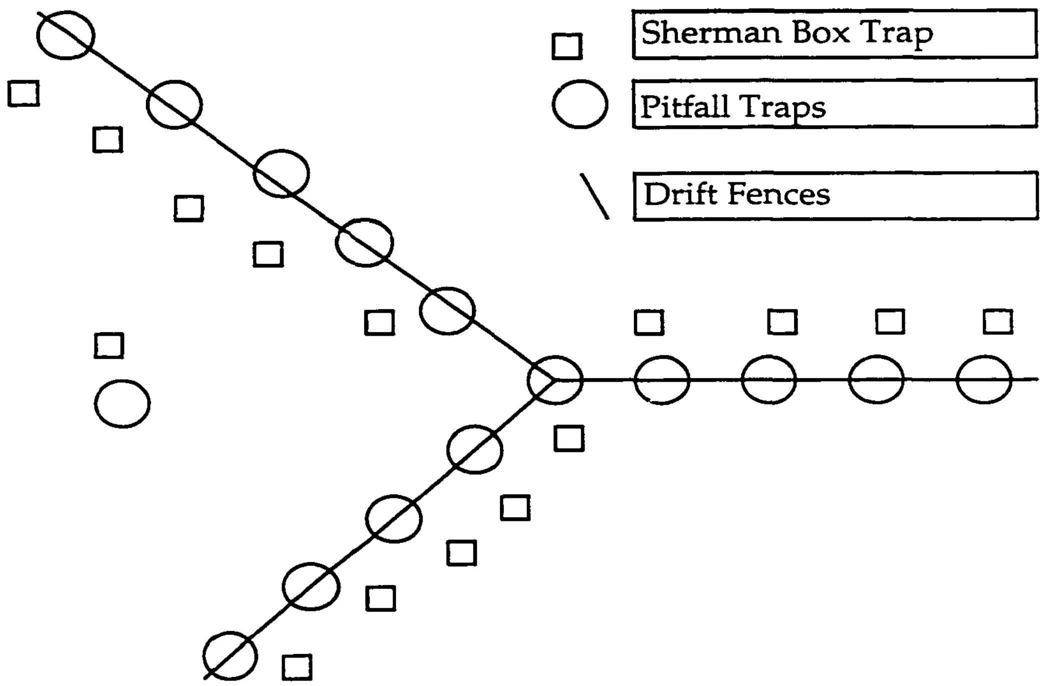

Figure 18. Layout of small mammal and reptile and amphibian transects on viewing and control site in Dixville Notch, NH during summers 1996-1998

site (Table 19) even in year one. It should also be noted that bear disturbance of sherman traps occurred several times on transect 3.

Four species of mammals accounted for 86% of all the individual mammals caught. Two species of amphibians accounted for 75% of all the individual amphibians and reptiles caught (Table 20).

The soot pans yielded only one result in the three year time period.

Table 19. Numbers of Amphibians, Reptiles and Small Mammals by year and transect on viewing (study) and control site in Dixville Notch during summers 1996-1998

Transect	Transect Type	Year	NIS	NIA	NSS	NSA
1	Viewing	1	19	3	5	1
1	Viewing	2	116	0	9	0
1	Viewing	3	47	0	6	0
2	Viewing	1	24	6	6	2
2	Viewing	2	0	8	0	3
2	Viewing	3	0	1	0	1
3	Control	1	25	0	4	0
3	Control	2	30	0	7	0
3	Control	3	25	0	3	0
4	Control	1	8	0	3	0
4	Control	2	0	2	0	1
4	Control	3	0	2	0	2

NIS= Number of individuals -small mammals
NIA= Number of individuals-reptiles and amphibians
NSS= Number of species of small mammals
NSA= Number of species of reptiles and amphibians

Table 20. Actual species present on viewing and control site in Dixville Notch during summers 1996-1998.

Species	Frequency	Present	Present
Reptiles		Viewing	Control
Brown Snake *Storeia d. dekayi*	4	x	
Garter Snake *Thamnophia s. sirtalis*	2	x	
Amphibians			
Wood Frog *Rana sylvatica*	7	x	x
American Toad *Bufo a. ammericanus*	8	x	x
Spotted Salamander *Ambystoma maculatum*	1		x
Mammals			
Chipmunk *Tamias stratus*	36	x	x
Deer Mouse *Peromyscus maniculata*	13	x	x
Masked Shrew *Sorex cinereus*	90	x	x
Meadow Jumping Mouse *Zapus hudsonius*	97	x	x
Meadow Vole *Microtus pennsylvanicus*	12	x	x
Raccoon *Proyon lotor*	1	x	
Red-Backed Vole *Clethrionomys gapperi*	4	x	
Red Squirrel *Tamiasciurus hudsonicus*	1	x	
Short-tailed Shrew *Blarina brevicauda*	9	x	x
Smokey Shrew *Sorex funeus*	29	x	x
Star-nosed Mole *Condylura cristata*	1		x
Woodland Jumping Mouse *Zapus insugnis*	1	x	

Literature Cited

Cooperider, A.Y. , R.J. Boyd and H.R. Stuart (eds.).(1986). Inventory and monitoring of wildlife habitat. US Department of Interior, Bureau of Land Management. Service Center. Denver, Co.

Heyer, W.R., M.A. Donnelly, R.W. McDiarmid, L.C. Hayek and M.S. Foster. (1994). Measuring and monitoring biological diversity: standard methods for amphibians. Washington,D.C., Smithsonian Institution Press.

Yamasaki, Mariko. (1996). Personal Correspondence.

APPENDIX VII

UNIVERSITY APPROVALS

UNIVERSITY OF NEW HAMPSHIRE

Office of Sponsored Research
111 Service Building
51 College Road
Durham, New Hampshire 03824-3585

(603) 862-2000 Proposals & Awards
(603) 862-3716 Accounting
(603) 862-3750 Director
(603) 862-3564 Fax

May 21, 1996

Ms. Judith Silverberg
c/o Peter Pekins
Wildlife Program
Pettee Hall

Approval Date: May 21, 1996 **ACUC Protocol #:** 960406

Dear Ms. Silverberg:

The Animal Care and Use Committee has reviewed and approved the protocol submitted for the study "Impact of the Development of a Wildlife Viewing Site on the Vertebrate Wildlife" under Category 3 on Page 3 of the "Application for Review of Animal Use or Instruction Protocol" - the research involves chronic maintenance of animals with a disease/functional deficit and/or procedures potentially inducing moderate pain, discomfort or distress which will be treated with appropriate anesthetics/analgesics.

Note: All cage, pen or other animal identification records must include your ACUC Protocol # as listed above.

This approval is contingent upon the following:

- Will food and water be available to the animals? They should be.
- The ACUC may request copies of observation logs and trap-checking logs. Traps should be checked three times daily.
- Are there new methods of ear-tagging? Investigator needs to indicate. Also, investigator must provide the ARO's Van Gould a sample of the ear tag that will be used in this study.
- PI and affiliated staff must contact the Occupational Health Program at Health services for appropriate health care and screening (see below), especially in regard to Rabies, Lyme Disease, etc.

Please note: All approvals are issued contingent upon participation in the UNH Health Services Occupational Health Program for Animal Users and Caretakers. Participation is required for all principal investigators and their project-affiliated personnel, employees of the University and students alike. Project-related health services are provided at no cost to the employee or student. To set up appointments with Health Services, please call 862-1579.

Sincerely,

Robert G. Mair, Ph.D.
Chairperson
Animal Care and Use Committee

RGM: ke

FILE

UNIVERSITY OF NEW HAMPSHIRE

Office of Sponsored Research
Service Building
51 College Road
Durham, New Hampshire 03824-3585
(603) 862-3564 FAX

LAST NAME	Silverberg	FIRST NAME	Judith
DEPT	Resource Economics and Development	APP'L DATE	1/14/99
OFF-CAMPUS ADDRESS (If applicable)	29 Albin Road Bow, NH 03304	IRB #	2094
		REVIEW LEVEL	EXE
PROJECT TITLE	Public Experiences and Impacts of Wildlife Viewing		

The Institutional Review Board for the Protection of Human Subjects in Research has reviewed the protocol for your project as Exempt as described in Federal Regulations 45 CFR 46, Subsection 46.101 (b) (2), category 2.

Approval is granted to conduct the project as described in your protocol. Changes in your protocol must be submitted to the IRB for review and approval prior to their implementation.

The protection of human subjects in your study is an ongoing process for which you hold primary responsibility. In receiving IRB approval for your protocol, you agree to conduct the project in accordance with the ethical principles and guidelines for the protection of human subjects in research, as described in the Belmont Report. The full text of the Belmont Report is available on the OSR information server at http://www.unh.edu/osr/compliance/belmont.html and by request from the Office of Sponsored Research.

There is no obligation for you to provide a report to the IRB upon project completion unless you experience any unusual or unanticipated results with regard to the participation of human subjects. Please report such events to this office promptly as they occur.

If you have questions or concerns about your project or this approval, please feel free to contact me directly at 862-2003. Please refer to the IRB # above in all correspondence related to this project. The IRB wishes you success with your research.

For the IRB,

Kara L. Eddy
Regulatory Compliance Officer
Office of Sponsored Research

cc: File

Rob Robertson, Resource Econ - James