Understanding Angler and Hunter Annual Spending in North Carolina

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Abstract: Given the economic importance of fishing and hunting and the pervasive declines in these activities, it is essential that natural resource planners and managers understand factors influencing angler and hunter spending. We conducted a mail survey of a random sample ($n = 844$) of North Carolina fishing and hunting license holders. On average, anglers spent US$964 and hunters spent $1,437 annually. The model that best explained annual angler expenditures included gender, age, number of days spent fishing annually, total value of their equipment, income, whether someone in their household had lost a job due to the economy, and importance of fishing to the respondent. The model that best explained annual hunter expenditures included number of days spent hunting annually, total value of their equipment, income, whether someone in their household had lost a job due to the economy, importance of hunting to the respondent, and whether they felt the current state of the economy would impact their hunting practices. All else equal, female anglers spent more than male anglers and the number of days anglers and hunters spent participating in their respective activity annually was negatively related to the amount they spent. Participants in activities with short seasons spent more than the average (e.g., 43% more for striped bass anglers, 170% more for bear hunters). Our results suggest job loss among both anglers and hunters led to increased spending. Fishing and hunting may represent a stabilizing force for local economies during economic recessions. Future research should explore why anglers and hunters who spend less time in the field spend more money than sportspersons who spend more time in the field and explore the relationships between economic downturns and fishing and hunting participation.

Key words: angler expenditures, fishing, human dimensions, hunter expenditures, hunting, North Carolina

Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 64:88–94

Angling and hunting play critical roles in fisheries and wildlife conservation and management throughout North America. These activities promote human connections with nature, control wildlife populations, and generate critical funding for wildlife management (Geist et al. 2001). Angler and hunter expenditures provide vital sources of funding for wildlife management agencies (Jacobson et al. 2010) through fishing and hunting license sales (Gabelhouse 2005, Jacobson et al. 2010) and through Dingell Johnson and Pittman Robertson excise taxes on purchases of fishing and hunting equipment (Gabelhouse 2005, Fairbrother 2009, Jacobson et al. 2010). Angling and hunting create millions of jobs across the United States (USDI and USDC 2008) and are especially beneficial in providing revenue to rural businesses, landowners, and communities (Wallace et al. 1991). Sales and excise taxes on equipment generate revenue for federal and state governments. Given the persistent difficulty in securing nongame funding through initiatives like the Conservation and Reinvestment Act (CARA) (Zanetell and Rassam 2003), hunter and angler expenditures remain vital sources of funding for wildlife management agencies (Jacobson et al. 2010).

Considerable recent literature has examined declines in angler and hunter participation (DiCamillo and Schaffer 2000, Enck et al. 2000, Dizard 2003, USDI and USDC 2008), yet little research has focused on individual angler and hunter spending. Further, few studies have assessed the impacts of major economic recessions

on angler and hunter spending. Intuition and economic theory suggest that discretionary spending is likely to decrease when unemployment rises and incomes decline. However, Long (1987) found that recessions can actually increase economies in areas dependent on natural resource-based recreation. The recession that began in 2008 provided an opportunity to assess these hypotheses in contexts of angling and hunting. Initial research in this arena found that from January to December 2009, fishing license sales in 11 states across the United States increased 4.7% over sales in 2008 (American Sportfishing Association 2010). These states were selected on their ability to provide long-term license data, but if these numbers hold true across the country, this change would represent one of the largest increases in fishing license sales in over 30 years (American Sportfishing Association 2010). Similarly, sales of hunting licenses in 12 states increased 3.5% in 2009 over sales in 2008, after remaining stable from 2005–2007. If the 3.5% increase is nationwide, it would mark one of the largest increases in license sales in over 20 years (National Shooting Sports Foundation 2010). These increases in license sales may reflect an increase in discretionary time and a shift from more expensive activities to angling and hunting.

Shrinking state budgets associated with the 2008 recession and ongoing declines in both angler and hunter spending and participation create a need to understand predictors of expenditures on fishing and hunting in the context of a major recession. We address this need with a case study in North Carolina. As in many states, days spent angling and hunting and expenditures related to those activities declined in North Carolina between 1996 and 2006 (USDI and USDC 1998, 2008). These declines threaten over 28,900 jobs, $687 million in salaries, and over $194 million in federal and $169 million in local and state tax revenues annually (Southwick Associates 2008). Further, approximately 17% of the North Carolina Wildlife Resources Commission's (NCWRC) funding comes from Pittman Robertson and Dingell Johnson funds and about 21% is derived from fishing and hunting license sales (T. Clark, NCWRC, personal communication). In this paper we evaluate expenditures on fishing and hunting in North Carolina and assess how socio-demographic variables, including those related to the 2008 recession (e.g., family job loss), impacted spending behaviors.

Methods

We developed a self-administered mail survey collaboratively with NCWRC Human Dimensions Biologists. We developed the questionnaire using cognitive interviews with 16 anglers and hunters and a pre-test (n = 33) of randomly selected North Carolina fishing and hunting license holders. We used the cognitive interviews and pretest to identify and resolve problems with question comprehension, wording, and skip patterns.

We mailed the survey instrument to a random sample of 3,000 individuals who held a current North Carolina fishing or hunting license (purchased within 12 months prior to sampling). Survey administration followed a modification of Dillman's Tailored Design Method (Dillman 2007) traditionally used by the NCWRC (Jenkins et al. 2010). The process involved four mailings: first survey packet, reminder postcard, second survey packet, and third survey packet. Survey packets included a cover letter, a survey booklet with prepaid return postage, and a sticker to seal the booklet. Respondents were entered into a raffle to win a North Carolina Lifetime Sportsmans License as an incentive to complete the survey.

We modeled annual expenditures of North Carolina anglers and hunters using ordinary least squares (OLS) regression (Mendenhall and Sincich 2003). The dependent variables (amount spent on fishing) and (amount spent on hunting) were continuous. We plotted the residuals of the dependent variables and found they were heteroskedastic (held non-constant variance), which is common with economic variables. To address this, we added one to each response to prevent errors in cases where the value was zero and transformed expenditures by their natural logs (Mendenhall and Sincich 2003). Models for angler and hunter expenditures were estimated separately; only those who answered the question "do you consider yourself primarily an angler, primarily a hunter, both an angler and a hunter, or neither" with "primarily an angler" or "both an angler and a hunter" were included in the models predicting angler annual expenditures. Likewise, only those who identified themselves as "primarily a hunter" or "both an angler and a hunter" were included in the models predicting hunter annual expenditures.

We selected 12 candidate variables for the global model based on hypotheses developed from theoretical relationships and past literature (e.g., Miller and Hay 1981, Offenbach and Goodwin 1994, Davies 2002; Tables 1 and 2). We used a backward selection method to find best models at each level of variable inclusion, then used the Akaike Information Criterion (AIC) to compare the models (Burnham and Anderson 2002). We selected the model with smallest AIC value as the "best fit" model, but report results for all models with delta AIC ≤ 2 (Table 3). SPSS 17.0 software (SPSS 2008) was used to estimate parameters and calculate statistics.

Based on previous research (Davies 2002), we hypothesized participation in both angling and hunting would be positively related to spending. We asked respondents how many days they had fished and hunted over the past year, and included the variable (days) as a continuous variable in our models (Table 1) with the hypothesis that it would be positively related to spending. Because days spent fishing/hunting was unexpectedly negatively related to annual expenditures, we conducted an additional analysis to compare expenditures of sportspersons participating in fishing/hunting activities with short seasons and specialized equipment to expenditures of

Table 1. Mean and standard deviation of variables from 2009 survey of North Carolina fishing and hunting license holders.

Variable	Description	Mean (std. dev) anglers	Mean (std. dev) hunters
ln (amount spent on fishing/hunting)	Natural log of the dollar amount (plus 1) spent fishing/hunting in the past year	5.87 (1.44)	6.57 (1.43)
importance fishing/ hunting	Likert scale of the level of importance of fishing/hunting (1 = not important; 2 = somewhat important; 3 = very important; 4 = essential)	2.91 (0.71)	3.20 (0.73)
days fished/hunted	Number of days spent fishing/hunting in the past year	33.01 (47.36)	22.54 (34.71)
ln (fishing/hunting equipment)	Natural log of the number of dollars (plus 1) it would take to replace all fishing/hunting equipment currently owned	7.71 (1.90)	8.62 (1.25)
eat fish[a]	Ordinal frequency of eating the fish caught (1 = never; 2 = almost never; 3 = sometimes; 4 = almost always; 5 = always)	2.89 (1.21)	NA
income	Income (in thousands of dollars) midpoint of respondent's income bracket	65.88 (46.62)	67.44 (45.42)
age	Age in years	46.63 (12.36)	44.83 (12.42)

a. Hunters were not asked

Table 2. Mean and standard deviation of binary variables from 2009 survey of North Carolina fishing and hunting license holders.

Variables	Description	Proportion of positive responses anglers	Proportion of positive responses hunters
job loss	The respondent (or someone in the household) has experienced job loss in the past year (0 = no; 1 = yes)	0.25	0.23
economy impact	Believes the state of the economy will impact personal fishing/hunting practices (0 = no; 1 = yes)	0.49	0.51
gender	Gender of the respondent (0 = female; 1 = male)	0.87	0.93
education	Level of education (0 = high school or less; 1 = vocational training or greater)	0.62	0.57

Table 3. Models predicting angler and hunter annual expenditures with Delta AIC values less than two resulting from 2009 survey of North Carolina fishing and hunting license holders.

Candidate model	AIC	Delta AIC	Akaike Weight	Evidence ratio
For anglers				
(1) importance[a] + days + ln (equipment)[b] + job loss[c] + gender[d] + income[e] + age[f] + age^2	85.386	0.000	0.195	1.000
(2) importance + days + ln (equipment) + job loss + gender + income + age + age^2 + education	85.635	0.25	0.172	1.133
(3) importance + ln (equipment) + job loss + income	85.798	0.412	0.159	1.229
(4) importance + ln (equipment) + job loss + gender + income + age + age^2	86.145	0.76	0.133	1.462
(5) importance + days + ln (equipment) + job loss + job X importance + gender + income + age + age^2 + education	86.465	1.08	0.114	1.716
(6) importance + ln (equipment) + job loss + income + age + age^2	86.536	1.15	0.11	1.777
For hunters				
(1) importance + days + ln (equipment) + job loss + economy impact[g] + income	93.262	0.000	0.264	1.000
(2) importance + days + ln (equipment) + age + job loss + economy impact + income	93.544	0.283	0.229	1.152
(3) importance + days + ln (equipment) + job loss + income	93.670	0.409	0.215	1.227
(4) importance + days + ln (equipment) + age + job loss + job X importance + economy impact + income	95.244	1.983	0.098	2.695

a. Likert scale of the level of importance of fishing/hunting (1= not Important; 2= somewhat important; 3 = very Important; 4 = essential)

b. Natural log of the number of dollars (plus 1) it would take to replace all fishing/hunting equipment currently owned

c. The respondent (or someone in the household) had experienced job loss in the past year (0 = no; 1 = yes)

d. Gender of the respondent (0 = female; 1 = male)

e. Income (in thousands of dollars) midpoint of respondent's income bracket

f. Age (in years) was divided by 10 and centered for the regression analysis

g. Believed the state of the economy will impact personal fishing/hunting practices (0 = no; 1 = yes)

sportspersons engaged in activities with longer seasons and more generalized equipment. We used a means comparison test (*t*-test) to compare the average annual expenditures of striped bass anglers with all anglers, and similarly compared the average annual expenditures of black bear hunters to all hunters. Striped bass seasons are two months per year in the Roanoke River and seven months in the Albemarle Sound, two places where striped bass are most prevalent in the state. Most inland fisheries species in North Carolina have no season limit, so we deduced striped bass were a representative short-season species. Black bear season varies throughout the state, with an average season length of 28 days. This is significantly smaller than the average season length of other species we tested for in our survey, which was 94 days.

Past literature demonstrates that gender (being male) and income are positive predictors of hunting participation (Miller and Hay 1981). We included gender and income in our models with the prediction both would be positively related to spending. As education level and income are typically related, we further hypothesized that education would be positively related to spending. Gender was coded as a binary variable (0 = female, 1 = male). We asked respondents to identify their annual household income bracket (e.g., $50,000 to $74,999). We used the midpoint of the respondent's selected income bracket as the value for the respondent; for example if a respondent selected the $50,000 to $74,999 bracket, their response was coded as $62,500. We included education as a binary variable (0 = high school education or less, 1 = vocational training or higher).

Davies (2002) found that participation in recreational sport-

ing activities (including angling and shooting activities) was significantly positively correlated with expenditures on related goods, such as equipment, clothing, and travel. The relevance of investment in hunting equipment to hunter behavior has also been demonstrated (Offenbach and Goodwin 1994). We included value of fishing or hunting equipment and participation frequency in the models and predicted they would be positively related to annual spending. To determine the value of respondents' equipment, we asked "If you had to replace all of your fishing/hunting equipment today, how much would it cost?" We coded equipment values (fishing equipment and hunting equipment) as continuous variables. Due to their skewed distributions we transformed them by adding one and taking the natural log (Mendenhall and Sincich 2003). Participation frequency and amount spent on equipment may be values of how important the activity is to the participant. Because of this we asked respondents how important fishing/hunting is to them on a four-point likert scale (1 = not important, to 4 = essential) and included the variable in the models with the prediction it would have a positive influence on spending behavior. Further we hypothesized that the frequency that anglers eat their catch would be positively related to annual spending. We asked anglers to identify how often they eat the fish they catch on a five-point likert scale (1 = always, to 5 = never).

Miller and Hay (1981) found age to be positively related to hunting participation; however, Offenbach and Goodwin (1994) found age to be negatively related to demand for hunting trips. Because these findings suggest potential nonlinearity in relationships between age and hunting expenditures, we included age in the models with the prediction it would be positively related to spending, and included age-squared as a variable to assess the potential for a bell-shaped distribution around the mean. Including the quadratic term required us to center the variable by subtracting the mean from each response (Mendenhall and Sincich 2003). Further, we divided age by 10 to make age coefficients more comparable with those for other variables in our models (Mendenhall and Sincich 2003).

Because recessions have been linked to increased angler and hunter participation (e.g., license sales; American Sportfishing Association 2010, National Shooting Sports Foundation 2010), we hypothesized that perceived effects of the 2008 recession would be positively related to spending. We assessed perceived impacts by asking respondents two questions: 1) Have you or anyone in your household lost your job due to the current state of the United States economy? (0 = no, 1 = yes), 2) Do you believe the current state of the United States economy will impact your hunting or fishing practices? (0 = no, 1 = yes). Because a loss of job would indicate a decrease in income, we predicted that it would be negatively related to annual expenditures. We hypothesized that loss of job may affect those that felt angling or hunting was important differently than it would affect those who did not feel it was as important, and created an interaction between these two variables to represent this relationship.

We conducted phone interviews with non-respondents ($n = 76$) to assess non-response bias. The non-response interview was an abbreviated version of the mail survey which included importance of fishing/hunting to the respondent. We attempted to contact each respondent four times before removing them from the sample. We were able to access age and gender information for the entire population of angling and hunting license holders. Because age and gender were included in the best model for angler expenditures, we conducted t-tests comparing the mean age and gender proportions from angler survey respondents with the population data. We detected differences for both gender ($P < 0.01$) and age ($P < 0.001$), and replaced sample means for age and gender with population means to predict an adjusted estimate of annual expenditures among anglers. We also compared importance of fishing/hunting among mail survey respondents to importance of fishing/hunting among non-response phone survey participants with *t*-tests, and detected no differences ($P > 0.05$ for all comparisons).

Results

We received 844 returned surveys for a response rate of 34% after adjusting for undeliverable addresses. Nearly half (48%; $n = 396$) of respondents reported being both anglers and hunters, 33% ($n = 280$) reported being primarily anglers, and 12% ($n = 102$) reported being primarily hunters. Hunter respondents were predominately male (93%), were 44 years old on average, and reported spending an average of $1,437 annually on hunting. Angler respondents were predominately male (87%) and were 46 years old on average. These estimates differed from the population, which was 83% male and had a mean age of 42. Because non-response bias tests indicated gender and age biases within the sample of anglers, we replaced sample data with population data for gender and age and calculated an adjusted annual angler spending amount of $964.

Evidence supported multiple candidate models for predicting angler and hunter spending (Table 3). The best approximating model for angler expenditures included: whether they had lost a job due to the economy, importance of fishing to respondents, number of days spent fishing annually, the natural log of the total value of their equipment, gender, income, age, and age-squared (Table 4). The best approximating model for hunter expenditures included: whether they had lost a job due to the economy, importance of hunting to the respondent, number of days spent hunt-

Table 4. Coefficients and significance of OLS regression results for empirical models describing angler/hunter spending behavior over the past 12 months, as reported on mail surveys of fishing and hunting license holders in North Carolina in 2009. (Model 1, n = 514; Model 2, n = 369; *P ≤ 0.1; **P ≤ 0.05; ***P ≤ 0.01; ****P ≤ 0.00)

	Coefficients	
Independent Variables	**ln (annual fishing related expenditures)[a]**	**ln (annual hunting related expenditures)[a]**
Importance fishing/hunting[b]	0.492****	0.291***
Days fished/hunted	–0.002*	–0.005***
ln fishing/hunting equipment value[c]	0.435****	0.572****
Job loss[d]	0.27**	0.283**
Economy impact[e]	N/A	0.191
Gender[f]	–0.237*	N/A
Income[g]	0.002**	0.003**
Age[h]	–0.028	N/A
Age squared	–0.055**	N/A
Intercept	1.187****	0.455
R^2 (adjusted R^2)	0.467 (.459)	0.383 (.373)

a. Natural log of the dollar amount (plus 1) spent fishing/hunting in the past year
b. Likert scale of the level of importance of fishing/hunting (1= not important; 2= somewhat important; 3 = very important; 4 = essential)
c. Natural log of the number of dollars (plus 1) it would take to replace all fishing/hunting equipment currently owned
d. The respondent (or someone in the household) had experienced job loss in the past year (0 = no; 1 = yes)
e. Believed the state of the economy will impact personal fishing/hunting practices (0 = no; 1 = yes)
f. Gender of the respondent (0 = female; 1 = male)
g. Income (in thousands of dollars) midpoint of respondent's income bracket
h. Age (in years) was divided by 10 and centered for the regression analysis

ing annually, the natural log of the total value of their equipment, whether they felt the current state of the economy would impact their hunting practices, and income (Table 4).

Both importance of fishing/hunting and the natural log of fishing/hunting equipment values were positively related to annual expenditures (Table 4). Days (days fishing/days hunting) was negatively related with expenditures. Sportspersons who participated in activities with shorter than average seasons (striped bass anglers and black bear anglers) spent more on an annual basis than other anglers and hunters. Striped bass anglers in our sample spent an average of $1,203, 43% higher than the average for non-striped bass anglers ($t = -1.76$, $P = 0.079$). Similarly, black bear hunters spent an average of $2,801 annually, 170% higher than the average for non-black bear hunters ($t = -6.03$, $P < 0.001$).

Income was positively related to annual expenditures for both anglers and hunters, however, job loss had a positive impact on both anglers' and hunters' annual expenditures (Table 4). The variable describing whether the respondent felt the economy would impact their fishing or hunting practices (economy impact) only appeared in models predicting hunter spending and suggested individuals who felt the economy would impact their hunting and fishing practices also spent more money.

Gender was found to only have explanatory power in the angler models and suggested that holding other factors constant, female anglers in North Carolina spend more on fishing annually than male anglers. Age did not have explanatory power for hunters. For anglers, age-squared was a significant predictor ($P = 0.05$) and age was not ($P = 0.486$), indicating that the relationship between age and annual expenditures was non-linear (Table 4). Because the age variable was centered at its mean, the negative coefficient for age-squared (–0.055; Table 4), along with the non-significant linear term, indicated that the peak age for expenditures was near the mean age, 46 years old. Therefore, anglers around 46 years old spent more money on average than older or younger individuals.

Discussion

The mean amounts spent annually on fishing and hunting, $964 and $1,437 respectively, were similar to those reported by USDI and USDC (2008), which found mean annual angler spending in North Carolina to be $849 and mean annual hunter spending in North Carolina to be $1,315. Our findings along with others (American Sportfishing Association 2010, National Shooting Sports Foundation 2010) suggest angler and hunter spending and participation may increase during times of economic downturn, and such an increase may explain annual expenditures being higher in this study than those reported by USDI and USDC (2008).

Our findings support previous research (Miller and Hay 1981, Offenbach and Goodwin 1994, Davies 2002) by suggesting that the importance of fishing or hunting to the respondent as well as income were positively correlated with annual expenditures on angling and hunting. Although income as a positive predictor of angler and hunter spending may not be surprising, this finding suggests face validity for the current study. Further, this finding suggests persistent declines in wages may reduce equipment sales and associated Pitman Robertson and Dingell Johnson funding. Our finding that equipment value was positively related to both angler and hunter spending also aligned with prior research (Davies 2002) and may be explained by past spending habits predicting future spending habits and by maintenance costs associated with owning expensive equipment (e.g., boats and all-terrain vehicles). Our finding that expenditures were greatest among middle-aged anglers could perhaps be explained by older individuals already owning all necessary equipment. Younger individuals may not have the income necessary for expensive equipment or travel costs, or may hunt and fish with their middle-aged family members. Middle-aged individuals could also have increased expenditures if they are purchasing extra equipment to teach their children to fish or hunt. Based on our results, future studies should include a quadratic term for age, as not including it could give an inaccurate linear perception of the relationship between age and annual expenditures and overlook important non-linear relationships.

Our results were the only we were aware of to find that, hold-

ing other variables constant, female anglers ($n = 83$) spent more money annually than male anglers. Several explanations for this result are possible. Among anglers age 6–15 in North Carolina, 41% are female, yet only 20% of anglers age 16 and older in North Carolina are female (USDI and USDC 2008). The rapidly declining proportion of female anglers in older cohorts suggests that women who persist as anglers may be particularly avid and thus spend more annually. Furthermore, a much larger percent of male anglers (63%) in our sample also hunted than did female anglers (27%). Therefore, most male anglers split their expenditures between the two activities, whereas most female anglers can dedicate their expenditures to fishing. This finding may have some negative implications for funding fisheries conservation, as the percent of women who fished in North Carolina decreased from 24% of anglers to 20% of anglers from 1996 to 2006 (USDI and USDC 2008). In combination, these trends highlight the critical need to engage more women in fishing.

The negative relationship between annual expenditures and days spent angling and hunting in the models differed from findings by Davies (2002), but could be explained by the fact that anglers and hunters who focused on species with relatively short seasons (e.g., striped bass anglers and bear hunters) spent more than their counterparts who focused on species with longer seasons. This could be because these activities require specialized equipment or are associated with unique cultural values. Additionally, those who spend more time fishing or hunting may do so because they live close to the place they fish or hunt. Greater proximity of a location to engage in the activity may allow for reduced travel costs. Future studies should further investigate these relationships.

The positive relationship between job loss and annual expenditures may be explained by anglers and hunters choosing to spend their newly acquired discretionary time angling, hunting, and shopping for related equipment. Our finding that those who felt their hunting practices would be altered by the economy spent more on average than those did not feel this way may be explained by limited spending flexibility among hunters who bought only basic supplies (e.g., ammunition, bait) prior to the recession. Sportspersons who spent more liberally prior to the recession could reduce spending in the face of financial constraints without forgoing fishing or hunting, whereas sportspersons who purchased only basic supplies prior to the recession could not reduce expenditures without forgoing fishing or hunting.

Our research suggests angler and hunter spending may be more resilient to economic fluctuations than previously thought. Given this finding, angling and hunting may play a critical role in stabilizing already fragile rural economies (Wallace et al. 1991) during economic downturns. As our findings suggested angler and hunter spending increases with job losses and economic downturns, state wildlife agencies do not necessarily need to avoid fee increases and restructuring during economic downturns. Angling and hunting may represent a cheaper alternative to other activities, and anglers and hunters may actually be more likely to continue fishing and hunting related purchases, including licenses, during an economic downturn than during better economic conditions. Future research should evaluate why anglers and hunters who spend less time in the field spend more money than sportspersons who spend more time in the field, and attempt to quantify the economic impact of sportspersons' annual expenditures on rural economies during economic downturns.

Acknowledgements

We thank Kerry Linehan and Dain Palmer for assistance with survey design and sampling. We thank Rob Southwick for insight on the influence of recessions on angler and hunter expenditures. We thank Dr. Stephen Grado and our anonymous reviewer for their edits and direction. Additionally we thank the North Carolina Wildlife Resources Commission and North Carolina State University for supporting this research.

Literature Cited

American Sportfishing Association. Leading the Way for Fishing's Future. *http://www.asafishing.org/newsroom/news_pr020310.html*. Accessed 5 May 2010.

Burnham, K. P. and D. R. Anderson. 2002. Model selection and multimodel inference: a practical information-theoretic approach, second edition. Springer-Verlag, New York, New York.

Davies, L. E. 2002. Consumer's expenditure on sport in the UK: increased spending or under-estimation? Managing Leisure 7(1): 83–102.

DiCamillo, J. A. and J. M. Schaffer. 2000. Internet program impacts youth interest in hunting. Wildlife Society Bulletin 28: 1077–1085.

Dillman, D. A. 2007. Mail and internet surveys: the tailored design method. John Wiley and Sons, Inc. Hoboken, New Jersey.

Dizard, J. E. 2003. Mortal stakes: hunters and hunting in contemporary America. University of Massachusetts Press. Boston.

Enck, J. W., D. J. Decker, and T. L. Brown. 2000. Status of hunter recruitment and retention in the United States. Wildlife Society Bulletin 28(4): 817–824.

Fairbrother, A. 2009. Federal environmental legislation in the US for protection of wildlife and regulation of environmental contaminants. Ecotoxicology 18(7): 784–790.

Gabelhouse, D. W. 2005. Staffing, spending, and funding of state inland fisheries programs. Fisheries 30(2): 10–17.

Geist, V., S. P. Mahoney, and J. F. Organ. 2001. Why hunting has defined the North American model of wildlife conservation. Transactions of the North American Wildlife and Natural Resources Conference 66: 175–185.

Jacobson, C. A., J. F. Organ, D. J. Decker, G. R. Batcheller, and L. Carpenter. 2010. A conservation institution for the 21st century: implications for state wildlife agencies. Journal of Wildlife Management 74(2): 203–209.

Jenkins, G., K. Linehan, and D. Palmer. 2010. Wildlife in North Carolina magazine evaluation: surveys of current subscribers, former subscribers, and hunters and anglers. Report to the North Carolina Wildlife Resources Commission, Raleigh, North Carolina.

Long, R. B. 1987. Effects of recession, inflation and high interest rates on growth in a recreation region. Annals of Regional Science 21(2): 86–107.

Mendenhall, W. and T. Sincich. 2003. A second course in statistics: Regression analysis, sixth edition. Pearson Education, Inc., Upper Saddle River, New Jersey.

Miller, J. R. and M. J. Hay. 1981. Determinants of hunter participation – duck hunting in the Mississippi flyway. American Journal of Agricultural Economics 63(4): 677–684.

National Shooting Sports Foundation. 2010. Hunting license sales up by 3.5% in NSSF index of states. *http://www.nssf.org/newsroom/releases/2010/020110-hunting.cfm* Accessed 5 May 2010.

Offenbach, L. A., and B. K. Goodwin. 1994. A travel-cost analysis of the demand for hunting trips in Kansas. Review of Agricultural Economics 16(1): 55–61.

Southwick Associates, Inc. 2008. The 2006 economic benefits of hunting, fishing, and wildlife watching in North Carolina. Report to the North Carolina Wildlife Resources Commission, Raleigh, North Carolina.

SPSS. 2008. Statistical Package for the Social Sciences, Version 17.0. SPSS Inc., Chicago, Illinois.

United States Department of the Interior (USDI), Fish and Wildlife Service, United States Department of Commerce (USDC), Bureau of Census 1998. 1996 national survey of fishing, hunting, and wildlife-associated recreation: North Carolina.

———. 2008. 2006 national survey of fishing, hunting, and wildlife-associated recreation: North Carolina.

Wallace, M. S., H. L. Stribling, and H. A. Clonts 1991. Effects of hunter expenditure distribution on community economies. The Wildlife Society Bulletin 19(1): 7–14.

Zanetell, B. and G. Rassam. 2003. Funding wildlife conservation: from CARA to CARA-lite to CARA-lighter? Fisheries 28(3): 32–32.