Activity Substitutability and Degree of Specialization among Deer and Elk Hunters in Multiple States

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This article is based on a project of the Human Dimensions Committee of the Western Association of Fish and Wildlife Agencies. Committee members and agency representatives are thanked for their support. Earlier versions were presented at the National Recreation and Park Association Leisure Research Symposium in Seattle, Washington in October 2006, and the Northeastern Recreation Research Symposium in Bolton Landing, New York in April 2011. Two anonymous reviewers and the editors are thanked for their comments.

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Abstract

This article examines relationships between hunter specialization and activity substitutability. Data were obtained from a mail survey of 6,983 deer hunters in eight states and 2,584 elk hunters in three states. Activity substitutability was measured by asking what activity would provide the same satisfaction as deer or elk hunting. Between 41% and 59% of deer hunters and 38% to 46% of elk hunters reported substitutes such as fishing and other big game hunting. Cluster analyses of hunter skill, centrality, equipment, and experience revealed four specialization groups (casual, intermediate, focused, veteran). Casual hunters were most likely to report a substitute followed by intermediates, focused, and veterans. This inverse relationship between concepts was consistent across states and species hunted. Veteran hunters were most likely to report other big game hunting as a substitute, whereas casual hunters in many states were most likely to consider fishing as a substitute.

Keywords: recreation specialization, substitutability, hunting, wildlife

Introduction

The concepts of recreation specialization and activity substitutability have received considerable attention (see Brunson & Shelby, 1993; Manning, 2011; Scott & Shafer, 2001 for reviews). Activity substitutability was initially described as the interchangeability of activities to satisfy participant needs, motivations, and preferences (Hendee & Burdge, 1974). This definition was expanded to refer to the interchangeability of activities so that "acceptably equivalent outcomes can be achieved" (Brunson & Shelby, 1993, p. 69) where a substitute provides satisfaction and benefits equivalent to the original (Iso-Ahola, 1986). If a replacement activity does not provide similar benefits, it is a complement or alternative, but not a substitute (Shelby & Vaske, 1991).

Specialization is useful for recognizing diversity among activity participants and differentiating them into groups based on "a continuum of behavior from the general to the particular, reflected by equipment and skills used in the sport and activity setting preferences" (Bryan, 1977, p. 175). At one end of the continuum are novices or infrequent participants who do not consider the activity to be a central life interest or show strong preferences for equipment or technique. The other end includes more avid participants who are committed to the activity and use more sophisticated methods. Recreationists are thought to progress to higher stages on this continuum, reflected by increasing skill and commitment (Bryan, 1977; Scott & Shafer, 2001).

In his original conceptualization of specialization, Bryan (1977) proposed that when participants become more specialized in an activity, they develop specific preferences and their participation increases, thereby narrowing the range of satisfactory alternatives. Similarly, Buchanan (1985) proposed that specialization is associated with psychological commitment, which should be negatively related to the range of alternative activities and willingness to substitute. Other researchers have also proposed this inverse relationship between specialization and substitutability, as participants with strong commitment and skill in an activity should be less likely to identify other activities providing similar satisfaction or benefits (Ditton & Sutton, 2004; Manfredo & Anderson,

1987). Empirical research examining direct relationships between specialization and activity substitutability, however, is relatively sparse and findings are mixed. A few studies have supported these propositions by reporting that specialized participants in some activities perceived these activities to have fewer substitutes (Baumgartner & Heberlein, 1981; Manfredo & Anderson, 1987). Other studies, however, have found weak or nonexistent relationships between activity substitutability and specialization (Choi, Loomis, & Ditton, 1994; Sutton & Ditton, 2005). This article examines relationships between activity substitutability and specialization for deer and elk hunters in multiple states. Understanding these relationships is important, especially given recent declines in participation for some leisure and recreation activities (e.g., hunting; Duda, Jones, & Criscione, 2010). If specialized hunters do not substitute other types of hunting or fishing when facing constraints (e.g., hunting regulations, lack of accessible land, low species populations), declines in agency revenues from reduced license sales may occur.

Conceptual Background

Recreation Substitutability

Substitutability is useful for understanding how recreationists may change behavior in response to circumstances influencing participation. Early research involved statistically grouping activities deemed similar by researchers based on variables such as participation rates and perceived similarity of activities (see Manning, 2011; Vaske, Donnelly, & Tweed, 1983 for reviews). Recent research, however, has directly questioned recreationists about activities they consider as substitutes. Given that activity benefits accrue to individuals, participants should decide what constitutes a substitute, not researchers (Vaske, Donnelly, & Shelby, 1990).

Several types of substitutes have been examined (Shelby & Vaske, 1991). Resource substitutability involves engaging in the same activity at a different location. Temporal or strategic substitutability requires participating in the same activity and location, but involves adjustments such as rescheduling to different times or using alternative strategies to gain access.

Activity substitutability involves replacing the original activity with an alternative that provides similar benefits, and has been examined for participants in activities such as fishing (Choi et al., 1994; Ditton & Sutton, 2004; Shelby & Vaske, 1991; Sutton & Ditton, 2005), hiking (Wu, Hsu, & Wang, 2008), and hunting (Baumgartner & Heberlein, 1981; Vaske et al., 1983, 1990).

Studies of activity substitutability have generally found that approximately half or more of participants identified other activities that could serve as substitutes (Manning, 2011). In the context of hunting, for example, Baumgartner and Heberlein (1981) found that 41% of deer hunters identified substitutes for this activity. Vaske et al. (1990) reported that 79% of turkey hunters had substitutes. Many substitute activities in these studies were associated with wildlife (e.g., hunt other species). Hunters who have substitutes can negotiate constraints when hunting regulations or low wildlife populations inhibit hunting for a particular species. Managers can use substitutability research to anticipate other species that may be targeted as replacements and the extent that shifts in hunter effort may occur.

Recreation Specialization

Some studies have suggested that specialization of participants may influence their willingness to substitute (Baumgartner & Heberlein, 1981; Choi et al., 1994; Ditton & Sutton, 2004; Manfredo & Anderson, 1987; Wu et al., 2008). Specialization has been examined relative to participants in numerous activities and settings (see Manning, 2011; Scott & Shafer, 2001 for reviews). For example, studies have examined hunter specialization and found that large proportions are highly specialized in some types of hunting (Barro & Manfredo, 1996; Kuentzel & Heberlein, 1992; Miller & Graefe, 2000; Needham, Vaske, Donnelly, & Manfredo, 2007).

There is little consensus regarding the best method for measuring specialization (Scott & Shafer, 2001). Single item (e.g., participation frequency; Choi et al., 1994) and multidimensional approaches have been used for grouping recreationists by their degree of specialization (Bricker & Kerstetter, 2000; Donnelly, Vaske, & Graefe, 1986; Lee & Scott, 2004). Researchers generally

agree, however, that specialization is multidimensional and consists of behavioral, cognitive, and affective components (Manning, 2011; Scott & Shafer, 2001). Behavioral indicators include past experience (Choi et al., 1994; Hammitt, Backlund, & Bixler, 2004) and investment in equipment (Donnelly et al., 1986). Cognitive variables include skill level (Needham, Rollins, & Vaske, 2005; Vaske, Dyar, & Timmons, 2004) and knowledge (Kerstetter, Confer, & Graefe, 2001; Lee & Scott, 2004). Indicators of affective attachment and commitment include involvement and centrality to lifestyle (McFarlane, 2004; McIntyre & Pigram, 1992). Researchers are not always clear about relationships among dimensions and whether variables measure one dimension or another (Scott, Ditton, Stoll, & Eubanks Jr., 2005). Centrality, for example, has been measured by whether a participant belongs to organizations associated with an activity or purchases related magazines and books (Donnelly et al., 1986; McFarlane, 2004). Other researchers, however, have defined centrality as the extent that an individual's life is centered around an activity, and is generally measured by variables such as "much of my life is organized around this activity" (Barro & Manfredo, 1996; McIntyre & Pigram, 1992; Needham, Sprouse, & Grimm, 2009).

Recreationists are typically grouped along a linear specialization continuum using single items or the sum of responses across dimensions. The resulting index is treated as continuous or arbitrarily subdivided into groups (e.g., low, medium, high; see Manning, 2011 for a review). Researchers have suggested that this approach is simplistic, based on researcher determined groups, assumes that dimensions covary, and can obscure explanatory detail of each dimension (Kuentzel & Heberlein, 1992; McIntyre & Pigram, 1992; Scott et al., 2005). Multivariate statistical approaches (e.g., confirmatory factor analysis) have revealed that these single item or summative approaches may be inappropriate. The dimensions should be examined separately for their individual effects on specialization because they may not always increase linearly in identical fashion (Kuentzel & Heberlein, 1992; Lee & Scott, 2004; Scott & Thigpen, 2003). Some individuals, for example, may participate regularly and become committed to an activity,

but exhibit low skill; others may partake infrequently, yet display attributes of skill and commitment (Scott & Shafer, 2001). Techniques such as cluster analysis, therefore, may be appropriate for grouping participants because they introduce less researcher bias and seldom assume that specialization dimensions covary (Scott et al., 2005). Although these analyses require researcher judgment regarding the final cluster solution, they may be more appropriate for classifying and describing groups in an activity (Needham et al., 2007; Scott et al., 2005).

Specialization has been examined for its relationship to concepts such as crowding, place attachment, and motivations (see Manning, 2011; Scott & Shafer, 2001 for reviews). Studies have also examined the influence of specialization on substitutability, especially resource substitutes, and findings are inconclusive. Hammitt et al. (2004), for example, found that veteran anglers reported the highest number of resource substitutes. Tseng and Ditton (2007) reported that some specialization variables (boat owner, fishing club member) were positively related to willingness to substitute fishing locations, whereas others were not (experience, skill). Hyun and Ditton (2006) found that willingness to substitute fishing locations was negatively related to specialization variables. Similarly, campers' willingness to substitute locations was negatively related to experience in this activity (Wynveen, Kyle, Hammitt, & Absher, 2007).

For activity substitutability, research examining direct relationships with specialization is relatively limited and findings are also mixed. Sutton and Ditton (2005), for example, reported that relationships between activity substitutability and variables measuring angler specialization were not statistically significant (skill, days fishing, equipment). Similarly, Choi et al. (1994) found no significant main effects of past experience on the probability of substituting alternative activities for fishing. Conversely, findings from other studies have shown that more specialized hikers (Wu et al., 2008), anglers (Ditton & Sutton, 2004; Manfredo & Anderson, 1987), and hunters (Baumgartner & Heberlein, 1981) tend to perceive these activities as having fewer substitutes. Most of these studies, however, did not directly measure specialization or used single item

surrogate measures of the concept (e.g., participation frequency), which have been shown to be less reliable and valid than multidimensional approaches (Lee & Scott, 2004; McFarlane, 2004).

This article extends this previous leisure and recreation research by using data from deer hunters in eight states and elk hunters in three states to address four questions. First, to what extent do these hunters have substitute activities for these types of hunting, and what are these activities? Second, what are the degrees of specialization among these hunters? Third, does activity substitutability differ among groups of these hunters based on their specialization? Fourth, are any relationships between these concepts consistent across states and species hunted?

Methods

Data Collection

Data were obtained from questionnaires mailed to resident and nonresident deer hunters in eight states (Arizona, Colorado, Nebraska, North Dakota, South Dakota, Utah, Wisconsin, Wyoming) and elk hunters in three states (Colorado, Utah, Wyoming; Table 1). State wildlife agencies provided names and addresses of random samples of hunters 18 years of age or older who purchased licenses to hunt deer or elk with a firearm in 2003. Potential overlap among these 11 strata was minimized by deleting a few duplicate cases across samples before administration (e.g., hunted in more than one state, deer hunters who also hunted elk).

-Table 1-

Three mailings were used for administering questionnaires beginning in July 2004. Hunters were sent a questionnaire, postage paid return envelope, and letter explaining the study. Reminder postcards were sent to nonrespondents two weeks later, and a second full mailing (questionnaire, envelope, letter) was sent to nonrespondents three weeks after this reminder. Questionnaires were mailed to 22,320 hunters. In total, 773 questionnaires were undeliverable (e.g., moved, wrong address) and 9,567 were completed and returned, yielding a 44% response rate (9,567/22,320 – 773). Sample sizes were 6,983 for deer hunters (44% response rate) and

2,584 for elk hunters (45%). Among strata, sample sizes ranged from 668 (39% response rate, Utah elk hunters) to 1,036 (52%, Colorado elk hunters; Table 1).[1]

To check for nonresponse bias, hunters who completed questionnaires were compared to those who did not. A sample of 785 nonrespondents was telephoned in November 2004 and asked nine questions from the questionnaire. Responses were examined for differences between respondents and nonrespondents for each stratum. Only 4 of 99 (4%; 11 strata * 9 questions = 99) tests for differences between respondents and nonrespondents for questions examined in this article were statistically significant at $p < .05$. This small percentage of significant differences is within statistical probabilities of occurring by chance. In addition, Cramer's *V* and point-biserial correlation (r_{pb}) effect size statistics ranged from .01 to .24 and averaged .09. Using guidelines from Cohen (1988) and Vaske (2008) for interpreting effect sizes, these values suggest that the magnitude of any differences between respondents and nonrespondents was "small" or "minimal," respectively. These findings suggest that nonresponse bias was not a substantial problem, so data were not weighted based on this nonresponse check. Data were, however, weighted to reflect the actual population proportions of hunters in each state.[2]

Analysis Variables

Consistent with previous research (Ditton & Sutton, 2004; Shelby & Vaske, 1991; Vaske et al., 1990), activity substitutability was measured using the direct question method with an open ended question "what one wildlife oriented activity would you likely do instead of deer hunting" followed by "is this activity a substitute that would give you the same level of satisfaction or benefit that you get from deer hunting" (coded 0 "no," 1 "yes")?

Identical to past studies (Donnelly et al., 1986; McFarlane, 2004; Needham et al., 2009; Scott et al., 2005), specialization was measured with affective, cognitive, and behavioral dimensions. Variables and response scales measuring these dimensions are provided in Table 4. Five variables measured the affective dimension of centrality and are similar to those in other

studies (Bricker & Kerstetter, 2000; McIntyre & Pigram, 1992; Needham et al., 2009). The cognitive dimension was measured using three variables associated with knowledge and skill in hunting, which are also consistent with previous research (see Manning, 2011; Scott & Shafer, 2001 for reviews). Three variables addressed the behavioral dimension; two of these measured equipment used for hunting and one computed variable measured previous hunting experience. Respondents were asked how many years they have hunted deer in their life. To control for age, experience was expressed as a percentage and calculated with the following equation:

Number of years hunted deer in life/age * 100 = proportion of life hunted deer

These variables are consistent with those in other studies of hunter specialization (Barro & Manfredo, 1996; Needham et al., 2007). For all variables, elk hunting was substituted for deer hunting in questionnaires completed by elk hunters.

Data Analysis

Cronbach's alpha coefficients measured reliability of the multiple variable indices of specialization. Reliability is the internal consistency or inter-correlation among variables (Vaske, 2008). Confirmatory factor analysis (CFA) examined if variables measuring the specialization dimensions (centrality, skill, equipment, experience) demonstrated construct validity and were explained by broader latent concepts (Vaske, 2008). Construct validity of these dimensions was assessed using second-order CFA models, which were performed for each of the 11 strata to test if: (a) individual variables measuring these first-order factors had acceptable factor loadings and provided a good fit, and (b) these broader latent factors were explained by a higher second-order latent factor (specialization). Factor loadings should generally be $\geq .40$ (Byrne, 1994).

EQS software and its Satorra-Bentler Robust estimation procedure to correct for multivariate non-normality were used for these CFAs because skewness, kurtosis, and Mardia's coefficients of 47.75 to 126.43 (average = 94.71 across 11 strata) indicated some violations of the normal distribution assumption required for this analysis. CFA assumes multivariate

normality, which is when each individual variable is distributed normally and with respect to other variables and concepts examined (Bollen & Long, 1993). Mardia's coefficients offer one test for multivariate normality and should be close to zero and generally less than three or four to assume normality and allow the default maximum likelihood estimation procedure to be used for model evaluation (Byrne, 1994). When these parameters are not met, the Satorra-Bentler Robust estimation procedure is one way to correct issues when data are not normally distributed (Byrne, 1994). Model evaluation, therefore, was based on the Satorra-Bentler scaled chi-square (S-B χ^2) and Robust corrected normed fit index (NFI*), non-normed fit index (NNFI*), incremental fit index (IFI*), comparative fit index (CFI*), and root mean square error of approximation (RMSEA*; * denotes Robust correction). NFI*, NNFI*, IFI*, and CFI* values $\geq .90$, and RMSEA* values $\leq .08$ suggest acceptable model fit (Browne & Cudeck, 1993). Consistent with this approach, Robust corrected standard errors were used for test statistics. Responses to these specialization items were converted to standardized *z*-scores ($M = 0$, $SD = 1$) and mean indices were computed for centrality, skill, and equipment. K-means cluster analyses were performed on these indices and the experience variable to classify hunters into specialization groups.

A content analysis of written responses to the open ended substitutability question was conducted to reveal themes and categories of activity substitutes. Descriptive and bivariate analyses (e.g., χ^2) compared responses to the substitutability questions among states and specialization groups, and effect sizes (e.g., *V*) were reported where appropriate. SPSS software was used for these analyses and the cluster and reliability analyses.

Results

Recreation Substitutability

Between 41% (Wisconsin) and 59% (Arizona) of deer hunters specified a substitute activity that would provide the same satisfaction they get from deer hunting (Table 2). Deer hunters in Western states (Arizona, Colorado, Utah, Wyoming) were slightly more likely (50% to 59%)

than those in Midwest states (Nebraska, North Dakota, South Dakota, Wisconsin) to specify a substitute (43% to 46%). Among elk hunters, 38% (Utah) to 46% (Wyoming) provided an activity substitute. These proportions of deer and elk hunters specifying substitutes differed significantly among states, χ^2(2 and 7, N = 2,361 and 6,468) = 10.18 and 110.77, p = .006 and < .001. Cramer's V effect sizes, however, were only .07 and .13, suggesting that these differences were "small" (Cohen, 1988) or "minimal" (Vaske, 2008).

-Tables 2 and 3-

Content analysis of the open ended substitutability question produced eight categories of activity substitutes (Table 3). The most popular substitute for both deer and elk hunting in each state was either fishing or other big game hunting (e.g., bear, moose, deer [if elk hunter], elk [if deer hunter]). These substitutes were especially prevalent in Western states (Arizona, Colorado, Utah, Wyoming). Among Colorado deer hunters, for example, 47% listed hunting other big game and 28% listed fishing as substitutes. In Midwest states (Nebraska, North Dakota, South Dakota, Wisconsin), however, hunting other big game was a less popular substitute, whereas upland bird (e.g., quail, pheasant, grouse) and waterfowl hunting (e.g., duck, goose) were common. Among North Dakota deer hunters, for example, common substitutes were fishing (39%), upland bird hunting (28%), and waterfowl hunting (14%). These substitutes differed significantly among states for deer and elk hunters, χ^2(14 and 49, N = 2,322 and 6,382) = 62.46 and 1306.82, p < .001. These differences, however, were relatively "small" (Cohen, 1988) or "minimal" (Vaske, 2008) because Cramer's V effect sizes were .11 and .17.

Recreation Specialization

Cronbach's alpha coefficients for the multiple item specialization indices showed high internal consistency, suggesting that the variables measured their respective dimensions (Table 4). Alphas ranged from .90 to .92 across strata for centrality, .61 to .78 for skill, and .91 to .96 for equipment. For each stratum, most item total correlations exceeded .40 and deletion of any

variable from its respective dimension did not improve reliability. Reliability of the overall specialization index was high (range = .78 to .85).

-Table 4-

Additional support for combining specialization variables into their dimensions was evident from the second-order CFAs (Figure 1). Fit indices demonstrated that the data provided strong measurement model fit (NFI* = .91 to .94, NNFI* = .90 to .93, IFI* = .91 to .95, CFI* = .92 to .95, RMSEA* = .07 to .09). All first-order factor loadings were significant at $p < .001$ and acceptable, ranging from .61 to .93 for centrality, .41 to .89 for skill, and .89 to .98 for equipment. All second-order loadings were significant at $p < .001$ and showed that the centrality (.83 to .89) and skill (.79 to .86) dimensions most strongly represented hunter specialization, followed by equipment (.64 to .76) and past experience (.31 to .52).[3]

-Figure 1-

Having demonstrated reliability and construct validity of these specialization variables, their standardized scores were combined to create indices for each dimension (centrality, skill, equipment). Cluster analyses were performed on these indices and the experience variable. A series of two to seven group cluster analyses showed that the four group solution provided the best fit for each stratum, and groups were labeled: casual, intermediate, focused, and veteran hunters. These groups were compared in terms of their responses to the original specialization variables. Casual hunters reported the lowest mean scores on all variables measuring centrality, skill, equipment, and experience; veterans had the highest scores. Responses from intermediate hunters fell between these groups. This pattern among casual, intermediate, and veteran hunters is consistent with the specialization continuum hypothesized by Bryan (1977). Focused hunters, however, had the second highest scores on all variables except experience, as they only hunted deer or elk 19% to 27% (average = 25%) of their lives. By comparison, intermediates hunted 53% to 64% (average = 57%) and veterans hunted 54% to 67% (average = 61%) of their lives.

Casual hunters participated 14% to 33% (average = 23%) of their lives. Among these groups for each stratum, effect sizes revealed "small" (Cohen, 1988) or "minimal" (Vaske, 2008) differences in age, education, residency, and income (*V*, eta $\eta \leq .12$).

Two analyses confirmed the stability of this cluster solution. First, data were randomly sorted and cluster analyses were conducted after each of three random sorts for each stratum. These analyses supported the solution identifying four groups of hunters in each stratum based on their specialization. Second, discriminant analysis was conducted to determine how well all 11 individual specialization variables predicted the four cluster groups generated from the four factor indices (centrality, skill, equipment, experience). All variables significantly predicted the clusters, Wilks' lambda $U = .304$ to $.786$, $F = 77.65$ to 669.68, $p < .001$. Among the strata, these variables correctly classified 92% to 97% (average = 94%) of casual hunters, 79% to 96% (average = 87%) of intermediates, 84% to 97% (average = 93%) of focused hunters, and 96% to 100% (average = 99%) of veterans. Overall, 93% to 96% (average = 95%) of hunters were correctly classified by this discriminant analysis. These results suggested that the individual specialization variables were capable of separating the same clusters as those based on the four broader indices, and support validity of the four group solution based on these indices.

The largest proportion of deer hunters in each state (32% to 55%) was classified as veterans (Table 5). The second largest group was intermediates (21% to 32%), followed by focused (11% to 25%) and casual hunters (9% to 22%). Veteran deer hunters were slightly more prevalent in Western states (Arizona, Colorado, Utah, Wyoming; 49% to 55%) than Midwest states (Nebraska, North Dakota, South Dakota, Wisconsin; 32% to 43%). The largest proportion of elk hunters in Wyoming was also classified as veterans (37% veterans, 32% focused, 17% casual, 14% intermediate). Among elk hunters in Colorado and Utah, however, the largest proportions were focused hunters (35% and 41%), followed by veteran (26% and 29%), casual (20% and 21%), and intermediate hunters (13% and 15%). These specialization groups differed

significantly among states for deer and elk hunters, χ^2(6 and 21, N = 2,531 and 6,849) = 34.91 and 308.45, $p < .001$. Cramer's V effect sizes of only .08 and .12, however, suggested that these differences were "small" (Cohen, 1988) or "minimal" (Vaske, 2008).

-Tables 5 and 6-

The group most likely to report a substitute activity was casual hunters followed by intermediate, focused, and veteran hunters (Table 6). Among South Dakota deer hunters, for example, 63% of casual, 60% of intermediate, 39% of focused, and 31% of veteran hunters reported a substitute. Similarly, 61% of casual, 49% of intermediate, 37% of focused, and 27% of veteran elk hunters in Colorado reported a substitute. This inverse relationship between specialization and activity substitutability was consistent across all states and both species hunted; highly specialized hunters were least likely to report a satisfying alternative activity, whereas less specialized hunters were most likely to have a substitute. This relationship was significant across states and species hunted, χ^2(3, N = 594 to 932) = 10.62 to 74.32, p = .014 to < .001. Cramer's V effect sizes ranged from .12 to .30 and averaged .23, suggesting that this relationship was relatively "typical" (Vaske, 2008) or "medium" (Cohen, 1988).

The two most popular substitutes were fishing and other big game hunting, and the group of deer hunters in each state who was most likely to report other big game hunting as a substitute was veterans followed by focused, intermediate, and casual hunters (Table 7). Among Utah deer hunters, for example, 22% of casual, 27% of intermediate, 36% of focused, and 46% of veteran hunters reported other big game hunting as a substitute. This pattern was significant and between "small" or "minimal" and "medium" or "typical" for deer hunters in each state, χ^2(3, N = 697 to 873) = 7.82 to 33.30, p = .049 to < .001, V = .10 to .22 (Cohen, 1988; Vaske, 2008). Although there were some statistical differences among groups in the proportion of elk hunters who listed other big game hunting as a substitute, there was no clear pattern among these differences.

-Tables 7 and 8-

Conversely, veteran deer hunters were least likely to consider fishing as a substitute, whereas less specialized deer hunters were most likely to report fishing as a substitute (Table 8). Among Arizona deer hunters, for example, 51% of casual, 48% of intermediate, 34% of focused, and 29% of veteran hunters listed fishing as a substitute. This pattern was significant and between "small" or "minimal" and "medium" or "typical" for deer hunters in each Western state (Arizona, Colorado, Utah, Wyoming), $\chi^2(3, N = 697 \text{ to } 864) = 8.31 \text{ to } 25.89$, $p = .044$ to $< .001$, $V = .09$ to .19 (Cohen, 1988; Vaske, 2008). There were no statistically significant differences among specialization groups in the proportion of deer hunters in Midwest states (Nebraska, North Dakota, South Dakota, Wisconsin) and elk hunters who listed fishing as a substitute. There were also no significant relationships between specialization and selecting other activities as substitutes (e.g., upland bird hunting, waterfowl hunting, wildlife viewing, photography, small game hunting, trapping) for each state and species hunted.

Discussion

This article examined relationships between hunter specialization and activity substitutability. Between 41% and 59% of deer hunters and 38% to 46% of elk hunters reported substitutes. These findings are consistent with other studies where 41% of deer hunters identified activity substitutes (Baumgartner & Heberlein, 1981), and just over half of anglers indicated that another activity could substitute for fishing (Ditton & Sutton, 2004). The most popular substitutes for deer and elk hunting were other consumptive activities such as fishing, other big game hunting, upland bird hunting, and waterfowl hunting. Studies have found similar patterns where hunters are likely to substitute activities that are perceived to share similar characteristics and outcomes as the original (Vaske et al., 1983, 1990). There were also some minor regional differences with hunters in Western states being slightly more likely than those in the Midwest to report activity substitutes. Hunters in Western states were also more likely to consider other big game hunting as substitutes, whereas upland bird and waterfowl hunting were common substitutes in the

Midwest. These findings are somewhat predictable, especially given that several Midwest states are renowned as premier locations for upland bird and waterfowl hunting (Duda et al., 2010). This information about activity substitutes is useful because it helps managers predict demand. If constraints such as hunting regulations or low wildlife population estimates inhibit hunting for one species, demand may increase for other species and managers can use this information to anticipate species that may be targeted and the extent that shifts in hunter effort could occur.

Results also showed that cluster analyses of skill, centrality, equipment, and experience revealed four specialization groups. Casual, intermediate, and veteran groups are consistent with the continuum of specialization hypothesized by Bryan (1977) and found in several other studies (see Manning, 2011; Scott & Shafer, 2001 for reviews). The largest proportion of deer hunters in each state was classified as highly specialized veterans, which is also consistent with past studies of deer hunters (Barro & Manfredo, 1996; Miller & Graefe, 2000). In addition, veteran deer hunters were more prevalent in Western states than the Midwest. Understanding distributions of hunters based on their specialization allows managers to target hunter recruitment and retention efforts, and tailor hunting opportunities to match levels of expertise (Miller & Graefe, 2000).

The fourth group, however, contained focused hunters and the presence of this large group, especially among elk hunters, suggests that trajectories of specialization dimensions are not identical and do not always increase linearly from low to high in identical fashion (Lee & Scott, 2004; Scott & Thigpen, 2003). Focused hunters spent a small proportion of their lives hunting, but felt almost as skilled and committed as veterans. Given that specialization groups did not differ in age, these hunters may have recently taken up and become immersed in hunting by purchasing equipment and developing skills. Socialization factors also could have contributed with focused hunters learning skills from specialized friends or guides. A more probable explanation is that hunting careers for some individuals may be characterized by multimodal participation patterns. People may start hunting as a child or youth and learn from their parents

(O'Leary, Behrens-Tepper, McGuire, & Dottavio, 1987). Participation may decline when attending college or starting a career or family, but increase again later in life when teaching children to hunt or when financial resources are available to afford hunting. Specialization, therefore, may be best suited for revealing styles of involvement and career stages in an activity rather than a linear continuum of progression (Scott & Shafer, 2001). These explanations of the specialization groups, however, are speculative and questions were not asked to determine hunter socialization or participation patterns. Research is required to understand these groups in more detail and determine if they exist for other activities. In addition, longitudinal or panel design studies are needed to determine if these groups progress to more advanced stages in hunting.

Variables used for classifying these specialization groups were generally consistent with past studies and specialization was treated as multidimensional consisting of affective, cognitive, and behavioral factors (Barro & Manfredo, 1996; Lee & Scott, 2004; McFarlane, 2004). Second-order CFAs showed that affective (centrality) and cognitive (skill) dimensions represented hunter specialization better than behavioral factors (equipment, experience). These results are similar to past research (e.g., Jett, Thapa, & Ko, 2009; Lee & Scott, 2004; Needham et al., 2007; Thapa, Graefe, & Meyer, 2006) and suggest that specialization may be best understood in terms of skill and centrality. Equipment and experience were less useful, but still statistically significant. This model was also superior to a summative approach, suggesting that a single specialization index may be imprudent. Additional research, however, is needed to confirm the validity and reliability of these and other items measuring the concept. This study, for example, employed a single item measure of experience (proportion of life hunted) and researchers should use multiple measures of concepts whenever possible (Vaske, 2008). Caution, however, should be exercised when adopting some measures of experience used in other studies. More days of participation, for example, may not imply high specialization. Hunting regulations often permit only one or two

animals to be harvested per season or year. Given their skill and ability, specialized hunters may reach their limit earlier, so could have lower participation compared to unsuccessful hunters.

Findings also showed relationships between these specialization groups and their activity substitutability across states and species hunted where casual hunters were most likely to report a substitute followed by intermediate, focused, and veteran hunters. This inverse relationship is consistent with early hypotheses proposing that participants who become deeply committed and involved in an activity develop specific experiences and preferences, thereby narrowing the range of alternatives and willingness to substitute (Bryan, 1977; Buchanan, 1985). Despite these early hypotheses and findings from this study, however, other research examining relationships between specialization and substitutability is relatively sparse and findings are mixed and inconclusive. Most of this previous research has also focused on resource or site substitutability, not activity substitutability (Hammitt et al., 2004; Hyun & Ditton, 2006; Tseng & Ditton, 2007; Wynveen et al., 2007). For the few studies examining activity substitutes, several have found weak or nonexistent relationships between activity substitutability and specialization (Choi et al., 1994; Sutton & Ditton, 2005). Conversely, a few other studies have found that specialized participants in activities such as hiking and fishing perceived these activities as having fewer substitutes (Baumgartner & Heberlein, 1981; Manfredo & Anderson, 1987; Wu et al., 2008). Most of these studies, however, did not directly measure specialization or used single item measures of the concept (e.g., participation frequency), which have been shown to be less reliable and valid than more contemporary multidimensional approaches (Manning, 2011). This study here extends the literature on substitutability and specialization by: (a) examining activity substitutability, not resource substitutability; (b) measuring specialization directly using multiple variables that recognize the multidimensional nature of this concept (behavioral, cognitive, affective); (c) focusing on hunting instead of other activities such as fishing and hiking; and (d)

revealing a clear and conclusive direct inverse relationship between specialization and activity substitutability that tends to generalize across multiple states and species hunted.

Although these results suggest that processes leading to specialization may impede the search for acceptable substitutes, increasing commitment to an activity can be linked to efforts for gaining knowledge about experiences and opportunities, which may actually increase the number of known alternative activities (Brunson & Shelby, 1993). In fact, some studies have shown that specialized users can be more likely to report substitutes (Hammitt et al., 2004; Tseng & Ditton, 2007). Situational factors such as financial considerations and available time for participation may also influence the ability to substitute irrespective of specialization. Research is needed to determine the extent that the negative relationship between these concepts found in this study extends to more activities, whether positive relationships between these concepts are also possible, and how much situational factors influence these relationships.

From a managerial perspective, it is important that wildlife agencies understand relationships between specialization and substitutability because these concepts may allow managers to predict what types of participants are most likely to substitute and whether other activities could accommodate increasing pressure from these participants. Veteran deer hunters, for example, mostly reported other big game hunting as a substitute, whereas casual deer hunters in many states mostly considered fishing as a substitute. Understanding activity substitutes and their participants may allow managers to predict demands on other species if policy decisions such as seasonal hunting closures constrain deer or elk hunting participation.

In addition, a large proportion of hunters were highly specialized. Given that these hunters were least likely to report substitute activities that could provide wildlife agencies with alternative revenue sources (e.g., fishing license sales), these agencies may experience revenue declines if these individuals reduce hunting participation. In the United States, for example, wildlife oriented recreation participation declined from 109 million participants in 1991 to fewer

than 87 million currently, and data from hunting license sales show a similar trend with the number of hunters in the nation declining from almost 17 million in 1982 to fewer than 14 million currently (Duda et al., 2010). Revenue from substitute activities (e.g., wildlife viewing) may compensate for some losses from hunting. Results from this study, however, suggest that casual hunters and newcomers are the most likely to have a substitute, but this group represents a minority of hunters. The majority of respondents were focused or veteran hunters and these groups were least likely to report a wildlife oriented substitute. As a result, wildlife agencies may not be able to fully retain their largest constituency of wildlife oriented recreationists, and these individuals contribute substantial personnel and financial resources to various conservation initiatives (e.g., Boone and Crockett Club, Rocky Mountain Elk Foundation, Ducks Unlimited; Duda et al., 2010). With fewer wildlife oriented substitutes among these individuals, support for these conservation efforts could diminish. Finding viable alternatives for deer and elk hunting, therefore, is important for keeping individuals interested in conserving natural resources.

These findings begin to generalize across states and species hunted, highlighting the value of researching issues on a regional scale whenever possible. Results, however, may not generalize to other types of hunting (e.g., archery) or species hunted (e.g., moose). In addition, this study focused on activity substitutability and did not examine resource, strategic, or temporal substitutes. Preferences for activity substitutes may change if there are also opportunities to obtain strategic, temporal, or resource substitutes (Brunson & Shelby, 1993). The direct question method used here and in most studies for measuring activity substitutes is also hypothetical because proposed actions may not have occurred (Manning, 2011). Little is known about other variables intervening between intended substitution behavior and actual behavior, and whether hypothetical substitute choices reflect actual decisions when confronted with the need to substitute (Brunson & Shelby, 1993). In addition, questions measuring these activity substitutes did not examine whether these substitutes would occur in the same location or another region or

state, which could have important practical implications. Most recreation studies, including the study here, are also bound by regulatory compliance protocols requiring human subjects to be over a certain age (e.g., 18 years). This may result in a lower proportion of novice or casual participants in a sample than what actually exists in the population because younger participants may have lower rates of experience and lack financial ability to purchase equipment. In addition, data for this study were collected in 2004 and specialization levels and substitution intentions may have shifted since this time. Taken together, therefore, applicability of findings to other years, groups, regions, and types of substitutes remain topics for further empirical investigation.

Notes

1. Mail questionnaires were pretested with other deer/elk hunters in each state (n = 659). Details are provided in Needham, Vaske, and Manfredo (2004).
2. Weights calculated using: Weight = Population %/Sample %, where (Population % = number of hunters in stratum/number hunters in state) and (Sample % = number of respondents in stratum/number of respondents in state). To represent all Arizona deer hunters combined, for example, the weight for Arizona resident deer hunters was 2.05 (32,502 deer hunters in stratum/33,581 deer hunters in state) / (396 respondents in stratum/840 respondents in state) and for nonresident deer hunters it was 0.06 (1,079 deer hunters in stratum/33,581 deer hunters in state) / (444 respondents in stratum/840 respondents in state).
3. Ancillary analyses tested single factor models (all 11 variables forced to load on one factor). These models did not withstand criteria for reasonable fitting models (NFI*, NNFI*, IFI*, CFI* $\leq$ .79; RMSEA* $\geq$ .14), suggesting that traditional single item or summative approaches for measuring specialization may be inappropriate.

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Table 1. Sample sizes and response rates for each state and species hunted

	Mailed questionnaires	Undeliverable questionnaires	Completed questionnaires (*n*)	Response rate (%)
Deer hunters				
Arizona	2,013	73	840	43
Colorado	2,050	54	968	48
Nebraska	2,050	30	947	47
North Dakota	2,050	46	855	43
South Dakota	2,050	20	980	48
Utah	2,050	92	767	39
Wisconsin	2,050	110	843	43
Wyoming	2,050	98	783	40
Total	16,363	523	6,983	44
Elk hunters				
Colorado	2,050	51	1,036	52
Utah	1,857	124	668	39
Wyoming	2,050	75	880	45
Total	5,957	250	2,584	45

Table 2. Proportion of hunters reporting an activity substitute for each state and species hunted

	Activity substitute (%) [1]				
	No	Yes	χ^2-value	*p*-value	Cramer's *V*
Deer hunters			110.77	<.001	.13
Arizona	41	59			
Colorado	43	57			
Nebraska	57	43			
North Dakota	54	46			
South Dakota	55	45			
Utah	50	50			
Wisconsin	59	41			
Wyoming	43	57			
Total	54	46			
Elk hunters			10.18	.006	.07
Colorado	60	40			
Utah	62	38			
Wyoming	54	46			
Total	59	41			

[1] Cell entries are percent (%) who provided a substitute for the open-ended question "what one wildlife oriented activity would you likely do instead of deer/elk hunting" and answered "no" or "yes" to the question "is this one activity a substitute that would give you the same level of satisfaction or benefit that you get from deer/elk hunting?" Hunters reporting substitutes are those answering "yes."

Table 3. Activity substitutes for each state and species hunted

	Activity substitute (%) [1]										
	Fishing	Other big game hunting	Upland bird hunting	Waterfowl hunting	Wildlife viewing/ photography	Small game hunting	Predator hunting	Wildlife trapping	χ^2-value	*p*-value	Cramer's *V*
Deer hunters									1306.82	<.001	.17
Arizona	36	35	10	2	8	5	3	1			
Colorado	28	47	7	9	5	2	1	1			
Nebraska	32	16	26	11	6	5	3	1			
North Dakota	39	5	28	14	6	5	1	2			
South Dakota	32	14	27	16	5	3	2	1			
Utah	35	37	6	9	7	4	1	1			
Wisconsin	55	13	9	8	7	6	1	1			
Wyoming	28	44	9	7	7	3	1	1			
Total	45	20	12	9	7	5	1	1			
Elk hunters									62.46	<.001	.11
Colorado	30	50	5	6	6	1	1	1			
Utah	31	41	5	10	10	1	1	1			
Wyoming	28	46	8	4	9	1	2	1			
Total	29	48	6	7	7	1	1	1			

[1] Cell entries are percent (%) and represent activities provided for the open-ended question "what one wildlife oriented activity would you likely do instead of deer/elk hunting" for those answering "yes" to the question "is this one activity a substitute that would give you the same level of satisfaction or benefit that you get from deer/elk hunting?" Other big game (e.g., bear, moose, sheep, deer [if elk hunter], elk [if deer hunter]), upland bird (e.g., quail, pheasant, grouse), waterfowl (e.g., ducks, geese), small game (e.g., rabbit, squirrel, prairie dog), predator (e.g., coyote, fox, wolf, bobcat).

Table 4. Reliability of specialization dimensions across states and species hunted [1]

		Mean responses (*M*)		Item total correlation		Alpha if deleted		Cronbach's alpha (α)	
Specialization dimensions and variables	Item Code	Range	Average	Range	Average	Range	Average	Range	Average
Centrality								.90-.92	.91
If I stopped deer/elk hunting, an important part of my life would be missing [2]	V_1	5.77-6.16	5.95	.77-.85	.82	.86-.89	.88		
Deer/elk hunting is an annual tradition that has become important to me [2]	V_2	5.95-6.30	6.16	.74-.84	.78	.86-.91	.89		
Participation in deer/elk hunting is a large part of my life [2]	V_3	5.45-5.88	5.65	.84-.88	.86	.85-.89	.87		
Given the effort I have put into deer/elk hunting, it would be difficult to find a replacement activity [2]	V_4	4.97-5.27	5.13	.70-.79	.74	.88-.91	.89		
If I could not deer/elk hunt, I would … [3]	V_5	1.78-1.97	1.87	.58-.71	.65	.90-.91	.91		
Skill [2]								.61-.78	.68
Given the deer/elk hunting skills / knowledge I have developed, it is important I continue to hunt	V_6	5.75-6.06	5.87	.44-.67	.56	.35-.63	.49		
Testing / improving my deer/elk hunting skills is more important to me than harvesting an animal	V_7	5.12-5.70	5.35	.39-.58	.45	.54-.74	.64		
I would describe my skill level in deer/elk hunting as advanced or expert	V_8	4.76-5.39	5.03	.38-.59	.48	.49-.73	.61		
Equipment [2]								.91-.96	.94
I have accumulated a lot of deer/elk hunting equipment	V_9	5.18-6.04	5.59	.83-.92	.88	--	--		
I have invested a lot of money in deer/elk hunting equipment	V_{10}	5.10-5.97	5.54	.83-.92	.88	--	--		
Experience [4]	V_{11}	32.02-58.13	46.33	--	--	--	--	--	--
Overall specialization index								.78-.85	.81

[1] Range represents lowest to highest mean responses and reliability statistics among all 11 strata. Average represents means across all strata.
[2] Variables on 7-point scales of 1 = strongly disagree, 2 = moderately disagree, 3 = slightly disagree, 4 = neither, 5 = slightly agree, 6 = moderately agree, 7 = strongly agree.
[3] Variable on 4-point scale of 0 = not miss it at all, 1 = miss it slightly, 2 = miss it more than most of my other activities, 3 = miss it more than all of my other activities.
[4] Variable calculated as: (number of years hunted deer or elk in life/age * 100) = proportion of life hunted deer or elk (%).

Table 5. Specialization cluster membership for each state and species hunted [1]

	Casual	Intermediate	Focused	Veteran	χ^2-value	*p*-value	Cramer's *V*
Deer hunters					308.45	<.001	.12
Arizona	11	22	17	50			
Colorado	11	21	19	49			
Nebraska	17	26	25	32			
North Dakota	22	22	20	36			
South Dakota	21	24	16	39			
Utah	9	26	16	49			
Wisconsin	14	32	11	43			
Wyoming	9	25	11	55			
Total	14	28	14	44			
Elk hunters					34.91	<.001	.08
Colorado	20	13	41	26			
Utah	21	15	35	29			
Wyoming	17	14	32	37			
Total	19	13	39	29			

[1] Cell entries are percent (%) classified into group by cluster analysis.

Table 6. Proportion of hunters in each specialization cluster reporting activity substitute for each state and species hunted

	Activity substitute (%) [1]						
	Casual	Intermediate	Focused	Veteran	χ^2-value	*p*-value	Cramer's *V*
Deer hunters							
Arizona	69	62	58	55	13.06	.005	.13
Colorado	77	66	63	47	43.28	<.001	.22
Nebraska	58	50	44	30	39.03	<.001	.21
North Dakota	64	60	35	33	56.97	<.001	.27
South Dakota	63	60	39	31	74.32	<.001	.29
Utah	68	55	51	46	10.62	.014	.12
Wisconsin	68	49	45	26	70.21	<.001	.30
Wyoming	75	70	51	48	33.20	<.001	.21
Total	68	53	47	34	379.91	<.001	.24
Elk hunters							
Colorado	61	49	37	27	53.96	<.001	.24
Utah	56	48	39	18	52.37	<.001	.29
Wyoming	71	47	44	35	48.45	<.001	.25
Total	62	49	39	28	135.42	<.001	.24

[1] Cell entries are percent (%) who provided a substitute for the open-ended question "what one wildlife oriented activity would you likely do instead of deer/elk hunting" and answered "yes" to the question "is this one activity a substitute that would give you the same level of satisfaction or benefit that you get from deer/elk hunting?"

Table 7. Proportion of hunters in each specialization cluster reporting "other big game hunting" as activity substitute for each state and species hunted

	"Other big game hunting" as substitute (%) [1]						
	Casual	Intermediate	Focused	Veteran	χ^2-value	*p*-value	Cramer's *V*
Deer hunters							
Arizona	22	23	33	39	19.55	<.001	.16
Colorado	34	38	50	52	19.97	<.001	.15
Nebraska	9	12	13	23	19.95	<.001	.15
North Dakota	3	3	4	8	7.82	.049	.10
South Dakota	5	10	16	21	31.74	<.001	.19
Utah	22	27	36	46	33.30	<.001	.22
Wisconsin	6	11	14	16	8.14	.043	.10
Wyoming	24	41	46	47	11.83	.008	.13
Total	11	15	21	26	123.32	<.001	.14
Elk hunters							
Colorado	46	37	57	46	18.63	<.001	.14
Utah	41	28	40	45	6.87	.076	.11
Wyoming	43	14	59	49	67.99	<.001	.28
Total	45	32	56	46	55.35	<.001	.15

[1] Cell entries are percent (%) who listed "other big game hunting" for the open-ended question "what one wildlife oriented activity would you likely do instead of deer/elk hunting" and answered "yes" to the question "is this one activity a substitute that would give you the same level of satisfaction or benefit that you get from deer/elk hunting?"

Table 8. Proportion of hunters in each specialization cluster reporting "fishing" as activity substitute for each state and species hunted

	"Fishing" as substitute (%) [1]						
	Casual	Intermediate	Focused	Veteran	χ^2-value	*p*-value	Cramer's *V*
Deer hunters							
Arizona	51	48	34	29	25.89	<.001	.19
Colorado	39	32	27	24	13.49	.004	.13
Nebraska	39	35	29	28	7.38	.051	.09
North Dakota	40	40	44	34	4.40	.221	.08
South Dakota	31	38	35	27	6.98	.073	.09
Utah	41	39	36	30	8.31	.029	.09
Wisconsin	55	59	53	52	3.30	.347	.07
Wyoming	41	29	28	23	8.39	.044	.10
Total	51	47	42	39	39.29	<.001	.08
Elk hunters							
Colorado	31	37	26	31	6.31	.097	.08
Utah	29	34	30	30	0.76	.860	.04
Wyoming	25	37	28	30	1.19	.623	.05
Total	29	39	25	30	20.63	<.001	.10

[1] Cell entries are percent (%) who listed "fishing" for the open-ended question "what one wildlife oriented activity would you likely do instead of deer/elk hunting" and answered "yes" to the question "is this one activity a substitute that would give you the same level of satisfaction or benefit that you get from deer/elk hunting?"

Figure 1. Second-order CFAs of four-dimensional measurement model of hunter specialization. First path loadings/coefficients represent range from lowest to highest among all 11 strata (e.g., .83-.88). Second path loadings/coefficients represent average across all strata (e.g., [.86]). All loadings/coefficients are standardized and statistically significant at $p < .001$ across all strata. Model estimation based on Satorra-Bentler robust estimation for multivariate non-normality. Model fit indices: S-B $\chi^2(42) = 198.30$ to 347.32 (average = 251.30), all $p < .001$, NFI* = .91 to .94 (average = .92), NNFI* = .90 to .93 (average = .91), IFI* = .91 to .95 (average = .94), CFI* = .92 to .95 (average = .94), RMSEA* = .07 to .09 (average = .08). See Table 4 for variables corresponding to codes (e.g., V_1).