Acceptance of North Carolinians for Strategies to Manage Human-black Bear Interactions

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Abstract: In North Carolina, black bear (*Ursus americanas*) and human populations have steadily increased between 1971 and 2001. To test the hypotheses that acceptability of bear management actions varied in different management contexts and was dependent on respondents' sex, participation in hunting, and knowledge of black bears, we surveyed North Carolina residents in 2005. We asked questionnaire recipients about the acceptability of educating the public on dealing with bear problems, frightening a bear with tools such as rubber bullets or fireworks, or destroying a bear in the following situations: a bear is sighted in a residential area, a bear chases a pet in a residential area, a bear attempts to enter a person's home, or a bear, unprovoked, injures a human. The mean acceptability of educating the public decreased with situations that were more threatening to humans, while destroying the bear became more acceptable with the higher the threat to people. There were differences in acceptability based on respondents' sex, participation in hunting, and current knowledge of black bears, with men, hunters, and those with less self-assessed knowledge of black bears having higher mean acceptance of lethal wildlife management than their counterparts. Our results indicate that lethal wildlife management actions will be more acceptable, and non-lethal actions (e.g., educating the public) less acceptable, when human safety is threatened.

Key words: acceptance capacity, human-bear interactions, North Carolina, public opinion survey, *Ursus americanus*.

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Through active management by the North Carolina Wildlife Resources Commission (NCWRC) and conservation partners (e.g., hunters, farmers, timber companies, and other management agencies) the coastal and mountain populations of black bears (*Ursus americanus*) steadily increased in North Carolina between 1971 and 2001 (NCWRC, unpublished data). Additionally, between 1970 and 2000 bear ranges expanded (NCWRC, unpublished data) and human populations increased 58% (U.S. Census Bureau 1995, U.S. Census Bureau 2000) creating many management challenges, including bear-human conflicts in residential areas.

Acceptance of wildlife management actions is determined by attitudes, beliefs, and values (Zinn et al. 2000) and by contextual factors of the management situations (Manfredo et al. 1998, Zinn et al. 1998, Zinn et al. 2000, Decker et al. 2006). Also, acceptance of wildlife management actions varies based on demographic characteristics, with women being less likely than men to support lethal wildlife management for wildlife in general (Zinn et al. 2000, Ash and Adams 2003, Koval and Mertig 2004, Martínez-Espiñeira 2006) and for bears in particular (Teel et al. 2002, Agee and Miller 2009b). Hunters are generally more likely to support lethal wildlife management for bears than non-hunters (Peyton and Bull 2001, Teel et al. 2002), although Agee and Miller (2009a) did not detect differences in support for bear management actions based on hunting behavior. Further, knowledge about bears is related to support for bear management actions (McFarlane et al. 2007) and support for increasing bear populations (Morzillo et al. 2007). Zinn et al. (1998) determined that acceptance of management actions depended on incident extremity (seriousness of the wildlife-human interaction), response extremity (extremity of the management action), and species.

Our objectives were to detect possible differences based on demographic characteristics in acceptability of three bear management actions of varying extremes in four situations of varying seriousness. We asked about situations that could occur in a residential context (a bear is sighted in a residential area, a bear chases a pet in a residential area, a bear attempts to enter a person's home, or a bear, unprovoked, injures a human). We asked about two non-lethal actions (educating the public on dealing with bear problems, frightening a bear with tools such as rubber bullets or fireworks) and one lethal action (destroying a bear) which are commonly used to manage bears in residential areas. We did not ask about trapping and relocating bears because trapping and relocating was not commonly done by the NCWRC. We tested the hypotheses that acceptability of bear management actions varied in different management contexts and was dependent on respondents' sex, participation in hunting, and knowledge of black bears.

Methods

Focus groups

To explore topics related to bear management and test a draft of the mail survey instrument we conducted three focus groups in February and March 2005. We mailed postcard self-mailers asking about willingness to participate to a random selection of 300 residents of Buncombe, Caswell, and Craven counties (Figure 1). Everyone who indicated, by returning a business reply postcard, a willingness to participate in a focus group was invited to attend a meeting. Because of the small number of Caswell County residents who agreed to participate, we invited some Caswell County residents known by local NCWRC field staff to participate in a focus group. We mailed each focus group participant a draft of the mail survey instrument and asked them to complete the survey instrument before the meetings.

Survey

Survey instrument design We designed the survey instrument with input from the NCWRC Bear Management Committee, which is comprised of NCWRC staff biologists with experience in bear management issues. The survey instrument asked questions related to personal experiences with black bears, values and concerns related to bears, tolerance for human-bear interactions, views on bear populations in North Carolina, acceptability of bear hunting and management practices for dealing with human-bear interactions, attitudes about hunting in general, knowledge of bears, participation in wildlife-related activities, and demographic and background information.

Survey sampling We divided the state into seven sampling strata based on NCWRC bear management units to include three urban and four rural strata (Figure 1). For our survey, Survey Sampling International randomly selected 1830 residents (≥18 years) from each of the seven strata (12,810 total).

Survey mailings We used a modified version of The Tailored Design Method (Dillman 2000) and sent participants up to four mailings. In 2005, the first full survey mailing (survey instrument and business reply return envelope) was mailed on 31 May and a reminder postcard was mailed to all survey recipients on 8 June. All nonrespondents were sent follow up mailings on 1 July and, if necessary, 2 August.

Data Analysis

To calculate mean acceptance for management strategies we coded responses as: Highly Acceptable = 2, Moderately Acceptable = 1, Neutral or No Opinion = 0, Moderately Unacceptable = –1, Highly Unacceptable = –2. We used *t*-tests and ANOVA's to determine if differences existed in the mean acceptability of management strategies to manage human-bear interactions based on attitudinal and demographic characteristics (Vaske 2008). Because our sampling over-represented some regions and under-represented other regions and our response rates varied among strata, we applied case weights based on stratum for the statewide percentages and means. We weighted cases to reflect the proportion of residents ≥18 in each stratum (Vaske 2008). However, we did not weight data for statistical tests (*t*-test, ANOVA, *eta*) which depended on standard errors (Winship and Radbill 1994). We used listwise deletion (omitted cases with missing data) for all analyses (Vaske 2008). All analyses were conducted using SPSS 13.0 (2005) and IBM SPSS Statistics 19.0 (2010). Because we conducted multiple statistical tests we used Bonferroni correction to maintain our alpha level (Vaske 2008). Whenever *t* tests or ANOVA's had $P < .0014$ we calculated *eta* to determine effect sizes and interpreted *eta* values of 0.1 as minimal, 0.243 as typical, and .371 as substantial relationships (Vaske 2008).

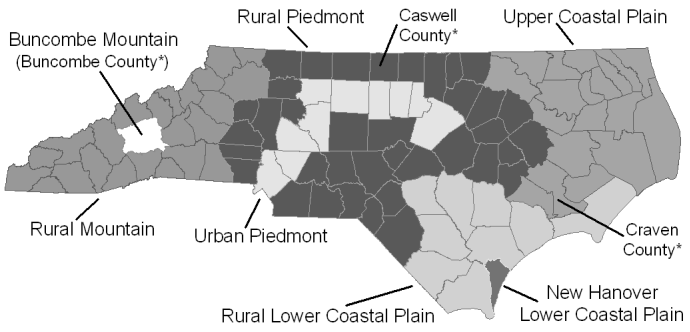

Figure 1. Map showing sampling strata for the 2005 North Carolina black bear survey. Shaded counties represent NCWRC bear management units developed using the presence of breeding females, bear population estimates, and physiographic characteristics of a county or region (NCWRC, unpublished data). Asterisks indicate counties where focus groups were held.

Results

Response rates (calculated by omitting incorrect addresses and persons ineligible to respond) were 40% ($n = 636$), 41% ($n = 654$), 32% ($n = 497$), 33% ($n = 535$), 37% ($n = 616$), 32% ($n = 524$), and 29% ($n = 471$) for Rural Mountain, Buncombe Mountain, Rural Lower Coastal Plain, New Hanover Lower Coastal Plain, Upper Coastal Plain, Rural Piedmont, and Urban Piedmont strata, respectively. The overall adjusted response rate was 35% ($n = 3933$).

There was evidence of non-response or non-coverage errors as respondents to the survey had different demographic characteristics from the North Carolina population (Table 1). For example, a lower proportion of respondents to the survey were age 16 to 44, female, had a high school degree or less than a high school degree, and had gross annual household incomes of less than $40,000 compared to the general North Carolina population. Therefore, respondents were generally more educated and had higher incomes than other North Carolina residents.

Table 1. Demographic characteristics of North Carolina residents and respondents to a 2005 survey of North Carolina residents about black bears.

Characteristic (wording used for 2005 survey)	Categories	2005 bear survey respondents (%)	NC population (%) (U.S. Census Bureau 2000)
Age (In what year were you born?)	16–24 years	1.7	13.3
	25–34 years	8.8	19.9
	35–44 years	16.4	21.2
	45–54 years	21.9	17.8
	55–64 years	22.1	11.9
	≥ 65 years	29.1	15.9
Sex (Are you male or female?)	Male	66.2	48.3
	Female	33.8	51.7
Highest education level (What is the highest level of formal education you have completed?)	< high school graduate	4.8	21.9
	High school graduation or GED	17.8	28.4
	Some college or trade school	23.9	20.5
	Associate or trade school degree	12.4	6.8
	Bachelor's or 4 year degree	23.6	15.3
	Graduate or professional degree	17.5	7.2
Gross annual household income (Which of the following best represents your gross household income (before taxes) last year?)	Less than $20,000	12.6	23.6
	$20,000 to $39,999	22.7	27.3
	$40,000 to $59,999	21.6	20.7
	$60,000 to $99,999	27.5	19.0
	$100,000 or more	15.5	9.4

Table 2. Mean acceptability[a] of strategies to manage bear/human interactions as reported by North Carolina residents, 2005.

Situation	Option[b]	*n*	Mean	SD
A bear is sighted in a residential area	A	3855	1.56	0.88
	B	3850	0.19	1.39
	C	3856	–0.98	1.29
A bear chases a pet in a residential area	A	3824	1.17	1.16
	B	3822	0.39	1.35
	C	3840	–0.73	1.34
A bear attempts to enter a person's home	A	3834	0.76	1.54
	B	3832	0.50	1.48
	C	3836	0.16	1.53
A bear, unprovoked, injures a human	A	3840	0.61	1.60
	B	3822	–0.03	1.49
	C	3852	0.53	1.40

a. Mean acceptability was based on a five-point scale coded as: Highly Acceptable = 2, Moderately Acceptable = 1, Neutral or No Opinion = 0, Moderately Unacceptable = –1, Highly Unacceptable = –2

b. Option A = educate the public on dealing with bear problems. Option B = frighten the bear with tools such as rubber bullets or fireworks. Option C = destroy the bear.

Table 3. Mean acceptability[a] of strategies to manage bear/human interactions in various situations by sex North Carolina, 2005.

		Sex				
Situation	Option[b]	Male	Female	*t*	*P*	*Eta*[c]
A bear is sighted in a residential area	A	1.59	1.60	–0.35	.725	NS
	B	0.26	–0.04	6.04	<.001	.101
	C	–1.08	–1.06	–0.40	.689	NS
A bear chases a pet in a residential area	A	1.19	1.22	–0.81	.420	NS
	B	0.48	0.21	5.56	<.001	.094
	C	–0.82	–0.83	0.20	.845	NS
A bear attempts to enter a person's home	A	0.72	0.87	–2.93	.003	NS
	B	0.59	0.41	3.54	<.001	.059
	C	0.19	–0.10	5.42	<.001	.089
A bear, unprovoked, injures a human	A	0.56	0.75	–3.39	.001	.055
	B	0.00	–0.10	2.01	.045	NS
	C	0.65	0.28	7.53	<.001	.126

a. Mean acceptability was based on a five-point scale coded as: Highly Acceptable = 2, Moderately Acceptable = 1, Neutral or No Opinion = 0, Moderately Unacceptable = –1, Highly Unacceptable = –2

b. Option A = educate the public on dealing with bear problems. Option B = frighten the bear with tools such as rubber bullets or fireworks. Option C = destroy the bear.

c. NS = Not Significant; *Eta* not reported when $P \geq .0014$.

Table 4. Mean acceptability[a] of strategies to manage bear/human interactions in various situations by hunting participation North Carolina, 2005.

		Participation in hunting[b]				
Situation	Option[c]	No	Yes	*t*	*P*	*Eta*[d]
A bear is sighted in a residential area	A	1.60	1.59	0.34	.737	NS
	B	0.12	0.29	–3.18	.002	NS
	C	–1.05	–1.15	2.11	.035	NS
A bear chases a pet in a residential area	A	1.20	1.18	0.34	.732	NS
	B	0.36	0.50	–2.71	.007	NS
	C	–0.81	–0.84	0.68	.496	NS
A bear attempts to enter a person's home	A	0.79	0.65	2.32	.020	NS
	B	0.51	0.58	–1.22	.222	NS
	C	0.05	0.29	–4.00	<.001	.065
A bear, unprovoked, injures a human	A	0.67	0.50	2.66	.008	NS
	B	–0.01	–0.11	1.83	.068	NS
	C	0.45	0.82	–7.09	<.001	.109

a. Mean acceptability was based on a five-point scale coded as: Highly Acceptable = 2, Moderately Acceptable = 1, Neutral or No Opinion = 0, Moderately Unacceptable = –1, Highly Unacceptable = –2

b. In which of the following activities do you regularly practice?

c. Option A = educate the public on dealing with bear problems. Option B = frighten the bear with tools such as rubber bullets or fireworks. Option C = destroy the bear.

d. NS = Not Significant; *Eta* not reported when $P \geq .0014$.

Survey responses varied among the acceptability of educating the public, frightening a bear, or destroying a bear in each of the following situations: a bear is sighted in a residential area, a bear chases a pet in a residential area, a bear attempts to enter a person's home, or a bear injures a human. The mean acceptability of educating the public on dealing with human-bear interactions decreased with situations that were more threatening to humans (1.56 if a bear is sighted in a residential area to 0.61 if a bear, unprovoked, injures a human), while destroying a bear became more acceptable the higher the threat to people (–0.98 if a bear is sighted in a residential area to 0.53 if a bear injures a human) (Table 2).

Male respondents had higher acceptance than female respondents for frightening the bear in all situations presented except for should a bear injure a human, and for destroying the bear when a bear attempts to enter a person's home or a bear injures a human. Male respondents also had a lower mean acceptability for educat-

Table 5. Mean acceptability[a] of strategies to manage bear-human interactions in various situations by knowledge of black bears, North Carolina, 2005. Means within rows with different lower case letter superscripts were significantly different at $P < .0014$ based on Tukey or Tamhane's T2 methods.

		Knowledge of black bears[b]							
Situation	Option[c]	Very little	Some	Average	Much	Expert	*F*	*P*	*Eta*[d]
A bear is sighted in a residential area	A	1.49[a]	1.64[b]	1.64[b]	1.72[b]	1.75	8.20	<.001	.093
	B	0.03	0.20	0.22	0.31	0.20	4.48	.001	.069
	C	–0.68[a]	–1.19[b]	–1.29[bc]	–1.49[c]	–0.90	54.35	<.001	.233
A bear chases a pet in a residential area	A	1.05[a]	1.25[b]	1.27[b]	1.32	1.60	8.62	<.001	.095
	B	0.25[a]	0.45	0.46[b]	0.50	0.90	5.96	<.001	.079
	C	–0.42[a]	–0.92[b]	–1.05[b]	–1.23[b]	–0.20	51.16	<.001	.226
A bear attempts to enter a person's home	A	0.76	0.78	0.74	0.71	1.50	1.27	.278	NS
	B	0.37[a]	0.57	0.61[b]	0.66	1.30	6.68	<.001	.083
	C	0.39[a]	0.03[b]	–0.09[b]	–0.11[b]	0.39	18.06	<.001	.136
A bear, unprovoked, injures a human	A	0.71	0.62	0.57	0.48	1.20	2.43	.046	NS
	B	–0.14	0.02	0.02	0.00	0.60	3.08	.015	NS
	C	0.65	0.47	0.48	0.51	0.70	3.21	.012	NS

a. Mean acceptability was based on a five-point scale coded as: Highly Acceptable = 2, Moderately Acceptable = 1, Neutral or No Opinion = 0, Moderately Unacceptable = –1, Highly Unacceptable = –2

b. How would you rate your current knowledge of black bears?

c. Option A = educate the public on dealing with bear problems. Option B = frighten the bear with tools such as rubber bullets or fireworks. Option C = destroy the bear.

d. NS = Not Significant; *Eta* not reported when $P \geq .0014$.

ing the public on dealing with bear problems when a bear injures a human (Table 3). Respondents who regularly participated in hunting had higher acceptance than those who did not regularly participate in hunting for destroying the bear when a bear attempts to enter a person's home or a bear injures a human (Table 4). For all four presented situations except a bear injures a human, respondents with very little self-assessed knowledge of black bears had higher mean acceptance for destroying the bear than those with some, average, or much self-assessed knowledge of bears (Table 5). The most substantial differences, based on effect sizes, between demographic groups were in the acceptability of destroying the bear.

Discussion

Differences in mean acceptability of management actions, especially lethal wildlife management, to deal with human-bear interactions based on respondents' sex, participation in hunting, and current knowledge of black bears are consistent with past research (Manfredo et al. 1998, Wittman et al. 1998, Zinn et al. 1998, Zinn et al. 2000, Ash and Adams 2003, Decker et al. 2006, Martínez-Espiñeira 2006, Agee and Miller 2009b). The acceptance capacity of specific management actions can be different for groups with different demographic or background characteristics and can vary based on the contextual factors of the human-wildlife interactions. We detected relatively small differences, based on effect sizes, in acceptance of management actions between hunters and non-hunters, between males and females. With the exception of destroying the bear if a bear is sighted in a residential area and a bear chases a pet in a residential area, there were relatively small differences in mean acceptance based on self-assessed knowledge of black bears. Our results indicate those with little knowledge of bears are more likely than those with more knowledge to support euthanizing a bear in cases that represent a relatively low threat to human safety. This may be because persons with higher knowledge of bears are more likely to have interacted with bears, and thus be more tolerant of low-risk bear-human interactions, or it may be because persons with higher knowledge of bears are more tolerant of low risk bear-human interactions or less tolerant of euthanizing bears, regardless of their personal interactions with bears.

Implications for wildlife managers include understanding that lethal wildlife management will likely be more acceptable, and non-lethal actions (e.g., educating the public) less acceptable, for cases where human safety is threatened. And, some constituent groups (e.g., women) may be more likely than others to oppose lethal wildlife management, regardless of the severity of the situation. Hunters were more likely than non-hunters to support euthanizing bears in situations where human safety is threatened, which could have implications for wildlife managers with the decline of hunting participation rates in North Carolina and the southeastern United States declined between 1991 and 2006 (U.S. Fish and Wildlife Service 2006).

Our findings indicate that one model for managing human-bear interactions will not be effective over a large geographic area,

such as an entire state, where the context in which human-bear interactions occur varies due to social or biological variables. For example, wildlife managers must understand that in areas (e.g., urban areas) where hunting participation is lower, there may be less support for lethal bear management actions than in areas with higher hunting participation. Effective management of human-bear interactions must include sufficient flexibility to adopt approaches to fit spatial and temporal variations in these social and biological factors among areas.

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