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Commentary

Managing risk from bears and other potentially lethal wildlife: predictability, accountability, and liability

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Accountability and liability of managers for protecting the public from wildlife should not assume an unrealistic ability to forecast attacks approaching the certainty of 20:20 hindsight after an attack. Although analysis of past attacks can yield valuable insights, it is likely to create exaggerated perceptions of average risk, of how much risk can be reduced by management actions, and of how predictable individual animals are during any given encounter. Such exaggeration can be minimized by understanding each species' aggression within the whole scope of its social behavior, body language, and interactions with humans.

Wildlife managers are responsible for keeping the public safe from wildlife, as well as for conserving wildlife species that, at least, occasionally injure or kill someone. Managers should balance the demands of public safety with those of public freedom to enjoy wildlands without killing animals unnecessarily. This is a balancing act that would work best if managers could make ballpark estimates of risk of attack under a wide range of scenarios, then tailor countermeasures to each scenario. Both estimating risks and countering them could be done in ways that assure accountability of managers who fail to act responsibly, yet, protect wise and diligent managers from unwarranted liability.

The difficulties of this challenge are emphasized by the recent judgment against the U.S. Forest Service (USFS) for nearly $2 million. The award was made to the family of Samuel Ives, the 11-year-old boy who was camping with his family in Utah's Uintah National Forest, was killed by a black bear (*Ursus americanus*; Francis versus State of Utah 2010). At approximately 0500 hours on that same day, and at the very same campsite, the bear had ripped into another tent and struck another man in the head without injuring him. The victim and his friends drove the bear away, then, reported the incident to the Utah Division of Wildlife Resources (UDWR), which sent personnel with dogs to trail the bear and kill it. When the bear's trail was eventually lost several kilometers away and hours later, the trackers gave up for the day. Although an off-duty USFS law enforcement officer was notified of the morning incident, the report was not passed on to other authorities who might have assured that warnings were posted and that campers were verbally informed of the incident. Because of this oversight, the court found the USFS negligent, resulting in the boy's death (Kevan Francis and Rebecca Ives versus United States of America). A separate suit was initiated against UDWR (Francis versus State of Utah 2010).

Without a fuller knowledge of those events and a deeper understanding of relevant law, I would not wish to question the court's decision. Nevertheless, I cannot ignore the wave of apprehension that this case is sending through wildlife-wildland management agencies. How will the Ives case affect future management of potentially lethal wildlife? Will agencies devote more of their dwindling resources to research on human–wildlife conflicts to keep improving methods of protecting the public without shortchanging their other responsibilities? Or will sympathy for victims, sensitivity to bad press, and fear of exploitive litigation force agencies to focus on more direct means of defending themselves to forestall lawsuits or to win them in courts of law?

One of the most counterproductive forms of

agency self-defense is excessively uniform and simplistic policy. Presumably, as long as there is official consensus within an agency or among agencies on which safety precautions to use, no one implementing them can be singled out for blame if and when they fail. Uniformity also facilitates educating agency personnel and the public about wildlife safety, because everyone is sending and receiving the same KISS (Keep-It-Simple-Stupid) messages.

Nevertheless, any simplistic, 1-size-fits-all, set of precautions for a species is doomed to mediocrity. I offer the following 5 characteristics for a more sophisticated management policy.

1. It should be cost effective. Except in the case of emergency actions, any new precaution should be screened to assure that the gains in public safety outweigh any new constraints on public freedom in wildlands. For example, what would the costs and benefits to the public be of forbidding them to bicycle or walk dogs in a national forest or park frequented by bears? How would those policies affect wildlife?
2. A species, such as bear, should not be killed to increase public safety unless it poses a substantive risk and not merely *pro forma* because someone was frightened by the animal. Risk assessment should be based both on analysis of previous attacks and on knowledge about bear behavior that has not led to attacks. For example, managers should learn to distinguish offensive versus defensive threats and to recognize how likely any given behavior (e.g., jaw popping or pant huffing) is to presage a bear trying to injure either a human or a another bear (Stringham 2011).
3. Pressures for uniformity should not be allowed to stifle adaptation of management practices to situational variations in the ways that animals interact with humans. For example, agencies might continue to allow closely viewing of brown bears (*Ursus arctos*) and black bears on the Pacific coasts of Alaska and British Columbia where these animals are especially tolerant of one another and of people, but keep viewers farther from bears in habitats where the bruins are much less forgiving (Smith et al. 2005, Herrero et al. 2005). Viewers might be allowed greater flexibility when natural foods are abundant than when they are scarce and bears are less tolerant. Viewing might be encouraged only at sites where bears and people on foot can usually see one another from a distance of at least 100 m, but discouraged where bears and people frequently surprise one another at much closer distances. Habituation might be encouraged in situations where the benefits of reducing bear defensiveness—the leading cause of brown bear inflicting serious or fatal injuries (Herrero 1985)—outweigh any increase in offensive aggression (Stringham 2009, 2010). Professionals might be allowed to provide food to bears to lure them away from residential areas (Rogers 2011); but, all feeding of bears might continue to be forbidden where the reverse is true.
4. Policy should guide managers in making cost:benefit analyses. If numerous people are at risk from a bear, how much would their risk have to be reduced to compensate for any consequent increase in risk for a much smaller number of other people? For example, caribou (*Rangifer tarandus*) herds cross rivers each year, and numerous calves drown. Suppose the carcasses float downstream until they hang up on sandbars in an area frequented by anglers and brown bears are attracted to the carcasses. Recognizing high danger that some angler may be attacked by a carcass-defending bear, a proactive manager might decide that the carcasses must be moved and that the only feasible way is to float them downstream to areas seldom visited by people. Unfortunately, in the event that someone is mauled by a bear defending a relocated carcass, the likelihood that the relocation saved other people from injury might be offset by its elevating the risk to 100 percent for another individual. A similar problem might arise when managers haze a bear away from numerous anglers or from a residential area. The bear then may go toward another person, injuring him, a scenario the manager had not forseen.
5. Policy should assure that managers meet at least minimum standards of due diligence in each scenario that they are likely to face. Unlike attorneys who study past tragedies

to fix blame and liability, biologists study them to prevent future tragedies. Also, unlike attorneys, we biologists do not make our living by playing Monday-morning-quarterback, focusing on a rare tragedy and dissecting it with the certainty of 20:20 hindsight. Hindsight concerning an attack might imply that once events A, B, and C occurred, tragedy was virtually inevitable. Indeed, if a bear has even once tried to prey on a human, most managers would expect more of the same and try to remove the bear. Some agencies might also do so even if a bear breaks into an occupied tent, as in the Ives case. However, if a bear's offense was merely foraging in campsites or defensively threatening someone who had stoned it, would this offense really increase risk of predatory attack by this bear? By how much?

Merely knowing that factors A, B, and C might increase the likelihood of tragedy does not tell us how high that likelihood is (e.g., one in 10^2, 10^5, or 10^8 encounters). Nor does that knowledge alone enable us to predict the specific encounter during which A, B, and C will have tragic consequences, rather than the innocuous consequences they have had during countless other encounters. Precision and accuracy of prediction are limited by what is known about all the factors contributing to an encounter's outcome. The more managers know, the better they can forecast optimal actions for meeting their numerous competing priorities with limited resources.

Identifying reliable risk predictors has been the goal of numerous studies on large carnivores, especially (a) bears (Herrero 1970, 1985; Herrero and Higgins 1999, 2003; Herrero et al. 2011; Miller and Tutterow 1998; Smith et al. 2005), (b) cougars (Deurbrouck and Miller 2001, Etling 2001, Mattson et al. 2011), and (c) wolves (McNay 2002, Graves 2007, Geist 2007). There also have been studies on ungulates (Geist 1978, 2011; Walther 1984).

Popular accounts of bear attacks commonly are stated as simple, qualitative associations. Such an account, for example, might state that the majority of large North American mammals that kill or seriously injure people have at least one of the following traits: they are habituated, food conditioned, ill, injured, or malnourished; or, they are unskilled at foraging, capturing prey or coexisting with humans; or they have a history of prior aggression. So, too, a popular account might state that most victims have at least one of the following characteristics: they surprised the animal at close range; or, hey were associated with foods or other things that attracted the animal. Additionally, they might have been perceived by the animal as vulnerable; as resembling prey; as competing with the animal for space, territory, food or mates; or as threatening the animal or its offspring.

Professional reports, on the other hand, are more likely to quantify associations, sighting the percentage of cases where the animal or the victim had one or more of those traits. This is illustrated by the findings of Herrero et al. (2011) that were based on all 63 instances of someone being killed by a black bear in North America since 1900:

- Of 56 fatal attacks by black bears, 88% were predatory;
- Of 36 fatal attacks, 92% were inflicted by an adult or subadult male; and
- 91% pf victims killed by black bears were alone or with just 1 other person.

Based an such statistics, if someone were to be killed by a black bear, one might confidently predict that the culprit was a predatory adult or subadult male and that the victim was alone or with a single companion.

However, such a conclusion would be made of course, after someone had been killed. It is not clear how such statistics can best help managers predict the likelihood of attack before one occurs. For example, what do Herrero's statistics tell us about risk of predatory attack in California or in any other state or province where no one has been killed by a black bear in the last 110+ years—the same situation that existed in Utah until the Ives boy was killed? In fatality-free areas, are adult and subadult males really 11-fold more dangerous than females? And if so, how dangerous are females, e.g., 1 nonfatal attack per 10^3, 10^5, or 10^7 encounters with a human?

Extrapolations from known killers to entire populations or metapopulations of a species are best treated as hypotheses in need of verification. The need for caution is perhaps best illustrated by recalling that most people

who kill other people are also adolescent or adult males. Yet, most human males never try to kill anyone. Case-by-case quantification of attack-risk by either bears or people requires information on a lot more variables than just age, sex, and species. For example, how much could risk of attack by an adult male black bear be altered (e.g., 0.1%, 50%, or 99.9%) by factors, such as shortage of wild foods, access to anthropogenic foods, conditioning of bears to those foods, habituation of bears to people, density of the bear population, or sport hunting of bears or ungulates? How much might a government agency reduce risk for visitors to a park by providing them with a bear-safety brochure, warning signs, or verbal instructions? How much can visitors reduce their own risk by following those precautions, e.g., wearing bear-bells while hiking or by surrounding tents with an electric fence?

Statistics for attacks by bears would be most useful if they were directly comparable to statistics for more familiar animals, such as dogs, horses, and bees. The common practice of simply contrasting the numbers of people injured or killed by each species is highly misleading because it does not address differences in exposure (see Pritchard 2000). Exposure is partly a function of abundance of each species. When abundance is considered, the >5-fold higher annual lethal attack rate for all dogs over all bears (16 people killed by dogs versus 3 people killed by bears per year; Herrero 1985, Sacks et al. 2000) becomes a 19-fold higher rate per bear than per dog (1/220,000 bears versus 1/4.2 million dogs; Stringham, unpublished report). Even more insightful figures could be obtained if we could limit calculations to the numbers of bears and dogs that encounter a human and to the numbers of people who encounter a bear or a dog. Then, risks could be compared in terms of attacks per person per animal per encounter. Indeed, probability of being mauled during an encounter should be separated from probability of having an encounter, as Mattson et al. (2011) did for pumas (*Puma concolor*). This distinction is essential for evaluating risk factors (e.g., habituation), given that those which raise or lower probability of encounters may have a different effect on probability of attack during an encounter.

Continent-wide summary statistics on risk levels and on factors that control risk level should eventually be integrated into a cumulative risk model that is designed so that managers could input knowledge about their local bear population. Then, such statistics should allow the model to compute both local baseline risk and how much risk could be modified above or below baseline by each environmental change (e.g., climatic warming) or management option.

Without such information, how can managers assess the cost-effectiveness of each option so that their resources can be focused where they do most good to enhance public safety and to meet their other responsibilities, while minimizing unwarranted liability? How are managers, administrators, judges, juries or the general public to avoid either vastly overestimating or underestimating the benefits of each precaution that managers could implement? How are judges and juries to avoid overestimating the capacity of managers to prevent attacks without unacceptably constraining public enjoyment of wildlife and without preventively killing far too many benign animals? How are they to assess liability based on realistic understanding of the limitations of managers to predict and control what wildlife will do?

Producing and implementing management plans with the 5 characteristics listed above would be markedly facilitated by better support for innovative research on wildlife behavior. If ursid predatory behavior had been better understood, then the quick return of the bear to the Ives campsite might have been predicted and adequate countermeasures taken. Knowledge can save both lives and money.

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