2009

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ABSTRACT Bear activity and behaviors in areas of human use or proximity require research because of significant and potentially dangerous conflicts between humans and bears. Previous studies in areas of the country outside of Utah determined that black bears (*Ursus americanus*) tend to exhibit diurnal or crepuscular activity patterns. Activity patterns, however, may be influenced by humans, especially in urbanized landscapes or in areas such as campgrounds where anthropogenic food resources are available. Our study objectives were to determine bear activity schedules and changes in visitation patterns to regularly supplied anthropogenic food sites in the La Sal Mountains of southeastern Utah. Using remote camera stations, we determined that bear visitation was primarily crepuscular and nocturnal (76.3% of visits), and bears did not visit freshly provisioned sites more quickly or more frequently through time. Although bear activity is different by region, provisioning food may not alter bear activity at supplemental feeding sites.

KEY WORDS activity, black bear, human food sources, *Ursus americanus*, Utah, visitation patterns

Black bears (*Ursus americanus*) frequently come into conflict with humans while obtaining anthropogenic food sources (Spencer et al. 2007). Bear activity is often destructive and potentially dangerous to humans as well as the bears themselves, because bears are frequently killed after coming into conflict with humans (Spencer et al. 2007, Mazur and Seher 2008).

Many bears become habituated to human foods, especially along the urban-wildland interface and in campgrounds. Bear behavior can be influenced in a variety of ways while exploiting regularly available and high-value human food sources. For example, bears tend to switch from the "wild" diurnal pattern to crepuscular and nocturnal activity patterns in order to avoid times of human activity (Ayres et al. 1986, Beckman and Berger 2003, Lyons 2005, Matthews et al. 2006).

Bears also may compete for limited food supplies in wild habitats and may change their activity levels in response to such limitations and to the presence of humans. As bears learn that a food resource is regularly available in small quantities, will they learn to become more efficient in obtaining the resource? That is, will bears become quicker at finding and consuming human food as they gain more experience, or will bears sample food sites more frequently in order to closely track the potential resource?

Fine-scale assessments of bear activity in response to anthropogenic food sources are needed both in Utah and elsewhere, because knowing when bears are actively visiting sites can help managers to best match management methods with particular damage management situations (Shivik 2006). The objective of this study was to describe activity patterns of a population of wild black bears at anthropogenic food

sources in the La Sal Mountains of Utah. More specifically, we hypothesized that bears would alter their activity patterns in order to more quickly obtain regularly supplied food and that bears would increase their visitation rates to sites with regularly provided human food.

STUDY AREA

Our study area was in the La Sal Mountains of southwest Utah on a combination of private and public lands. The La Sals were selected because they are relatively remote and low human activity enabled us to bait wild black bears while minimizing risk to public safety. The area is surrounded by a desert of sandstone mesas, slot canyons, and sagebrush flats. Mountain peaks range from 10,895 ft to 12,721 ft. Aspen (*Populus tremuloides*), scrub oak (*Quercus gambelii*) and ponderosa pine (*Pinus ponderosa*) were the dominant plant species. High daily temperatures typically remain below 26° C but lows can be below freezing, even during early summer months. Beginning in July, the region often experiences daily thunderstorms and monsoon-like rainfall. There are several established recreation sites throughout the La Sals, although public recreation predominantly occurs along the southeastern section of the mountains. Our field experiments were conducted on the northeast side of the range.

METHODS

We established and baited 21 sites, all at least 1.6 kilometers apart, from 29 May to 30 July 2008. Each site consisted of a 20-gallon plastic trash bin that was bolted to a tree. Bins had plastic covers which were secured with elastic cords; covers were designed to allow bears to gain access, but to exclude other smaller species. We drilled holes (< 10 mm) into the bottom of the bins to allow water to drain and into the sides to allow dispersion of scent. We affixed a Cuddeback® Digital motion-sensor camera (Non Typical, Inc., Park Falls, WI) to a tree facing the trash bin to monitor bear activity. Sites were defined using a single strand of barbed wire set 0.5 m high and > 0.6 m from the bin so that bears were forced to cross the wire to access the bin. Thus, hairs were collected to confirm bear presence in the event that photographic evidence was equivocal. We baited each site with 300 g of discarded baked goods that we obtained from local grocery stores.

We checked and replenished sites every other day throughout the duration of the study, although on 3 occasions checks were delayed up to 2 days due to logistical issues (e.g., flat tires). We used the trail cameras to document the date and time of all bear visits to the sites. We defined a bear visit as any image or video of a bear that was captured by the infrared camera. We used site visitation as our dependent variable because damage is caused when a bear visits a site; consequently it was not necessary to identify individual bears.

Bear and human (i.e, our visits) activity schedules were assessed using descriptive statistics. We constructed histograms to identify the 4-hr blocks of time that received the most visitation. To determine if bears attempted to obtain the regularly provisioned food more rapidly as they became more familiar with the sites (i.e., through repeated visits), we regressed the number of visits to the sites against the latency for the first bear to visit the re-provisioned sites. We determined latency to visit a site by calculating the amount of time between the baiting event and the first bear visit to the site. To determine if bears began to sample sites more frequently as they became more familiar with them, we categorized sites by the number of times bears had visited them and then compared the mean number of bear visits per

provisioning period to each category using ANOVA.

RESULTS

We recorded 376 bear visits to the feeding sites; 274 were repeated visits during the same 2-day observation period and 102 were first-time visits of recently provisioned food sites. Of the first-time visits, 82.4% were during the evening to morning hours (Fig. 1). There were 303 human visits and most were during the day (Fig. 2). Of the 102 first-bear visits, 52% were during the first 24 hours after baiting, and 41.2% occurred during the second 24 hours (Fig. 3).

Bears repeatedly visited sites from 1 to 11 times during the course of the study (Table 1). Bears did not appear to decrease latencies or to visit re-provisioned bins faster as they visited each site more (P = 0.17, R^2 = 0.02, Fig. 4). Bears also did not increase sampling rates as they visited each site more (P = 0.37).

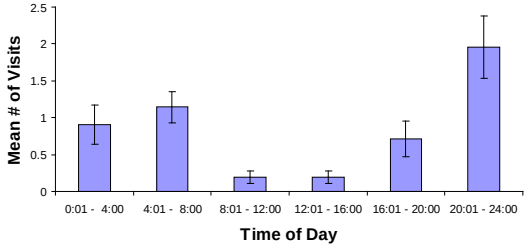

Figure 1. Daily activity pattern of black bears as measured by bear visitation to 21 supplemental feeding sites in the La Sal Mountains, Utah, during 29 May to 30 July 2008.

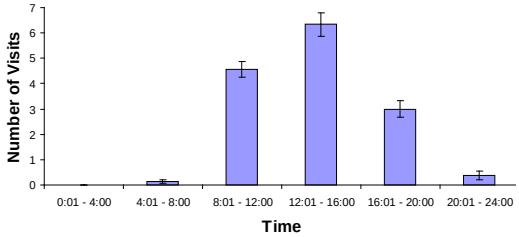

Figure 2. Daily activity pattern of humans replenishing 21 supplemental feeding sites for black bears in the La Sal Mountains, Utah, during 29 May to 30 July 2008.

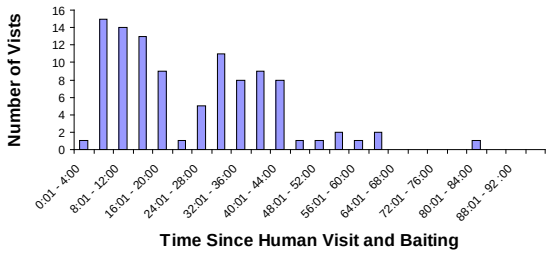

Figure 3. Latency of bears to visit 21 supplemental feeding sites in the La Sal Mountains, Utah, during 29 May to 30 July 2008.

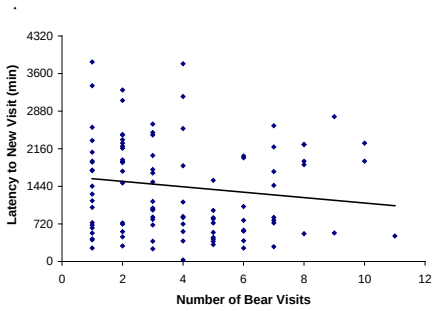

Figure 4. Latency to visits to a recently provisioned food source by the number of times bears had visited sites. Data were collected from 21 supplemental feeding sites in the La Sal Mountains, Utah, during 29 May to 30 July 2008.

DISCUSSION

Black bears exhibited a crepuscular/nocturnal activity pattern when visiting human food sources on our study site, and showed little activity during the day. The observed activity pattern at our sites differed from that reported for wildland bears in other areas where bears were typically diurnal during the summer months (Ayres et al. 1986, Beckman and Berger 2003, Lyons 2005, Matthews et al 2006), suggesting that bear activity is spatially and temporally variable.

Our latency data did not indicate that bears avoided or were attracted to the sites soon after humans re-baited them. Visitation was generally delayed until the evening hours, regardless of the time of food

Table 1. Count of the number of repeated bear visits to each of 21 food-provision sites and mean number of visits during each 2-day sampling period in the La Sal Mountains, Utah, during 29 May to 30 July 2008.

	Number of bear visits to site category										
	1	2	3	4	5	6	7	8	9	10	11
Count of sites	21	18	17	13	10	8	7	6	3	2	1
Mean visits/period/site	3.2	3.9	3.99	3.2	2.9	3.3	3.6	5.5	2.3	5	1
Standard Error	0.5	0.5	0.5	0.6	0.3	0.5	0.8	1.6	0.4	4.0	--

replenishment. We suspect that a crepuscular/nocturnal pattern may be natural for this population during the summer months, however bear activity patterns prior to our arrival are unknown. It is possible that the bears in the La Sal mountains do not exhibit diurnal patterns due to the high day-time temperatures, as was found by Garshelis (1978).

We hypothesized that multiple bears would compete to obtain the limited food resource we provided and thus bears would learn to be faster and more efficient in obtaining the resource by visiting sooner and more frequently during the course of the study. However, we did not find evidence of shifts in bear behavior. One possible reason for the lack of behavioral shifts was that we only provided 300 g of food at each site; although the resource was desired by bears, as indicated by their numerous visits to sites, the amount of food may not have been nutritious enough to compel bears to expend the extra effort needed to obtain it. It is also possible that there was not a large number of bears competing for the resource.

MANAGEMENT IMPLICATIONS

Bear activity and conflict will vary in space and time, but if bears maintain normal activity patterns in spite of diurnal food provisioning, targeting management strategies during specific periods that coincide with bear activity should be most effective. For example, electrified fence or other tools may be used around garbage bins at night when humans are sleeping but bears are active, and then turned off during the day when the opposite occurs. Such optimization creates a situation that maximizes the effectiveness of a specific management tool while minimizing its cost and negative influence.

ACKNOWLEDGMENTS

We thank J. du Toit and the Berryman Institute; B. Baldwin and the Tehabi Internship Program; B. Bates, G. Wallace, D. Ketron and the Utah Division of Wildlife Resources for the support of this research, JB and Redd Ranch for allowing research on their land and Village and City Markets in Moab, UT for providing discarded food items for baiting purposes.

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