Education programs for reducing American black bear–human conflict: indicators of success?

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Abstract: Education programs designed to reduce conflicts between American black bears (*Ursus americanus*) and humans are often implemented by diverse groups of wildlife practitioners who may devote significant resources to these programs, yet little has been done to characterize the content, structure, and effectiveness of these programs. We review 6 education programs in North America. We build on a common performance indicator used in 5 of 6 programs—a reduction in the number of bear–related complaints to wildlife authorities—and suggest that practitioners incorporate other explanatory variables such as human dimensions, weather, natural food, or number of bears harvested. Some of these explanatory variables draw on potentially existing databases; others require new databases. If education programs are to remain an integral part of bear conservation and management, evaluation is essential to understand the ability of such programs to reduce conflict and encourage coexistence between people and bears.

Key words: American black bear, bear–human conflict, education, evaluation, performance indicators, *Ursus americanus*

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Conflicts between bears and people include any negative interaction between a person and bear that is aggressive, defensive, or nuisance in nature. Such conflicts can have ecological, economic, behavioral, safety, psychological, and social impacts such as crop or livestock damage, destruction of property, and perceived and real threats to personal safety, including, rarely, human injury or death. In North America, American black bears (*Ursus americanus*) are the most common species of bear involved in conflict, which are primarily non-life threatening events. Brown bears (*Ursus arctos*) and polar bears (*Ursus maritimus*) interact with people with less frequency and at different magnitudes of conflict (Herrero 2003). Black bear–human conflict is increasing in frequency and magnitude (Conover and Decker 1991, Conover 1998, Messmer 2000, Beckmann et al. 2004). In 2004, US state wildlife agencies estimated a 45% increase in expenditures to control bear-related damage, a 22% increase in personnel hours to resolve bear-related complaints, and a 19% increase in the overall number of complaints over the previous 5 years (International Association of Fish and Wildlife Agencies 2004).

Causes of black bear–human conflict vary. In communities where bears have become conditioned to food made available by people, the likelihood of negative bear–human interactions increases (Peine 2001). Such negative interactions also may increase substantially when black bear populations grow or expand their range or when the availability of natural foods is low (Peine 2001). Human food conditioning of black bears is considered to be the primary cause of conflicts and the primary factor that can be changed to reduce or prevent bear problems (Herrero 2003).

Black bear–human conflict occurs in diverse locations: residential, rural, agricultural, and back country. This highlights the limitations associated with single-solution remedies (Decker et al. 2005). Many wildlife practitioners and communities have institutionalized specific bear-related programs to reduce conflict (Gore 2004), advance conservation goals, and reduce non-harvest loss of bears. Non-lethal actions directed at bears, however, such as translocation, exclusion (electric fencing), aversive conditioning, or habitat modification are not always feasible due to substantial financial and time requirements (Rauer et al. 2003). Management

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programs can also focus on human activities that tend to lead to black bear–human conflict, such as garbage disposal, fruit harvesting, use of bird feeders, or food storage at campgrounds. In the latter instances, public education often is used in an attempt to change human behavior and hence reduce black bear–human conflict.

Education programs designed to reduce black bear–human conflict are often implemented by diverse groups of stakeholders, including non-governmental organizations, state and federal wildlife agencies, community associations, animal welfare groups, and others. These groups may devote significant resources to these programs, yet little has been done to characterize the structure of these programs or their effectiveness. Information about the outcomes and influence of these education programs is lacking, but could be used to improve program development and delivery. Education programs are popular among stakeholders, but the publicized perceived effectiveness of education programs designed to reduce black bear–human conflicts has not been evaluated critically (Beckmann et al. 2004). Indeed, Herrero (2003:53) noted in a meta-analysis of bear attacks in British Columbia, "most [management] recommendations focused on conveying knowledge regarding bear behavior. . .," but offered no insights evaluating the effectiveness of such an approach. More attention is needed to understand the program mechanisms and consequences of these educational efforts (Gore 2004). Furthermore, as negative black bear–human interactions and conflict increase in the future, new education programs likely will be designed and implemented. To this end, our objectives were to identify the indicators of black bear education program success, characterize program features, and identify potential improvements to a set of comprehensive performance indices.

Methods

We used methods described in Patton (1980) to analyze 6 North American education programs designed to reduce black bear–human conflict: Whistler (British Columbia, Canada), Lake Tahoe (California and Nevada), West Yellowstone (Montana), Central Florida, Northern New Jersey, and Adirondack State Park (New York). These programs were selected based on state agency information, the recommendation of education specialists and biologists, and available peer-reviewed and gray literature (conference proceedings, reports, masters theses). These programs do not represent the universe of bear-related education programs, black bear–human conflict, or efforts of stakeholders to reduce conflict. However, these programs are well known outside their regions. Most of these programs used other non-education strategies to ameliorate black bear–human conflict, such as aversive conditioning of bears or feeding ordinances. The program in West Yellowstone (Montana) also educates people about brown bears and gray wolves (*Canis lupus*).

We gathered information from: (1) state agency officials and conservation organization employees working on each program (where applicable); (2) a comprehensive search of peer-reviewed and popular literature; and (3) telephone interviews with stakeholders in leadership positions in each program. We analyzed the programs for 6 characteristics using an inductive approach (Patton 1980): (1) target audience, (2) stakeholders involved in program delivery, (3) defined problem, (4) alternative options reviewed, (5) program objective, and (6) performance indicators and explanatory variables.

We compiled potential program performance indicators, including explanatory variables for use in future comprehensive program evaluation. Our participation in society meetings (The Wildlife Society, Eastern Black Bear Workshop) provided opportunities to present program profiles and performance indicators and solicit input on our interpretation and conclusions. Draft profiles were distributed to key stakeholders in each program for review. Our list of performance indicators and explanatory variables relies on the context within which the education program occurs.

Results

Residents were the targeted audience of 4 of the 6 education programs (Table 1); programs also targeted hikers, hunters, and campers (3 programs) and students and teachers (3 programs). Key problems targeted included lethal control (4 programs), conflict between black bears and visitors or tourists (4 programs), and conflicts with black bears in residential areas (4 programs). Seven kinds of black bear–human conflict were identified. All programs targeted more than 1 bear-related problem.

Local conservation groups (5 programs) and state wildlife agencies (4 programs) were the most common stakeholders involved with the design, implementation, and financing of the education programs (Table 1). No program involved only 1 stakeholder. All 6 programs involved collaboration between ≥ 2 groups of stakeholders. Many involved traditional partnerships (state

Table 1. Characteristics of 6 North American education programs designed to reduce black bear–human conflict, 2003 (presence = x, absence = –).

Category	Characteristic	Adirondack State Park, New York	West Yellowstone, Montana	Central Florida	Northern New Jersey	Whistler, British Columbia, Canada	Lake Tahoe, Nevada and California
Target audience	user groups	x	x	–	–	x	–
	students and teachers	–	x	x	x	–	–
	residents	–	x	x	x	x	–
	individuals	–	–	–	x	–	–
	no audience specified	–	–	–	–	–	x
Problem	black bear–residential human conflict	–	–	x	x	x	x
	black bear–visitor human conflict	x	x	–	–	x	x
	lethal control	x	–	–	x	x	x
	lack of accurate perceptions of bears	–	x	–	–	–	–
	black bear–human conflict counteracts conservation efforts	–	–	x	–	–	–
	preventable access to garbage and unnatural food	–	–	x	–	–	x
	bears damaging or threatening property	x	–	x	x	–	–
Stakeholders	state agency	x	–	x	x	–	x
	federal agency	–	x	x	–	x	x
	local conservation group	x	x	–	x	x	x
	national conservation group	–	x	x	–	–	x
	municipality	–	–	x	–	x	x
	retail store	x	–	–	–	–	–
Interventions considered	lethal control	x	–	x	x	x	x
	translocation	–	–	x	–	x	x
	garbage ordinance	–	–	–	x	x	x
	restricted use	x	–	–	–	–	–
	none	–	x	–	–	–	–
Program objective	reduce magnitude or frequency of black bear–human conflict	–	–	x	x	x	x
	reduce lethal control of bears	–	–	–	x	–	x
	promote bear conservation	–	–	x	–	–	–
	promote black bear–human coexistence	–	–	x	–	–	–
	increase awareness of human actions that result in conflict	x	x	x	–	–	–
Performance indicators	reduction in complaints to authorities	x	–	x	x	x	x
	lack of acute black bear–human conflict	–	–	–	x	–	–
	increased requests for information	–	–	x	x	–	–
	knowledge acquisition and behavior change survey	–	–	x	–	–	–
	none	–	x	–	–	–	–

and federal agency), while others were less traditional (state agency, retail store, and local conservation group).

In 5 of 6 cases, stakeholders elected to dedicate resources to education programs in lieu of other interventions designed to reduce black bear–human conflict (other non-lethal control actions, translocation, chemical sterilization of bears, garbage ordinance). The most common alternative action to implementing an education program was lethal control of nuisance bears (via euthanasia or regulated hunting season), which preceded education in 5 of 6 programs. Interview questions did not explore stakeholder rationale for selecting an education program in lieu of another intervention.

Reducing the magnitude and frequency of black bear–human conflict was the most common program objective (4 programs), followed by increasing awareness of human actions that result in black bear–human conflict (3 programs), and reducing lethal control of bears (2 programs). Five cases noted a reduction in the number of bear-related complaints to wildlife authorities as a performance indicator (Table 1). Three of these cited reductions in complaints as their sole performance indicator. One case cited no performance indicators.

Table 2. Data from state wildlife agencies, research institutions, conservation organizations, or governments that may assist in the interpretation of black bear education program efficacy beyond only considering the number of black bear-related complaints filed with authorities. These explanatory variables may increase or decrease complaints filed to wildlife authorities.

Type	Form	Reference
Harvest	number of bears harvested	Johnson and Pelton 1980, Ryan et al. 2004
Food availability	magnitude of food or seed crop, availability of human foods	Gunther et al. 2004, Beckmann and Berger 2003, Kasbohm et al. 1996, Ryan et al. 2004
Management	number of bears translocated and euthanized, expansion of hunting range or season	Hebblewhite et al. 2003
Habitat	landscape-level changes in forested, agricultural, or residential areas	Jonker et al. 1998, Mitchell and Powell 2003, Rogers 1993, Wilson et al. 2005
Human dimensions	changes in attitudes, beliefs, motivations, and values	Andersone and Ozoliņš 2004, Decker et al. 2001
Weather	precipitation, temperature, season	Gunther et al. 2004, Zack et al. 2003
Ecology	survival rates, movement or distribution throughout landscapes, denning chronology	Ciarniello et al. 2005, Lee and Vaughan 2003, Garshelis and Pelton 1981, Pelton 1989

Only 1 case measured knowledge acquisition. All the problems requiring action defined by program implementers involved varying human dimensions (for example, lack of accurate perceptions of bears). In 1 case, program directors explored changes in the behavior of community residents after receiving bear-education materials. The prevalence of a human dimension in the identification of bear-related problems has important implications for program evaluation, most notably the need to include changes in human behavior among evaluation criteria.

Discussion

Five of the 6 programs we analyzed evaluated their effectiveness by the number of complaints filed to wildlife authorities. This indicator ignores changes in human behavior and fails to interpret results using environmental parameters, which may influence the likelihood of bear interactions with people (Table 2). Because the number of bear-related complaints can be confounded by other variables, measuring other explanatory variables should improve the interpretation of program effectiveness. Particularly in the face of increasing expenditures and limited institutional resources, emphasis should be placed on evaluating the efficacy of education programs to identify improvements or inform decisions about the allocation of scarce resources.

Performance indicators should incorporate explanatory variables that capture changes in human behavior, perceptions, and knowledge as well as ecological factors such as weather and landscape changes. We suggest a more comprehensive program evaluation that incorporates a larger set of performance indicators and explanatory variables (Table 2), addressing a more complete suite of ecological and human dimensions factors that may influence the frequency and magnitude of bear–human conflicts. There are numerous benefits in using explanatory variables in program evaluation, such as: (1) improved accountability to stakeholders or donors, (2) increased program efficacy, (3) efficient allocation of resources, (4) increased citizen interest and awareness (Smith et al. 1984), and (5) advancement of bear management.

Our proposed set of performance indicators and explanatory variables (Table 2) can help assess program effectiveness by recognizing that external influences may ultimately affect the magnitude and frequency of black bear–human conflicts. Evaluation of bear-related education programs should focus on outcomes that actually relate to an increase or decrease in black bear–human conflict rather than measuring only the delivery of education messages. Changes in black bear–human conflicts should also be interpreted relative to the suite of forces that may have influenced those changes. For example, practitioners could attribute a decrease in the number of bear-related complaints to an education program without considering the potential impact of other explanatory variables such as a good acorn crop or an above-average black bear harvest. Beckmann et al. (2004) suggested that education might be more effective than bear-focused deterrent techniques (rubber buckshot, dogs, cracker shells) at reducing black bear–human conflict. If education programs are to retain their role in bear conservation and management, it is essential to understand their ability to reduce conflict, foster awareness, modify behavior, and encourage coexistence between people and bears.

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