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Assessing the Effects of a Selective Harvest System on Moose Hunters' Behaviors, Beliefs, and Satisfaction

DAVID C. FULTON

USGS, Minnesota Cooperative Fish and Wildlife Research Unit
University of Minnesota
St. Paul, Minnesota, USA

KRIS HUNDERTMARK*

Alaska Department of Fish and Game
Kenai Moose Research Center Soldotna, Alaska, USA

Selective harvest systems (SHS) have been developed by several state and provincial wildlife management agencies to prevent the over harvest of bull moose (Alces alces). Although these regulations potentially achieve biological objectives for the targeted moose population, wildlife managers and decision makers recognize that such hunting regulations can also affect hunter attitudes and behaviors. The social psychological impacts of a SHS for bull moose in south-central Alaska on resident moose hunters were examined. Results indicated a majority of hunters supported the SHS and had positive evaluations of its effects for both moose and moose hunters. In addition, beliefs about the outcomes of the SHS and attitudes toward the SHS were strong predictors of whether or not hunters were satisfied with their most recent moose hunt. A minority of hunters believed that the SHS would lead to negative outcomes and were responsible for lowering hunting satisfaction. Information on specific beliefs that lead to negative evaluations of the SHS, used in tandem with biological information about the objective

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*Present address: Zoological Society of London, King Khalid Wildlife Research Centre, P. O. Box 61681, Riyadh 11575, Saudi Arabia.

Address correspondence to David C. Fulton, US6S, Minnesota Cooperative Fish and Wildlife Research Unit, University of Minnesota, 1980 Folwell Ave., St. Paul, MN 55014, USA. E-mail: dcf@fw.umn.edu

impacts of the SHS on moose, can help to address the concerns of those hunters who do not support the SHS.

Keywords *moose, hunter satisfaction, selective harvest system, hunting regulations, attitudes*

Introduction

Moose (*Alces alces*) have long been essential to people living in Alaska (Reeves & McCabe, 1997; Regelin & Franzmann, 1998), and many residents of Alaska still depend on moose for income and meat. Each year residents and nonresidents spend more than \$30 million on goods and services related to moose hunting (Regelin & Franzmann, 1998). Millions more are spent in activities and trips to view moose (Miller & McCollum, 1997). Moose, however, are a limited resource and with Alaska's population and demand for moose increasing, the impacts on the moose population are more evident. For these reasons, moose management, including decisions about moose hunting seasons, is of utmost importance in Alaska (Crichton, Regelin, Franzmann, & Schwartz, 1997).

The Alaska Department of Fish and Game (ADF&G) and the Alaska Board of Game, concerned about the moose populations, instituted a selective harvest system (SHS) on the Kenai Peninsula in 1987. The SHS limited harvest to spike-fork (yearling) bulls, bulls with antlers ≥ 127 cm (50 inches), and/or bulls with 3 or more brow tines on at least one side. The Kenai Peninsula SHS was determined to be biologically effective (Schwartz, Hundertmark, & Spraker, 1992), and subsequently was adopted in 1993 for other road-accessible game management units in ADF&G's south-central region. The objectives of the SHS were to: (1) increase the bull:cow ratio, (2) increase the number of prime bulls in the population, (3) maintain hunting opportunity, (4) promote hunter ethics, and (5) increase the opportunity to view bull moose. Although biological objectives (1 and 2) of the SHS were paramount, it was recognized that the SHS could influence hunter participation and hunter satisfaction.

In 1997 ADF&G initiated a study to evaluate hunter acceptance of the SHS and identify its effects on hunter behavior, beliefs, and satisfaction, in addition to reviewing and evaluating the biological consequences of the SHS regulations between 1993 and 1997. The objectives of this article are to: (1) examine support for the SHS among resident Alaskan moose hunters; (2) identify beliefs about the outcomes of the SHS; (3) assess the effects of the SHS on moose hunting participation and hunting satisfaction; and (4) determine how beliefs about the outcomes of the SHS influence support for the SHS.

Conceptual Framework

Several studies have examined attitudes toward and satisfaction with moose hunting in North America (Donnelly & Vaske, 1995; Hansen, Dalton, & Stevens,

1995; Rollins, 1987; Rollins & Romano, 1989; Wedeles, Smith, & Rollins, 1989; Whittaker, Manfredo, Fix, Sinnott, Miller, & Vaske, 2001). Rollins and Romano (1989) applied the framework of multiple-facet recreational hunting satisfaction (Decker, Brown, & Guitierrez, 1980; Driver, 1985; Hendee, 1974; Vaske, Fedler, & Graefe, 1986) to help understand moose hunters' satisfaction with selective harvest regulations in Ontario. The multiple-satisfaction approach argues that satisfaction with hunting involves more than just harvest success and related aspects of the hunt. Fulfilling diverse psychological motivations such as enjoying nature, testing hunting skills, and being with friends and family are equally important (Driver, 1985).

This study extends the approach of evaluating hunting regulations via the multiple-satisfactions framework by adopting approaches from cognitive hierarchy theories in social psychology (Ajzen & Fishbein, 1980; Bem, 1970; Fishbein & Manfredo, 1992; Pierce, Manfredo, & Vaske 2001). From the perspective of cognitive hierarchy theories, attitudes toward an object or behavior are composed of multiple evaluative beliefs about that object or behavior (Ajzen & Fishbein, 1980; Fulton, Manfredo, Lipscomb, 1996; Vaske & Donnelly, 1999). Typically, an individual's attitude is not determined by one particular belief but rather the overall pattern of negative and positive beliefs and the strength with which they are held (Ajzen & Fishbein, 1980; Fishbein & Manfredo, 1992). The patterns of beliefs influencing an individual's attitude toward a particular object or behavior are complex (Tetlock, 1989), with some beliefs complementing one another and encouraging a convergent attitude whereas other beliefs conflict with one another. The beliefs important to forming an attitude can be identified and evaluated to assess the degree to which each influences attitudes (e.g., Bright, Manfredo, Fishbein, & Bath, 1993; Pate, Manfredo, Bright, & Tischbein, 1996; Whittaker et al., 2001). Such analysis could better explain why hunters hold positive or negative attitudes toward such practices as selective harvest systems for moose.

Barro and Manfredo (1996) suggest attitudes toward regulations can diminish hunting satisfaction and potentially act as a constraint to hunting participation. In this study, cognitive hierarchy theory is used to guide the assessment of how beliefs about the outcomes of the SHS influence evaluations of the SHS as good or bad and subsequent overall support for the SHS. Through this assessment the relative importance of different specific beliefs about the outcomes of the SHS are identified providing a better understanding of why moose hunters support or oppose the SHS and how that affects their moose hunting satisfaction.

Methods

Sampling

The study population included all Alaskan residents who hunted moose in Game Management Units (GMUs 7, 11, 13, 14, 15, or 16) with the SHS for at least one

season during the time period 1993 through 1997. A stratified random sample of the study population was drawn from the ADF&G harvest database. Because preliminary biological information suggested variable effectiveness of the SHS across the region, four study strata were defined based on the location of the individual's most recent moose hunt. These strata included: (1) Kenai Peninsula (GMUs 7 and 15); (2) Nelchina area (GMUs 11 and 13); (3) Eastern Matanuska Susitina Valley and Anchorage (East Matsu GMU 14); and (4) Western Matanuska Susitina Valley (West Matsu GMU 16). Data were collected from sampled hunters via a mail-out survey using methods modified from Dillman (2000).

Survey Instrument

The data collection instrument was developed collaboratively among ADF&G researchers, ADF&G managers, and hunters representing local fish and game advisory committees. Development of the questions also was guided by the substantial literature addressing evaluation of hunting satisfaction (e.g., Decker et al., 1980; Driver 1985; Hammitt, McDonald, & Patterson, 1990; McCullough & Carmen, 1982; Vaske et al., 1986).

Support for the SHS was measured using a single question with a 5-point response scale ranging from -2 (strongly oppose) to +2 (strongly support). In addition, evaluative beliefs about the SHS were measured using two items. Respondents were asked if they believed the SHS was good or bad for moose and for moose hunters. On each of these 2 questions, responses were recorded on a 5-point scale ranging from -2 (very bad) to +2 (very good).

Three questions were used to assess moose hunters' level of satisfaction with their most recent hunting trip to an SHS area. Specifically, respondents were asked: (1) if their last moose hunt was worth the time and effort, (2) whether they were satisfied with their last moose hunting season, and (3) if their last moose season was a disappointment (reverse coded). Responses were recorded on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). An overall satisfaction scale was calculated using the mean of these 3 items. To assess hunters' views on moose management strategies, respondents were asked to indicate the acceptability of three general management strategies for reducing bull moose harvests: antler size or configuration restrictions, shortening the length of hunting seasons, and limiting the number of hunters. Responses were recorded on a 5-point scale ranging from -2 (very unacceptable) to +2 (very acceptable).

Respondents were asked the extent to which 18 moose hunting related experiences potentially added or detracted from their moose hunting satisfaction. Responses for each item were recorded on a 5-point scale ranging from -2 (greatly detracts) to +2 (greatly adds). Respondents were also asked the degree to which they had each of these experiences during their most recent moose hunt in an area with the SHS. Responses to each of these items were recorded on a 5-point

scale (-2 not at all to +2 very much). An experience-attainment score was calculated for each experience by multiplying the 2 matching ratings together. These scores could range from -4 to +4 for each type of moose hunting experience.

Early in the survey development process, hunters' salient beliefs about positive and negative outcomes of the SHS were identified by eliciting their opinions during local advisory committee meetings. A total of 13 beliefs were identified, including 7 beliefs related to positive outcomes of the SHS and 6 beliefs related to negative outcomes. On the final survey instrument, respondents were asked to identify the extent to which they agreed or disagreed that the SHS led to these 13 outcomes. Responses were recorded on a 5-point scale ranging from -2 (strongly disagree) to +2 (strongly agree). Negative outcomes were reverse scored, and a summative index ranging from -26 to +26 was created.

Respondents were also asked whether they or their hunting partner(s) killed a moose during their most recent moose hunting season, the GMU in which they most recently hunted moose, and whether they had hunted moose in Alaska outside Region 2 in the past five years to avoid the SHS.

Analyses

Descriptive statistics (percentages and means) were used to summarize responses to survey questions. Region-wide data were weighted to reflect the actual proportions of the population hunting in each study stratum. The internal consistency reliability of the 3-item satisfaction scale was assessed using Cronbach's alpha.

Mean differences across study strata on hunting satisfaction, support for the SHS, hunting experiences and evaluations of the SHS were compared using one-way analysis of variance with Scheffé post hoc tests to identify significant differences between individual strata, and η (eta) reported as the measure of effect size. Effect sizes were evaluated based on the guidelines of Cohen (1988) and Gliner, Vaske, and Morgan (2001). Based on these guidelines 0.1 = small effect, 0.3 = medium effect, and 0.5 = large effect. A repeated measures general linear model was used to assess differences within individuals concerning the acceptability of management strategies to protect bull moose from harvest.

Hierarchical regression models were used to assess the relative influence of hunting harvest, support for the SHS, and hunting experiences on hunting satisfaction (Stevens, 1992). Multiple regression models were used to assess the influence of evaluative beliefs on support for the SHS. The role of evaluative beliefs as a mediator between the relationship of salient beliefs about consequences of the SHS and support for the SHS was also assessed using regression models, as outlined by Baron and Kenny (1986).

Each hunter's responses to evaluative beliefs questions about whether the SHS was good or bad for moose populations and for hunters were summed to create an index. The hunters were divided into two groups based on a median split of the

summed scores. MANOVA was used to identify differences between the two groups among the 13 beliefs using η as a measure of effect size (Stevens, 1992).

Results

Response Rate

Initially, 4,450 resident moose hunters were sampled. Of these, 17.1% (762) were at undeliverable addresses or were invalid respondents, providing 3,688 potentially valid respondents. Of the 3,688 surveys sent to valid respondents, 2,424 were returned for an overall study response rate of 65.7% (error estimate within $\pm 2\%$ at the 95% confidence interval). The respondent sample closely matched the sampling frame with respect to location of residence and location of last moose hunt in the south-central region.

Level of Support for the SHS and Evaluation of the SHS

Nearly 3 out of 5 Alaskan moose hunters hunting under the SHS either strongly (28%) or somewhat (30%) supported the system. Twenty-nine percent either strongly (11%) or somewhat (18%) opposed the SHS. Fourteen percent were neutral toward the SHS. Hunters on the Kenai Peninsula were more supportive of the SHS than hunters in the other locations (Table 1).

TABLE 1 Comparison of Support for and Evaluative Beliefs about the Selective Harvest System in South-Central Alaska

	Region wide	Kenai ¹	Nelchina	East Matsu	West Matsu	<i>F</i>	<i>p</i>	η
Support/ Oppose SHS ²	0.45	0.76 ^a	0.41	0.31	0.25	16.47	<0.001	0.15
SHS Good/ Bad for Moose ³	0.79	1.01 ^a	0.76	0.68	0.70	12.72	<0.001	0.13
SHS Good/ Bad for Hunters ³	0.21	0.42 ^a	0.21	0.07	0.05	11.24	<0.001	0.12

¹ Means with superscripts are significantly different from other means in the same row at $p < 0.05$ (post hoc Scheffé).

² Responses were measured on a scale where -2=strongly oppose, -1=somewhat oppose, 0=neutral, 1=somewhat support, 2=strongly support.

³ Responses were measured on a scale where -2=very bad, -1=moderately bad, 0=neutral, 1=moderately good, 2=very good.

A large majority of hunters believed that the SHS was either moderately (37%) or very (28%) good for moose populations. In contrast, only 46% reported that the SHS was moderately (30%) or very (16%) good for moose hunters. More moose hunters on the Kenai Peninsula evaluated the SHS as more positive for moose populations and for moose hunters than did moose hunters in any of the other areas (Table 1). With respect to hunters' views on moose management strategies, results indicated that hunters found antler size and configuration restrictions more acceptable (mean=0.423, $F=319.02$, 2 df, $p<0.001$, $\eta=0.37$) than either shortening seasons (-0.450) or limiting hunters (-0.578) as a general strategy to reduce bull moose hunting harvest.

About 13% of moose hunters in the south-central region indicated they had hunted outside the region between 1993 and 1997 to avoid the SHS. The decision to hunt outside the region varied by the area in which they hunted ($\chi^2=29.023$, 3 df, $p<0.001$, Cramer's $V=0.113$). About 1 in 10 moose hunters from the Kenai (9%), East Matsu (10%), and West Matsu (11%) reported hunting outside the region to avoid the SHS, compared with almost 1 in 5 hunters in Nelchina (18%) who had done so.

Satisfaction with Moose Hunting

The 3-item hunting satisfaction scale had high reliability ($\alpha=0.89$), and the corrected item total correlation of each was >0.70 . The region-wide sample had a moderate satisfaction level. Mean satisfaction score on the 3-item scale was 3.4 on a 5-point scale. Hunters in West Matsu had lower mean satisfaction (mean=3.2, $F=7.309$, 3 df, $p<0.001$) than hunters in the other three study strata (all other GMUs mean=3.5).

Experiences Influencing Moose Hunting Satisfaction

All but 2 of the 18 potential experiences were evaluated as adding to moose hunting satisfaction (Table 2). Enjoying the outdoors, getting meat, seeing wildlife other than moose, and spending time with family and friends all had mean scores greater than 1.50 (on a scale where 2=greatly adds to the experience). Respondents indicated they were less likely to obtain meat than actually attain the other three experiences. Based on the means of experience-attainment products, enjoying the outdoors, spending time with family and friends, and seeing wildlife other than moose were the three most likely favorable experiences respondents reported. Most respondents indicated that seeing or hearing other hunters and poor behavior among other hunters would distract from their moose hunting experience, but on average such experiences only occurred to a slight degree.

Results of a regression model predicting hunting satisfaction with all 18 experience-attainment products indicated that nine experiences were significantly related to moose hunting satisfaction (Table 3). Together these 9 experiences explained 16% of the variance in moose hunting satisfaction ($R^2=0.163$).

TABLE 2 Region-Wide Mean Scores for Experiences that Influence Satisfaction with Moose Hunting

	Add/detracts from moose hunting ^a	Happened last moose hunt ^b	Add/detracts × happened product
Enjoying the outdoors	1.84	1.72	3.28
Testing your hunting skills	1.13	0.91	1.62
Getting meat for yourself or family	1.66	0.71	1.38
Chance to harvest a bull moose	1.21	0.72	1.26
A long moose hunting season	1.18	0.63	1.24
Unrestricted access	0.92	0.54	1.40
Seeing wildlife other than moose	1.59	1.16	2.13
Seeing bull moose, even if they are not legal bulls	1.28	0.76	1.57
Chance at a “big” bull (50-inch + antlers)	1.18	0.27	0.97
Hunting when you can effectively call moose	0.90	0.04	0.74
Seeing or hearing other hunters, not in your party	-1.21	-0.55	0.88
Hunting regulations that are consistent in different areas	0.70	0.32	0.62
Ability to hunt caribou, or other animals, while moose hunting	1.41	0.49	1.18
Easy identification of a legal moose	1.22	0.43	0.77
Spending time with family or hunting partners	1.51	1.26	2.35
Spending time hunting with kids or young hunters	0.99	0.31	1.31
Poor behavior among other hunters	-1.82	-1.12	2.15
Regulations that are easy to understand	1.46	0.64	1.18

^a Responses recorded as -2=Greatly Detracts, -1=Somewhat Detracts, 0=Neutral, 1=Somewhat Adds, 2=Greatly Adds.

^b Responses recorded as -2=Not at all, -1=Slightly, 0=somewhat, 1=Largely, 2=Very Much.

Effects of the SHS, Harvest Success, and Experiences on Hunting Satisfaction

Whether the moose hunter or someone in their party harvested a moose was a strong predictor of overall hunting satisfaction ($r=0.422$) explaining 17.0% of

TABLE 3 Regression Model ($R^2=0.163$) Predicting Moose Hunting Satisfaction from Attained Experiences

	<i>B</i>	<i>SE</i>	β	<i>p</i>
Attained Experiences				
Enjoying the outdoors	0.120	0.021	0.131	<0.001
Testing your hunting skills	0.014	0.016	0.019	0.397
Getting meat for yourself or family	0.065	0.011	0.155	<0.001
Chance to harvest a bull moose	0.020	0.014	0.036	0.171
A long moose hunting season	-0.012	0.015	-0.020	0.431
Unrestricted access	0.001	0.014	0.002	0.945
Seeing wildlife other than moose	0.051	0.017	0.079	0.004
Seeing bull moose, even if they are not legal bulls	0.039	0.014	0.071	0.006
Chance at a "big" bull (50-inch + antlers)	0.043	0.013	0.087	0.001
Hunting when you can effectively call moose	0.015	0.014	0.026	0.034
Seeing or hearing other hunters, not in your party	-0.007	0.013	-0.013	0.586
Hunting regulations that are consistent in different areas	-0.022	0.017	-0.031	0.201
Ability to hunt caribou, or other animals, while moose hunting	-0.053	0.012	-0.109	0.000
Easy identification of a legal moose	0.015	0.013	0.030	0.256
Spending time with family or hunting partners	0.082	0.016	0.121	0.000
Spending time hunting with kids or young hunters	-0.037	0.013	-0.065	0.006
Poor behavior among other hunters	0.030	0.012	0.057	0.010
Regulations that are easy to understand	0.010	0.015	0.018	0.483

the variance in satisfaction (Table 4). Including support for the SHS, however, explained an additional 13.8% of the variance in hunting satisfaction (Table 4). These results indicate that evaluations and support of the SHS influenced satisfaction with moose hunting almost as much as actual harvest success. However, subsequently adding the effects of the 9 attained hunting experiences only explained an additional 6.1% of variance in hunting satisfaction (Table 4).

TABLE 4 Hierarchical Regression Models Assessing Role of Harvest, Support for Bull Moose Selective Harvest System, and Attained Experiences on Hunting Satisfaction for Moose in South-Central Alaska

Variable	<i>B</i>	<i>SEB</i>	β	<i>p</i>	<i>R</i> ²	ΔR^2
Model 1					0.170	
KILL LAST SEASON HUNTED	1.107	0.051	0.412	<0.001		
Model 2					0.309	0.138
KILL LAST SEASON HUNTED	0.996	0.047	0.380	<0.001		
SUPPORT OR OPPOSE SPIKE/FORK 50 REGULATIONS	0.176	0.031	0.184	<0.001		
Model 3					0.370	0.061
KILL LAST SEASON HUNTED	0.866	0.048	0.330	<0.001		
SUPPORT OR OPPOSE SPIKE/FORK 50 REGULATIONS	0.310	0.017	0.323	<0.001		
ENJOYING THE OUTDOORS	0.082	0.018	0.088	<0.001		
GETTING MEAT FOR YOURSELF OR FAMILY	0.032	0.009	0.077	<0.001		
SEEING WILDLIFE OTHER THAN MOOSE	0.048	0.014	0.075	0.002		
SEEING BULL MOOSE, EVEN IF THEY ARE NOT LEGAL BULLS	0.020	0.012	0.036	0.118		
CHANCE AT A "BIG" BULL (50-INCH+)	0.031	0.010	0.064	0.007		
ABILITY TO HUNT CARIBOU, OR OTHER ANIMALS, WHILE MOOSE HUNTING	-0.015	0.010	-0.031	0.136		
SPENDING TIME WITH FAMILY OR HUNTING PARTNERS	0.059	0.014	0.088	<0.001		
SPENDING TIME HUNTING WITH KIDS OR YOUNG HUNTERS	-0.034	0.011	-0.061	0.002		
POOR BEHAVIOR AMONG OTHER HUNTERS	0.032	0.009	0.061	0.001		

Effects of Beliefs about the Outcomes and Evaluation of the SHS on Support for the SHS

The influence of beliefs about outcomes of the SHS on support for the SHS was largely mediated through the evaluation of the SHS as good or bad for moose and moose hunters (Table 5). Beliefs about the outcomes of the SHS were a significant predictor of evaluation of the SHS as good or bad for moose and moose hunters ($\beta=0.710$, $p<0.001$) and level of support for the SHS ($\beta=0.682$, $p<0.001$). Evaluation of whether the SHS was good or bad for both moose and moose hunters was a strong predictor of support for the SHS ($\beta=0.84$, $p<0.001$) explaining 70.6% of the variance in level of support for the SHS, with those who felt the SHS was good for both moose and hunters more supportive of the SHS.

When both beliefs about the outcomes of the SHS and good or bad evaluations of the SHS were regressed on level of support for the SHS, however, the β for beliefs about the outcomes dropped dramatically, $\beta=0.171$. Although the relationship between beliefs about the outcomes of the SHS and support for the SHS remained statistically significant, beliefs about the outcomes explained less than 2% unique variance in level of support for the SHS ($\Delta R^2=0.014$). This result indicated that the influence of beliefs about the outcomes on level of support for the SHS was primarily mediated through evaluations of the SHS as good or bad for moose populations and hunters.

MANOVA revealed differences ($p<0.001$) in beliefs between those who held positive attitudes toward the SHS and those who held negative attitudes (Table 6).

TABLE 5 Regression Models to Assess Role Beliefs about Outcomes and Evaluative Beliefs on Support for Bull Moose Selective Harvest System

Variable	<i>B</i>	<i>SE B</i>	β	<i>p</i>	<i>R</i> ²
Model 1: Effect of Beliefs on Evaluation of SHS					
BELIEFS ABOUT OUTCOMES	0.158	0.003	0.710	<0.001	0.504
Model 2: Effects of Beliefs on Support for SHS					
BELIEFS ABOUT OUTCOMES	0.097	0.002	0.682	<0.001	0.465
Model 3: Effects of Evaluation of the SHS on Support for SHS					
SHS GOOD/BAD	0.539	0.007	0.840	<0.001	0.706
Model 4: Effects of Beliefs and Evaluation of the SHS on Support for SHS					
BELIEFS ABOUT OUTCOMES	0.024	0.002	0.171	<0.001	0.720
SHS GOOD/BAD	0.461	0.010	0.719		

TABLE 6 Comparison of Means between Those who Felt Selective Harvest System was “Good” versus “Bad” for Moose and Hunters¹

Consequence items	Attitudes toward SHS						η
	Bad			Good			
	<i>mean</i>	<i>SE</i>		<i>Mean</i>	<i>SE</i>	<i>F</i> ¹	
The spike-fork/50-inch or 3 brow time regulation ...	-0.713	0.039		1.143	0.025	1622.54	0.73
Maintains overall moose hunting opportunity	0.235	0.047		1.278	0.031	342.68	0.41
Makes hunters more careful when shooting at a moose	1.347	0.051		0.469	0.033	208.69	-0.38
Decreases chances for harvesting a moose	-0.434	0.045		0.956	0.029	669.50	0.56
Improves the opportunity for seeing bull moose	-0.831	0.048		0.009	0.031	264.67	0.38
Provides the opportunity to take children hunting	1.153	0.049		0.567	0.032	101.74	-0.27
Increases the number of illegal moose killed	-0.382	0.038		1.275	0.025	1309.76	0.69
Increases the total number of bulls in the moose population in the long term	1.311	0.050		0.002	0.032	476.24	-0.53
Makes it too difficult to tell if a bull is legal	1.237	0.048		-0.171	0.031	606.35	-0.56
Keeps you from getting meat	1.568	0.044		0.771	0.028	232.21	-0.38
Increases the chance of making an honest mistake	-0.689	0.042		0.731	0.027	819.94	0.60
Improves hunter understanding of moose management	0.511	0.051		-1.067	0.033	681.81	-0.53
Discourages you from moose hunting	-0.583	0.044		1.035	0.028	974.99	0.64
Increases the number of large bulls (50" or larger) in the moose population in the long term							

¹ All significant at $p < 0.001$.

Assessment of the effect size for each belief statement indicated the relative influence each has on good/bad evaluations of the SHS. The beliefs with the largest positive influence on good/bad evaluations included beliefs the SHS would: (1) maintain overall moose hunting opportunity ($\eta=0.73$), (2) increase the total number of bulls in the moose population in the long term ($\eta=0.69$), (3) increase the number of large bulls in the moose population ($\eta=0.64$), (4) improve hunter understanding of moose management ($\eta=0.60$), and (5) improve the opportunity for seeing bull moose ($\eta=0.56$). Conversely, beliefs associated with negative evaluations of the SHS included: discourages you from hunting ($\eta=-0.53$), keeps you from getting meat ($\eta=-0.56$), and makes it too difficult to tell if a bull is legal ($\eta=-0.53$).

Discussion and Management Implications

In a previous evaluation of the SHS in south-central Alaska, the biological consequences of the SHS for moose populations were examined, but researchers noted that, given the goals of the SHS, a thorough evaluation of impacts of the SHS on moose hunters was also needed (Schwartz et al. 1992). Results reported here indicate that beliefs about the biological and social consequences of the SHS largely shaped attitudes (evaluative beliefs) toward the SHS as good or bad for both moose and moose hunters. In turn, these attitudes greatly influenced whether or not hunters supported the SHS. Understanding the beliefs behind supporting or opposing the SHS is important because moose hunting satisfaction was influenced almost as much by support for the SHS as it was by actual harvest. Also, about 10% of moose hunters indicated they had hunted elsewhere in the state to avoid the SHS.

Results of this study indicated that although a majority (57%) of Alaskan moose hunters supported the SHS, more than 25% opposed the SHS, suggesting that it is important to understand and address beliefs related to the support of the SHS. Those who supported the SHS evaluated it as good for both moose and moose hunters and believed it maintained moose hunting opportunities, increased the number of bull moose in the population, and improved hunter behavior. Those who opposed the SHS felt it was bad because it kept them from getting meat, made it too difficult to tell whether a bull is legal, and discouraged them from hunting. These findings indicate that regardless of their intended or actual biological effects, hunting regulations may not be supported by hunters if they believe the consequences of the regulations lead to negative biological effects or negative impacts on hunting experiences.

As noted by Barro and Manfredo (1996), regulations and perceptions about the impacts of regulations have the potential to act as a constraint on hunting participation as well as lower the satisfaction of hunters with the hunt. Further, Miller and Graefe (2001) emphasize the importance of harvest in support for big game regulations. Given the mandate of most state wildlife agencies to provide social benefits through management of the wildlife resource (e.g., Alaska Department of

Fish and Game, 1998), assessing and responding to public beliefs regarding hunting regulations is key to crafting adaptive management strategies that are not only founded on sound ecological science, but also achieve both their social and biological objectives. In this case, information about hunters' beliefs regarding the consequences of the SHS can be used to (1) alter existing regulations to improve their acceptability among hunters and (2) identify misconceptions about the consequences of the regulations.

The SHS has effectively achieved its biological objective (increasing bull:cow ratios) and enjoys fairly broad support among moose hunters. However, public discussion about the merits and problems of the SHS continues (Bartley, 1999; Monzigo, 1999). Although many acknowledge that the SHS has maintained or increased hunting opportunities as measured by season length (Bartley, 1999), others suggest it places too heavy a burden on hunters in identifying legally harvestable animals (Monzigo, 1999). Study results suggest a majority of Alaskan moose hunters share both of these perspectives.

Although the SHS regulations are biologically effective and have support among a majority of moose hunters, managers will need to continue to adapt the regulations to enhance biological effects as well as social consequences. The harvest of moose meat has been and continues to be culturally important to resident Alaskans, and a substantive minority of hunters is likely to continue to value maximizing their probability of harvesting a moose. Information on specific beliefs hunters hold about how the SHS may impact their harvest success can be used to help refine information and education materials and improve the acceptability of the regulations among the hunting public. As noted by White and Lubow (2002) in their call for rigorous biological procedures on which to build harvest management decisions, such management decisions are under the intense scrutiny of hunters and other stakeholders. Information concerning the affected publics' specific beliefs about the outcomes of management practices provides valuable information that enables managers and decision makers to make decisions that achieve biological goals and are socially acceptable.

References

- Ajzen, I., & Fishbein, M. (1980). *Understanding Attitudes and Predicting Social Behavior*. Englewood Cliff, NJ: Prentice Hall.
- Alaska Department of Fish and Game. (1998). Mission Statement. Available at <<http://www.state.ak.us/adfg/geninfo/overview/mission.htm>>.
- Baron, R. M. and D. A. Kenny. 1986. The moderator-mediator variable distinction in Social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*. 51(6): 1173–1182.
- Bartley, B. (1999). Spike-fork/50: a good strategy. *Alaska Hunting Bulletin*, 4(1), 32.
- Bem, D. J. (1970). *Beliefs, Attitudes, and Human Affairs*. Belmont, CA: Brooks, Cole.

- Barro, S. C., & Manfredi, M. J. (1996). Constraints, psychological investment, and hunting participation: Development and testing of a model. *Human Dimensions of Wildlife*, 1(3), 42–61.
- Bright, A. D., Manfredi, M. J., Fishbein, M., & Bath, A. (1993). The theory of reasoned action as a model of persuasion: A case study of public perceptions of the National Park Service's controlled burn policy. *Journal of Leisure Research*, 25, 263–280.
- Cohen, J. 1988. *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Crichton, V. F. J., Regelin, W. L., Franzmann, A. W., & Schwartz, C. C. (1997). The future of moose management and research. In A. W. Franzmann and C. C. Schwartz (Eds.), *Ecology and management of the North American moose* (pp. 655–663). Washington, DC: Smithsonian Institution Press.
- Decker, D. J., Brown, T. L., & Guitierrez, R. J. (1980). Further insights into the multiple-satisfaction approach for hunter management. *Wildlife Society Bulletin*, 8, 323–331.
- Dillman, D. (2000). *Mail and Internet Surveys: The Tailored Design Method*, 2nd Edition. J. Wiley and Sons: New York.
- Donnelly, M. P., & Vaske, J. J. (1995). Predicting attitudes toward a proposed moose hunt. *Society and Natural Resources*, 8, 307–319.
- Driver, B. L. (1985). Specifying what is produced by management of wildlife by public agencies. *Leisure Sciences*, 7, 281–285.
- Fishbein, M., & Manfredi, M. J. (1992). A theory of behavior change. In M. J. Manfredi (Ed.), *Influencing human behavior: Theory and applications in recreation, tourism, and natural resources management* (pp. 29–50). Champaign, IL: Sagamore.
- Fulton, D. C., Manfredi, M. J., & Lipscomb, J. (1996). Wildlife value orientations: A conceptual and measurement approach. *Human Dimensions of Wildlife*, 1(2), 24–47.
- Gliner, J. A., J. J. Vaske, and G. A. Morgan. 2001. Null hypothesis significance testing: *Effect size matters*. *Human Dimensions of Wildlife* 6: 291–301
- Hammit, W. E., McDonald, C. D., & Patterson, M. E. (1990). Determinants of multiple satisfaction for deer hunting. *Wildlife Society Bulletin*, 18, 331–337.
- Hansen, S., Dalton, W. J., & Stevens, T. (1995). An overview of a hunter opinion survey of satisfaction with the Ontario moose management system. *Alces*, 31, 247–254.
- Hendee, J. C. (1974). A multiple-satisfaction approach to game management. *Wildlife Society Bulletin*, 2, 104–113.
- McCullough, D. R., & Carmen, W. J. (1982). Management goals for deer hunting satisfaction. *Wildlife Society Bulletin*, 10, 49–52.
- Miller, C., & Graefe, A. (2001). Effect of harvest success on hunter attitudes toward white-tailed deer management in Pennsylvania. *Human Dimensions of Wildlife*, 6, 189–203.
- Miller, S. M., & McCollum, D. W. (1997). *Alaska Hunters: Their Hunting Trip Characteristics and Economics*. Alaska Department of Fish and Game, Division of Wildlife Conservation, Anchorage, AK.
- Monzingo, T. (1999). Spike-fork 50: Not a good strategy. *Alaska Hunting Bulletin*, 4(1), 32–33.
- Pate, J., Manfredi, M. J., Bright, A. D., & Tischbein, G. (1996). Coloradoans' attitudes toward reintroducing the gray wolf in Colorado. *Wildlife Society Bulletin*, 24, 421–428.
- Pierce, C., Manfredi, M. J., & Vaske, J. J. (2001). Social science theories in wildlife management. In D. J. Decker, T. L. Brown, and W. F. Siemer (Eds.), *Human*

- dimensions of wildlife management in North America* (pp. 39–56). Bethesda, MD: The Wildlife Society.
- Reeves, H. M., & McCabe, R. E. (1997). Of moose and man. In A. W. Franzmann and C. C. Schwartz (Eds.), *Ecology and management of the North American moose* (pp. 1–17). Washington, DC: Wildlife Management Institute and Smithsonian Institution Press.
- Regelin, W. L., & Franzmann, A. W. (1998). Past, present, and future moose management and research in Alaska. *Alces*, *34*, 279–286.
- Rollins, R. (1987). Hunter satisfaction with the selective harvest system for moose in northern Ontario. *Alces*, *23*, 181–194.
- Rollins, R., & Romano, L. (1989). Hunter satisfaction with the selective harvest system for moose management in Ontario. *Wildlife Society Bulletin*, *17*, 470–475.
- Schwartz, C. C., Hundertmark, K. J., & Spraker, T. H. (1992). An evaluation of selective bull moose harvest on the Kenai Peninsula, Alaska. *Alces*, *28*, 1–13.
- Stevens, J. (1992). *Applied Multivariate Statistics for the Behavioral Sciences*. Hillsdale, NJ: Erlbaum.
- Tetlock, P. E. (1989). Structure and function in political belief systems. In A. R. Pratkanis, S. J. Breckler, and A. G. Greenwald (Eds.), *Attitude structure and function* (pp. 129–151). Hillsdale, NJ: Erlbaum.
- Vaske, J. J., & Donnelly, M. P. (1999). A value-attitude-behavior model predicting wildland preservation voting intentions. *Society and Natural Resources*, *12*, 523–537.
- Vaske, J. J., Fedler, A. J., & Graefe, A. R. (1986). Multiple determinants of satisfaction from a specific waterfowl hunting trip. *Leisure Sciences*, *8*, 149–166.
- Wedeles, C. H. R., Smith, H., & Rollins, R. (1989). Opinions of Ontario moose hunters on changes to the selective harvest system. *Alces*, *25*, 15–24.
- Whittaker, D., Manfredo, M. J., Fix, P. J., Sinnott, R., Miller, S., & Vaske, J. J. (2001). Understanding beliefs and attitudes about an urban wildlife hunt near Anchorage, Alaska. *Wildlife Society Bulletin*, *29*, 1114–1124.
- White, G. C., & Lubow, B. C. (2002). Fitting population models to multiple sources of observed data. *Journal of Wildlife Management*, *62*, 300–309.

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