

Individual and Situational Influences on Declining Hunter Effort in Illinois

CRAIG A. MILLER

Illinois Natural History Survey
Champaign, Illinois, USA

JERRY J. VASKE

Human Dimensions in Natural Resources Unit
Colorado State University
Fort Collins, Colorado, USA

This study examines individual and situational influences on declining hunter effort in Illinois. Data were obtained from a self-administered mail survey of 2,872 (response rate = 67%) resident hunters in Illinois. A series of four separate logistic regressions were constructed to model demographics, past experience, and perceived personal and situational constraints related to declining hunter effort. A final model included variables from each of the separate regressions. Nine variables were significant predictors of hunter effort in the final model: four perceived personal constraints (lack of time, interest, finances, and poor health), three situational constraints (not enough game, no land available for hunting, and too many regulations), and two past experience variables (years of hunting experience and days afield during prior season). None of the demographic variables had a significant influence on hunter effort after controlling for the other predictors in the model. The final model that included past experience and the two sets of perceived constraint measures (personal and situational) explained 91% of the variance and correctly classified 97% of hunters in both the “decreased” and “did not decrease” categories. Discussion focuses on the need for understanding perceived constraints to hunting participation that are within the control of management agencies.

Keywords *hunting, hunter effort, logistic regression models, perceived constraints*

Funding for this study was provided by Federal Aid for Wildlife Restoration Grant W-112-R, the Division of Wildlife Resources of the Illinois Department of Natural Resources, and the Illinois Natural History Survey.

Address correspondence to Craig Miller, Illinois Natural History Survey, 607 East Peabody Drive, Champaign, IL 61820, USA. E-mail: craigm@uiuc.edu

Introduction

Hunting license sales have declined dramatically in many states (Mangun, Hall, & O'Leary, 1996; Mehmood, Zhang, & Armstrong, 2003; U.S. DOI Fish and Wildlife Service, 1996). In Illinois, for example, the hunting population decreased from 5.5% during the mid-1950s to 2.4% during 1999. The number of resident Illinois hunting licenses sold in 1999 (294,000) was approximately equal to the number sold during 1938 and was lower than the number sold in 1942 (309,000), a year in which ammunition was severely rationed due to World War II (Miller, Campbell, Yeagle, & Williams, 2002). For state wildlife agencies, such declines result in less direct revenue from license purchases, less money returned to the Federal Aid in Wildlife Restoration Fund (Pitman-Robertson Act), and potentially less support for wildlife conservation programs (Enck, Decker, & Brown, 2000; Enck, Swift, & Decker, 1993).

Efforts to understand declining hunter participation have suggested *individual* characteristics (e.g., demographics, past experience), and perceived *personal* and *situational* constraints as explanations (Boxall, Watson, & McFarlane, 2001; Decker & Brown, 1979; Enck et al., 1993; Heberlein & Thompson, 1996; Johnson, Vaa, & Gigliotti, 1999; Li, Zinn, Barro, & Manfredo, 2003). This article investigates the individual and combined influence of (a) demographic variables (e.g., age, place of residence), (b) prior experience (e.g., years of hunting experience), (c) personal constraints (e.g., lack of time, lack of finances, no hunting partners, poor health), and (d) situational constraints (e.g., no land available to hunt, low game populations, too many regulations) on changes in hunter effort in Illinois during a 5 year period from the 1995–1996 through the 1999–2000 hunting seasons.

Demographic/Past Experience Influences

Hunting has traditionally been a rural pastime in the United States (Heberlein & Thompson, 1996). As the U.S. population becomes more urbanized and older, fewer rural residents are available for recruitment and fewer young people to carry on the hunting tradition (Boxall et al., 2001). Backman and Wright (1993), for example, identified age and place of residence as barriers to hunting participation. Therefore, we hypothesize:

H₁ Age will influence hunter effort.

H₂ Place of residence will influence hunter effort.

Past research suggests that hunters who become involved in hunting at earlier ages are likely to be more committed and remain involved than those hunters who were introduced to hunting as adults (O'Leary, Behrens-Tepper, McGuire, & Dottavio, 1987; Solfranko & Nolan, 1972; Yoesting & Burkhead, 1973; Yoesting & Christensen, 1978). A study of Colorado hunters (Barro & Manfredo,

1996), for example, found that past experience increased hunters' intention to participate in future rifle deer seasons. Based on this literature, we hypothesize:

H₃ Past experience will influence hunter effort.

Perceived Personal/Situational Constraints

Perceived constraints to participation are dynamic and influenced by life-cycle stages, psychological states, and attributes assigned to the activity (Crawford & Godbey, 1987). The leisure constraints literature, for example, notes the importance of differentiating interested and uninterested nonparticipants (Jackson, 1988, 2000). Interested nonparticipants may want to participate, but are constrained by what they perceive to be barriers to their participation (Jackson & Dunn, 1988). Godbey (1985) characterized constraints affecting interested nonparticipants as those a) beyond agency control and b) those within the control of an agency.

Constraints beyond agency control are often associated with an individual's beliefs about personal barriers to participation (Backman & Wright, 1993; Wright & Goodale, 1981). Lack of time, for example, has been noted as a perceived personal constraint to recreation participation (Ritter, Ditton, & Riechers, 1992). Other similar personal constraints include lack of finances, hunting partners, and poor health (Barro & Manfredi, 1996). Therefore, we hypothesize:

H₄ Perceived personal constraints will influence hunter effort.

Given that hunting is a highly regulated activity, some perceived situational constraints are within an agency's control (e.g., hunting regulations, season length). State wildlife agencies, for example, release preseason population estimates to the outdoor press. Hunter perceptions of wildlife populations may be related to hunter effort. In Illinois, for example, hunter effort declined for pheasant, quail, and cottontail rabbit following agency reported population declines for these species (C. A. Miller, unpublished data).

Although not directly under agency control, access to private lands reflects an important perceived situational constraint on hunter participation (Wright & Kaiser, 1986). From 1960 to 1985, Illinois experienced a 50% decline in the number of family-owned farms (Gunkel, 1988). Although hunters may have personally known landowners and been able to secure permission to hunt on their farms in the past, Illinois hunters have found access to private lands more difficult to obtain in recent years (Miller, Campbell, Yeagle, & Williams, 2002). Liability concerns, leasing, and corporate-owned farms have all been linked to fewer lands accessible to hunters (Wright & Kaiser, 1986). Consequently, we hypothesize:

H₅ Perceived situational constraints will influence hunter effort.

Methods

A self-administered mail survey of Illinois resident hunters was conducted during July and August 2000 using a random sample of individuals who purchased either the resident license or mandatory state habitat stamp. The 12-page questionnaire was pretested by senior staff of the Division of Wildlife Resources in the Illinois Department of Natural Resources and a subsample of 100 Illinois hunters randomly selected from the larger sample.

Survey participants were mailed a questionnaire, cover letter explaining the purpose of the survey, and stamped return envelope. Nonrespondents were mailed a postcard reminder two weeks after the questionnaire. A second questionnaire was mailed to nonrespondents two weeks after the postcard, followed two weeks later with a second postcard reminder. Of the 2,872 questionnaires initially mailed, 1,919 were returned (response rate = 67%).

Variables Measured

Dependent variables—Hunter effort over the five years prior to the study (1995 through 1999) was measured by hunters' response to the question: "In the past five years, has your hunting effort "Increased," "Stayed the same," or "Decreased"? For analysis purposes, responses for "Increased" and "Stayed the same" were collapsed into one category labeled "Did Not Decrease" (coded 0); "Decreased" effort was coded as 1.

Independent variables—Demographic and past experience characteristics: Three demographic variables were examined: age, current place of residence (6-point scale ranging from rural to large city), and place of residence where respondents were raised (same 6-point scale as current place of residence). Prior experience variables included age at first hunting experience, years of hunting experience, and days afield during previous seasons (1999–2000).

Independent variables—Perceived personal and situational constraints: Hunters were asked to select factors affecting their hunting effort from a list of ten items. Six items related to perceived personal constraints: lack of time, lack of interest, lack of finances, no hunting partners, poor health, and too much equipment required. The remaining four items represented perceived situational constraints: too many regulations, season too short, no land available for hunting, and not enough game. All ten items were coded as "1" (Yes) or "0" (No).

Analyses

The distributional characteristics of all the variables for the entire sample were examined first. Bivariate analyses compared the relationship between each independent variable and the dependent variable (hunter effort). A series of four binary logistic regression models were created to predict hunter effort as a function

of each set of independent variables (i.e., demographics, hunting experience, perceived personal constraints, and perceived situational constraints). A final logistic regression model was constructed that included all significant independent variables simultaneously.

Results

Descriptive Findings

In total, 43% of hunters reported their hunting effort had decreased during the 5-year period 1995–1999. Of the remaining 57% of hunters, 26% reported their effort had increased and 31% indicated “no change” in their hunting participation during this time period.¹

Illinois hunters were, on average, 43 years of age. Less than 6% of the hunters were 20 years of age or younger; 50% were 33 to 52 years old. The distribution of hunters by years of hunting in Illinois produced a mean of 25 years. The majority of hunters (56%) had hunted in Illinois for more than 20 years; 14% had hunted less than 5 years. Illinois hunters spent a mean of 18 days afield during the 1999–2000 season.

“Lack of time” (21%), “lack of financial resources” (5%), and “poor health” (5%) were the most commonly cited perceived personal constraints on hunting participation. “No land available for hunting” (26%) and “not enough game” (17%) were mentioned most often as perceived situational constraints.

Bivariate Analyses

Age was the only demographic variable that statistically differentiated hunters whose effort had decreased (mean age=46.4) from those whose effort had not decreased (mean age=40.1, $F=92.33$, $df=1$, 1842, $p<.001$, Table 1). The effect size indicator ($\eta=.218$), however, suggests that the strength of this relationship can be characterized as “minimal” to “typical” (Vaske, Gliner, & Morgan, 2002). Place of current residence or residence as a youth were not statistically related to hunter effort ($p>.05$).

All three of the past experience indicators (i.e., age at first hunting experience, years of hunting experience, days afield during prior season) were statistically associated with hunter effort ($F\geq 10.52$, $df=1$, 1842, $p<.001$, in all cases). Contrary to past research, those who were introduced to hunting at an earlier age ($M=11.2$) were more likely to report decreased hunting effort than those introduced later ($M=12.2$). The effect size ($\eta=.075$) for this relationship, however, suggests that the difference may not be of practical significance, and that the statistical significance might be attributed to the large sample size. Similar to the findings for the demographic age variable, those with more years of experience hunting in Illinois ($M=30.4$) were more likely to indicate decreased effort than those with

TABLE 1 Bivariate Analysis: Demographics and Past Experience

| Variable | Hunter effort decreased | | χ^2 or F-value | p-value | Effect size Cramer's V or eta |
|---------------------------------|-------------------------|------|------------------------|---------|-------------------------------------|
| | Yes | No | | | |
| Demographics | | | | | |
| Age (Mean years) | 46.4 | 40.1 | 92.33 | <.001 | .218 |
| Current residence | | | 3.30 | .347 | .042 |
| Rural area | 43% | 57% | | | |
| Small town | 45 | 55 | | | |
| Small city (5,000 to 50,000) | 39 | 61 | | | |
| Urban area | 42 | 57 | | | |
| Youth residence | | | 5.11 | .164 | .053 |
| Rural area | 45% | 55% | | | |
| Small town | 41 | 59 | | | |
| Small city (5,000 to 50,000) | 37 | 53 | | | |
| Urban area | 41 | 59 | | | |
| Past experience (Means) | | | | | |
| Age at first hunting experience | 11.2 | 12.2 | 10.52 | <.001 | .075 |
| Years of hunting experience | 30.4 | 22.5 | 116.21 | <.001 | .243 |
| Days afield during prior season | 2.3 | 3.2 | 106.06 | <.001 | .232 |

less experience ($M=22.5$). Consistent with prior studies (e.g., Li et al., 2003), people who hunted more days during the prior season were less likely to note a decline in effort.

Bivariate comparisons of hunter effort and each of the six personal and four situational constraints revealed statistically significant differences ($\chi^2 \geq 7.10$, $p < .001$, in all cases; Table 2). Among the perceived personal constraint indicators, only "lack of time" showed a "substantial" relationship ($\phi = .595$, see Vaske et al., 2002). Hunters who reported lack of time as a constraint were 155 times more likely to have decreased hunting participation compared to those who did not feel constrained by time. The effect sizes for the other five perceived personal constraint measures ranged from $\phi = .062$ to $\phi = .246$, suggesting "minimal" to "typical" relationships (Vaske et al., 2002).

Among the perceived situational constraints, "no land available for hunting" ($\phi = .632$) and "not enough game" ($\phi = .512$) had the strongest association with declining hunter effort. For example, hunters who felt they did not have access to hunting lands were 106 times more likely to have decreased participation than hunters who had land available for hunting.

TABLE 2 Bivariate Analysis: Personal and Situational Constraints on Hunter Participation

| Constraint variables | Hunter effort decreased | | χ^2 | p-value | ϕ | Odds ratio |
|---------------------------------|-------------------------|--------|----------|---------|--------|------------|
| | Yes (%) | No (%) | | | | |
| Personal constraints (% Yes) | | | | | | |
| Lack of time | 98 | 2 | 779.58 | <.001 | .595 | 155.45 |
| Lack of interest | 90 | 10 | 50.90 | <.001 | .158 | 12.75 |
| Lack of finances | 88 | 12 | 94.36 | <.001 | .213 | 10.65 |
| No hunting partners | 85 | 15 | 73.12 | <.001 | .192 | 8.56 |
| Poor health | 91 | 9 | 124.17 | <.001 | .246 | 15.53 |
| Too much equipment required | 67 | 33 | 7.10 | <.001 | .062 | 2.73 |
| Situational constraints (% Yes) | | | | | | |
| Too many regulations | 96 | 4 | 225.91 | <.001 | .324 | 40.68 |
| Seasons too short | 93 | 7 | 164.12 | <.001 | .280 | 21.47 |
| No land available for hunting | 97 | 3 | 864.92 | <.001 | .632 | 105.83 |
| Not enough game | 98 | 2 | 575.46 | <.001 | .512 | 101.78 |

Logistic Regression Models for Demographics and Past Experience

The first binary logistic regression model examined the influence of the demographic variables on hunter effort. The independent variables included age, place of residence (rural/urban), and place of residence as a youth (Table 3). Of the three predictors, only age had a significant influence on hunter effort. Consistent with Hypothesis 1, older individuals are more likely to have reduced their hunting participation. Contrary to Hypothesis 2, place of residence (either current or as a youth) had no relationship with hunter effort.

Hunter effort as a function of past experience was the second logistic regression model (Table 3). All three experience variables were statistically significant predictors. Age at introduction to hunting and days afield during the prior season were negatively associated with hunter effort. Years of hunting experience was positively correlated with declining hunter effort, a finding that is consistent with the relationship between age and reduced participation. Consistent with Hypothesis 3, there is a relationship between past experience and hunter effort, although the direction and nature of the association is complex.

The third logistic regression examined the influence of perceived personal constraints on hunter participation (Table 3). Five of the six personal constraints were significant predictors of decreased effort: lack of time, lack of interest, lack

TABLE 3 Logistic Regression Models Predicting Decreased Hunter Participation

| | Partial models | | | Full model ¹ | | | | |
|--------------------------------------|----------------|--------|------------|-------------------------|---------|--------|------------|------------|
| | β | Wald | Odds ratio | p -value | β | Wald | Odds ratio | p -value |
| Demographics model | | | | | | | | |
| Age | 0.03 | 85.96 | 1.03 | <.001 | | | | |
| Place of current residence | 0.01 | 0.01 | 0.99 | .910 | | | | |
| Place of residence as youth | -0.06 | 1.11 | 0.94 | .292 | | | | |
| Past experience model | | | | | | | | |
| Age at first hunting experience | -0.02 | 3.72 | 0.98 | .050 | | | | |
| Years of hunting experience | 0.03 | 83.11 | 1.03 | <.001 | 0.03 | 15.02 | 1.03 | <.001 |
| Days afield during prior season | -0.31 | 101.14 | 0.74 | <.001 | -0.33 | 17.95 | 0.72 | <.001 |
| Personal constraints model | | | | | | | | |
| Lack of time | 5.05 | 169.30 | 155.89 | <.001 | 6.60 | 195.80 | 735.94 | <.001 |
| Lack of interest | 2.38 | 20.78 | 10.80 | <.001 | 4.18 | 28.21 | 65.35 | <.001 |
| Lack of finances | 1.82 | 24.82 | 6.20 | <.001 | 3.07 | 24.48 | 21.50 | <.001 |
| Lack of hunting partners | 1.71 | 22.39 | 5.51 | <.001 | | | | |
| Poor health | 3.13 | 81.39 | 22.91 | <.001 | 4.80 | 109.71 | 121.93 | <.001 |
| Too much equipment required | 0.78 | 2.41 | 2.17 | .121 | | | | |
| Situational constraints model | | | | | | | | |
| Too many regulations | 3.42 | 57.65 | 30.45 | <.001 | 5.04 | 74.48 | 155.16 | <.001 |
| Seasons too short | 2.43 | 34.84 | 11.35 | <.001 | | | | |
| No land available for hunting | 4.38 | 216.13 | 79.41 | <.001 | 5.62 | 195.54 | 274.71 | <.001 |
| Not enough game | 4.22 | 110.99 | 68.15 | <.001 | 5.64 | 128.93 | 281.65 | <.001 |

¹ Only the statistically significant ($p < .05$) are shown for the full model.

of finances, no hunting partners, and poor health. Of the five significant personal constraint predictors, lack of time (odds ratio=155.89) and poor health (odds ratio=22.91) had the strongest association with decreased hunting effort. With the exception of the “too much equipment required” variable ($p=.121$), these findings are consistent with Hypothesis 4.

Four variables measuring perceived situational constraints were used as independent variables in the fourth logistic model. All of these variables were significant predictors of decreased hunting effort: no land available for hunting, not enough game, too many regulations, and season too short (Table 3). “No land available for hunting” (odds ratio=79.41) and “not enough game” (odds ratio=68.15) showed the strongest association with decreased effort in the situational constraints model. These findings support Hypothesis 5.

The final logistic regression examined the combined influence of demographics, past experience, personal constraints, and situational constraints on hunter effort (Table 3). Nine variables were significant predictors of hunter participation in the final model: four personal constraints, three situational constraints, and two past experience variables. None of the demographic variables had a significant influence on hunter effort after controlling for the other predictors in the model.

Of the nine significant variables, lack of time (a personal constraint), not enough game (a situation constraint), and no land available for hunting (a situational constraint), had the largest impact on hunter effort. For example, hunters who indicated a lack of time as affecting participation were 736 times more likely to indicate decreased effort than those for whom time was not a constraint. Hunters who felt there was not enough game were 282 times more likely to have decreased their hunting participation, and those with no land available to them were 275 times more likely to have decreased effort. The two past experience variables were weak predictors of hunter participation.

Of the initial four regression models, the situational constraints model explained the most variance ($R^2=68\%$) and correctly classified 89% of hunters by effort (Table 4). The personal constraints model accounted for 56% of the variance and correctly classified 83% of the hunters. The demographics and past experience models explained the least variance in hunter effort ($R^2=.07$ and $.15$, respectively). The combined model that included past experience and the two sets of perceived constraints measures (personal and situational) had an R^2 of 91% and correctly classified 97 % of hunters in both the “decreased” and “did not decrease” categories.

Discussion

This study examined the individual and combined influence of demographics, past experience, and perceived personal and situational constraints on hunter effort in

TABLE 4 Comparison of Partial and Full Models

| Models | χ^2 | df | Nagelkerke R ² | Hunter effort % Correctly classified: | | |
|----------------------------|----------|----|------------------------------|--|---------------------|---------|
| | | | | Decreased | Did not decrease | Overall |
| Demographics | 94.78 | 3 | .07 | 33 | 81 | 61 |
| Past experience | 212.92 | 3 | .15 | 49 | 78 | 66 |
| Personal constraints | 1006.77 | 6 | .56 | 66 | 96 | 83 |
| Situational constraints | 1339.09 | 4 | .68 | 78 | 97 | 89 |
| Full model | 2082.60 | 10 | .91 | 97 | 97 | 97 |

Illinois. Across all respondents, 43% of hunters indicated that their participation in the activity had decreased during the past five years. These findings are consistent with national trends (Enck et al., 2000; Heberlein & Thompson, 1996; Mangun et al., 1996; Mehmood et al., 2003; U.S. DOI Fish & Wildlife Service, 1996).

Previous studies examining hunter participation from a demographic perspective have proposed age and place of residence as significant predictors of hunter effort (e.g., Backman & Wright, 1993; Li et al., 2003). Aging hunter populations reflect the overall American population, especially in rural regions. Age, however, was not a significant predictor of decreased effort once the influences of situational and personal constraints were controlled. Results of this study also bring into question the relative importance of place of residence (either current or as a youth) in predicting hunter effort. The nature of the activity dictates that hunting will occur in less populated areas. A person growing up in a rural area is more likely to be introduced to hunting than someone raised in a city, but place of residence is not a good predictor of hunter effort. Consistent with other research (Donnelly & Vaske, 1995), these general demographic variables (e.g., age, place of residence) have less predictive power than more specific psychological constructs (e.g., perceived personal and situational constraints).

Two measures of past experience were significant predictors of hunter effort in the final model. The finding of days afield during the year prior to this study as a significant predictor suggests that hunters may be relatively consistent in their participation patterns. Hunters who spent more days afield during the previous year indicated a low likelihood of decreased participation over the previous five years. Similar to the demographic indicators, however, measures of past experience were relatively weak predictors of declining hunter effort ($R^2 = 15\%$).

The best predictors of decreased hunter effort were the perceived personal and situational constraints. Of these, the personal constraint “lack of time” and the situational constraints “no land available for hunting” and “not enough game” had the greatest influence on decreased effort. Hunters who perceived lack of time to hunt were 736 times more likely to have reported decreased hunting efforts. When “lack of time” is viewed in combination with “no land available for hunting,” the concept of time may extend to the time needed to find a place to hunt. With more than 96% of the state in private ownership, Illinois hunters are dependent on private land for hunting opportunities. Changing agricultural practices and land ownership (e.g., commercial agriculture), increased residential and commercial development, and shifts in public values related to hunting may all contribute to loss of hunting access to private land (Miller, 2002). Hunters displaced from lands may not have the time or resources to devote to finding new places to participate in the activity. Efforts required to find new areas for hunting and frustrations that can arise from failure to gain access can lead to decreased participation in hunting.

Perceptions of not enough game ranked third in predicting hunter effort in the overall model. Hunters were almost 282 times more likely to have decreased their efforts if they perceived game populations to be low. Understanding the causal linkages between perceptions of game populations and declining hunter effort is beyond the scope of this article, but deserves attention in future work. The constraint of “too many regulations” supports the findings of Wentz and Seng (1999) in a study of hunter retention. In that investigation, Michigan hunters who were new to the state perceived regulations to be onerous and therefore decreased their participation in hunting.

Management Implications

Of the nine variables in the final predictive model, seven were perceived constraints. Three of the seven are situational constraints that may be influenced by wildlife managers: no land available for hunting, not enough game, and too many regulations. Land access for hunting is a growing concern among wildlife agencies, particularly in the Midwest, Central Plains, and many eastern states where the proportion of private to public land makes access to private land an important component of hunting. Providing access to private land and having such lands within reasonable proximity to hunters throughout a given state may contribute to hunter retention.

Perceptions of game populations are influenced by agency-provided information about game. While the populations of some waterfowl species (e.g., pintails, canvasbacks) are currently at low levels, Canada goose, wild turkey, and white-tailed deer populations are at historic records highs. Findings reported here suggest managers should consider hunter perceptions of game populations when providing information about the species.

Managers can also address the notion of too many regulations. In Illinois, for example, hunting permits for many state lands are issued separately for each individual site. Each of these state sites also have regulations specific for that area. Administrative regulations such as these can be perceived as constraints to hunter participation and lead to decreased effort (Miller, Anderson, Campbell, & Yeagle, 2001). Seasons and bag limits may also contribute to this sense of regulatory constraint. Illinois regulations contain 29 due dates for permits for 12 species spread over 11 months (2002 Digest of Hunting and Trapping Regulations, Illinois Department of Natural Resources). Hunters new to the activity, new to the state, or interested in hunting different game species may find such regulatory requirements a hindrance to participation.

Declining hunter involvement is a complex, multidimensional issue that cannot be explained simply on the basis of demographics or lack of time. Commitment and investment in hunting, social networks that reinforce and encourage participation, and situational constraints (e.g., regulations, lack of hunting land) all act in concert to influence an individual's ability and willingness to go hunting. As agencies are dependent on hunters for operating funds and support for wildlife programs, we must broaden our understanding of the diverse nature of hunter involvement if hunters are to continue to provide this support.

Note

1. For purposes of this article, the responses "increased" and "no change" were combined into a single category "hunter effort did not decrease." This decision was based on ancillary analyses that revealed the predictive models for the 2-category dependent variable yielded the same conclusions as the models including the 3-category response measure.

References

- Backman, S. J., & Wright, B. A. (1993). An exploratory study of the relationship of attitude and the perception of constraints to hunting. *Journal of Park and Recreation Administration, 11*, 1–16.
- Barro, S. C., & Manfredi, M. J. (1996). Constraints, psychological involvement, and hunting participation: Development and testing of a model. *Human Dimensions of Wildlife, 1*, 42–61.
- Boxall, P. C., Watson, D. O., & McFarlane, B. L. (2001). Some aspects of the anatomy of Alberta's hunting decline: 1990–1997. *Human Dimensions of Wildlife, 6*, 97–114.
- Crawford, D. W., & Godbey, G. (1987). Recreational barriers to family leisure. *Leisure Sciences, 9*, 119–127.
- Decker, D. J., & Brown, T. L. (1979). Hunting in New York: Participation, demand, and land access. *New York Fish and Game Journal, 26*, 101–131.
- Donnelly, M. P., & Vaske, J. J. (1995). Predicting attitudes toward a proposed moose hunt. *Society and Natural Resources, 8*, 307–319.
- Enck, J. W., Decker, D. J., & Brown, T. L. (2000). Status of hunter recruitment and retention in the United States. *Wildlife Society Bulletin, 28*, 817–824.

- Enck, J. W., Swift, B. L., & Decker, D. J. (1993). Reasons for decline in duck hunting: Insights from New York. *Wildlife Society Bulletin*, 21, 10–21.
- Godbey, G. (1985). Nonuse of public leisure services: A model. *Journal of Park and Recreation Administration*, 3, 1–12.
- Gunkel, N. (1988). Place to hunt committee: A cooperative Illinois program. In R. McCabe (Ed.). *Transactions of the 53rd North American Wildlife and Natural Resources Conference* (pp. 350–360). Wildlife Management Institute, Washington, D.C.
- Heberlein, T. A., & Thompson, E. (1996). Changes in U.S. Hunting participation, 1980–90. *Human Dimensions of Wildlife*, 1, 85–86.
- Jackson, E. L. 2000. Will research on leisure constraints still be relevant in the twenty-first century? *Journal of Leisure Research* 32, 62–68.
- Jackson, E. L. (1988). Leisure constraints: A survey of past research. *Leisure Sciences*, 10, 203–215.
- Jackson, E. L., & Dunn, E. (1988). Integrating ceasing participation with other aspects of leisure behavior. *Journal of Leisure Research*, 20, 31–45.
- Johnson, R. R., Vaa, S., & Gigliotti, L. (1999). To hunt or not to hunt? What makes duck hunters tick? *South Dakota Conservation Digest*, July/August, 3–7.
- Li, C., Zinn, H., Barro, S. C., & Manfredo, M. J. (2003). A cross-regional comparison of recreation patterns of older hunters. *Leisure Sciences*, 25, 1–16.
- Mangun, J. C., Hall, D. A., & O'Leary, J. T. (1996). Desertion in the ranks: recruitment and retention of sportsmen. *Transactions of the North American Wildlife and Natural Resources Conference*, 61, 338–344.
- Mehmood, S., Zhang, D., & Armstrong, J. (2003). Factors associated with declining hunting license sales in Alabama. *Human Dimensions of Wildlife*, 8, in this issue.
- Miller, C. A. (2002). Big bucks: Balancing resident and nonresident bowhunter demand in Illinois. In R. Warren (Ed.). *Proceedings of the 1st National Bowhunting Conference* (pp. 125–133). The Wildlife Society: Bethesda, MD.
- Miller, C. A., Anderson, W. L., Campbell, L. K., & Yeagle, J. A. 2001. *Results of the 2000 Illinois Hunter Harvest Survey*. Job Completion Report, Federal Aid in Wildlife Restoration W-112-R-10. Human Dimensions Program Report HR-01-01. Champaign, IL: Illinois Natural History Survey.
- Miller, C. A., Campbell, L. K., & Yeagle, J. A. (2002). *Results of the 1999 Illinois hunter harvest survey*. Job Completion Report, Federal Aid in Wildlife Restoration W-112-R-9. Human Dimensions Program Report HR-00-01. Champaign, IL: Illinois Natural History Survey.
- Miller, C. A., Campbell, L. K., Yeagle, J. A., & Williams, R. J. (2002). *Hunter access to private lands in Illinois*. Job Completion Report, Federal Aid in Wildlife Restoration W-112-R-10. Human Dimensions Program Report SR-01-01. Champaign, IL: Illinois Natural History Survey.
- O'Leary, J. T., Behrens-Tepper, J., McGuire, F. A., & Dottavio, F.D. (1987). Age at first hunting experience: Results from a national survey. *Leisure Sciences*, 9, 225–233.
- Ritter, C., Ditton, R. B., & Riechers, R. K. (1992). Constraints to sport fishing: Implications for fisheries management. *Fisheries*, 17, 16–19.
- Solfranko, A. J., & Nolan, M. F. (1972). Early life experience and adult sports participation. *Journal of Leisure Research*, 4, 6–18.
- U.S. Department of the Interior, Fish and Wildlife Service, and U.S. Department of Commerce, Bureau of the Census. (1996). *National Survey of Fishing, Hunting, and Wildlife-Associated Recreation*.

- Vaske, J. J., Gliner, J. A., & Morgan, G. A. (2002). Communicating judgements about practical significance: Effect size, confidence intervals and odds ratios. *Human Dimensions of Wildlife, 7*, 287–300.
- Wentz, J., & Seng, P. (1999). *Hunter retention: An investigation into the development of a national program*. Report to the National Shooting Sports Foundation, Federal Aid in Sport Fish and Wildlife Restoration Grant 1448-98210-98-G038.
- Wright, B. A., & Goodale, T. L. (1981). Beyond nonparticipation: Validation of interest and frequency of participation categories in constraints research. *Journal of Leisure Research, 23*, 314–335.
- Wright, B. A., & Kaiser, R. A. (1986). Wildlife administrators' perceptions of hunter access problems: A national overview. *Wildlife Society Bulletin, 14*, 30–35.
- Yoesting, D. R., & Burkhead, D. L. (1973). Significance of childhood recreation experience on adult leisure behavior: An exploratory analysis. *Journal of Leisure Research, 5*, 25–36.
- Yoesting D. R., & Christense, J. E. (1978). Reexamining the significance of childhood recreation patterns on adult leisure behavior. *Leisure Sciences, 1*, 219–229.