

Visitor Compliance with Bear Spray and Hiking Group Size in Yellowstone National Park

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Large party sizes have been shown to reduce the risk of bear attack (Herrero 2002). In addition, bear deterrent spray has proven effective at reducing aggressive behavior by bears during surprise encounters (Herrero and Higgins 1998, Smith et al. 2008). To reduce the risk of bear attack in Yellowstone National Park (YNP), safety information distributed to visitors recommends all backcountry recreationalists traveling by foot maintain group sizes of at least three people and carry bear spray. YNP managers are interested in the level of visitor compliance with these recommendations. To evaluate compliance, we conduct annual surveys to determine the proportion of recreationalists that hike in groups of three or more people and the proportion that carry bear spray or other deterrents (e.g., bear bells, firearms). Although it is legal to carry firearms in Yellowstone National Park, it is illegal to discharge them in the park, so they are not considered a legal bear deterrent. While working on other bear research, monitoring, and management projects throughout YNP, we recorded how many recreationalists we encountered at trailheads and on trails and boardwalks carried bear spray or other deterrents. We also recorded information on the group size and the type of recreational activity. We grouped recreational activity into six broad categories: 1) day hikers, 2) overnight backpackers, 3) boardwalk trail users, 4) stock (horse or mule) day-riders, 5) stock overnight-riders, and 6) day-use bicyclist trail riders. Surveys were conducted visually. We recorded the presence of bear spray and other deterrents that were visible, and therefore quickly retrievable.

From 2011 to 2014, we surveyed 8,281 people in 2,908 groups on 64 different hiking trails and 5 boardwalk trails. Our surveys included 5,911 backcountry day hik-

ers, 1,855 people walking on boardwalk trails, 355 overnight backpackers, 70 overnight stock-riders, 59 day stock-riders, and 31 day-use bicyclists.

Overnight backpacking parties had the highest level of compliance with YNP's bear spray recommendation. Fifty-two percent of backpackers carried bear spray. We believe the level of compliance by this type of recreationalist is due to the methods used to convey bear safety information to overnight backpackers. In YNP, permits are required for camping in the backcountry. During the permit process, backpackers are given face-to-face verbal information about bears and bear spray from the ranger issuing the permit. They are also required to watch a safety video containing information on hiking and camping in bear country and how to use bear spray. Backpackers are also given the "Beyond Road's End" safety booklet containing information on bear spray and hiking and camping in bear country. Social surveys indicate YNP visitors retain verbal information better than written information from signs or brochures (Taylor et al. 2014). In addition, we suspect many backpackers may have a high level of experience in bear country. Although the average group size for backpackers was 2.7 people per party, the most common party size was 2 people; indicating many backpackers did not follow YNP's recommended group size of 3 people for hiking in bear country.

Only 13% of day hikers carried bear spray. Permits are not required for day hiking, so day hikers may not receive the same level of bear safety information as backpackers. Since a permit is not required, day hikers may not receive verbal safety information from a park ranger, may not obtain published bear safety materials, and are not required to watch the safety video containing bear

safety information. Visitor's day hiking in YNP can seek and obtain bear safety information from the YNP web page, park newspaper, day hike trip planners, safety brochures, and from rangers at visitor centers. However, the only bear safety information day hikers are exposed to if they don't seek it out themselves, is from the signs posted at trailheads. We also suspect many day hikers in YNP have a lower level of experience in bear country than backpackers. With an average group size of 2.9 people per party, day hikers were closer to the parks recommended group size; however, the most frequently observed group size was 2 people indicating many day hikers did not comply with the recommended group size of 3 for hiking in bear country.

The most common group size on boardwalk trails was less than the recommended 3 people per party and < 1% of boardwalk hikers carried bear spray. The low compliance with bear safety recommendations by this type of recreationalist may be due to the lower level of experience of visitors that use boardwalk trails, the methods that they receive bear safety information, and/or the assumption that bears are not found close to roads where boardwalk trails are located. Like day hikers, recreationalists on boardwalks are unlikely to receive face-to-face verbal bear safety information. In addition, although the chances of encountering bears may be lower on boardwalk trails than backcountry trails, the probability is not zero. It is not uncommon for grizzly bears to be observed on or near boardwalk trails, especially during spring when bears scavenge winter-killed ungulate carcasses which tend to be concentrated in thermal basins. Although rare, bears have attacked people on and near boardwalk trails. During the 45-year period from 1970 to 2014, 52 people were attacked by grizzly bears in YNP, 1 non-fatal attack occurred on and 1 fatal attack occurred near boardwalk trails. Although the risk of a bear attack on or near boardwalk trails is very low, only two incidents in 45 years, the risk could be further reduced by increasing the proportion of visitors that carry bear spray while walking boardwalk trails.

Overnight stock riders had an average group size of 5.0 people per party and 37% carried bear spray. The moderate level of compliance by this type of recreationalist is likely due to the face-to-face verbal bear safety information received by overnight stock riders and their high level of experience. Although bear spray may not be very useful while in the saddle, as deploying it from horseback may result in the rider being thrown from their horse, it is useful and encouraged for carry by

stock groups during rest stops along the trail and while in camp. In general, people riding stock are less likely to be involved in surprise encounters and bear attacks. Horses usually sense a bear's presence before a person does (Herrero 2002), alerting the rider and reducing the chances of surprise encounters at close distances. The large size of horses is also more intimidating to bears. In addition, unlike humans, when charged by bears horses have enough speed and agility to outrun bears providing an added margin of safety as long as the rider can stay in the saddle.

Bicycle groups riding designated bike trails had a relatively low rate of compliance (13%) with YNP's bear spray recommendation and had an average group size (2.4 people per party) lower than recommended for bicycling in bear country. Bicyclists incur greater risk of surprise encounters because as a mode of transportation, bicycles are fast and relatively quiet, increasing the probability of surprise encounters.

Although some backcountry recreationalists in YNP carry firearms, and it is legal to do so, it is illegal to discharge them within the park or to take wildlife with them, so they are not considered a legal bear deterrent inside YNP. Firearms were openly carried by < 1% of the total recreationalists we observed. Day stock riders had the highest frequency of firearms carry (2%). Recreationalists riding horses often carry firearms for euthanizing injured stock. From our survey methods we could not determine if groups riding stock carried firearms for bear protection or for euthanizing injured stock.

Bear bells were used by only 1% of all recreationalists we observed. Backpackers (2%) and bicyclists (3%) had the highest frequency of bear bell use. Although bear bells may provide some benefit in alerting bears to the presence of approaching hikers (Jope 1982), they are generally not considered effective at preventing surprise encounters when hiking in strong winds, heavy rain, near rushing water, or in dense forest (Herrero 2002).

Knowledge of standard bear safety practices can significantly reduce the risks of bear-human confrontations and attacks. Although Yellowstone National Park provides bear safety information to visitors through many different media, the results of our survey indicate that many people are not following these recommendations. The reasons for the low rate of compliance are not known, but knowledge of these reasons would be useful to develop more effective bear safety messaging techniques. We suggest conducting a survey to determine

why so few visitors carry bear spray. We also suggest using actual changes in visitor bear safety behavior to measure the success of any new messaging techniques implemented by the park.

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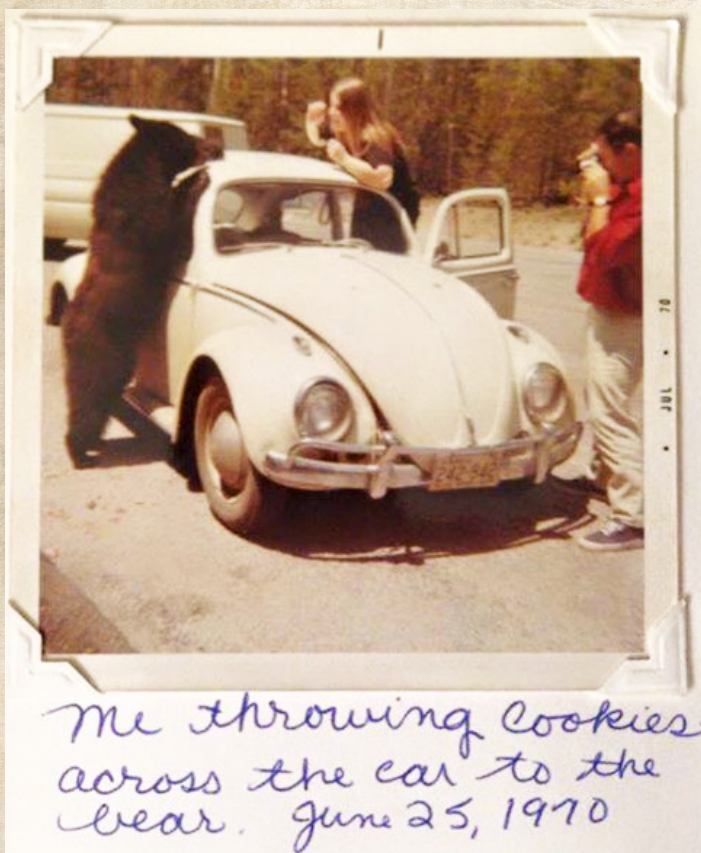
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FROM THE ARCHIVES - 1970

Visitors & Bears



Cheryl Coble during a family visit to the park in 1970. Photo © Wayne Coble

Bear Attacks - 1970	
Number	Species
4	Grizzly Bear
6	Black Bear
2	Unidentified Species

The year 1970 was a period of transition for bears in Yellowstone National Park. In 1970, the Rabbit Creek Garbage Dump near Old Faithful was closed in an effort to wean bears off of human generated garbage. In addition, in an effort to reduce human-bear conflicts, park managers were converting all garbage cans in the park to a bear-proof design and were more strictly enforcing regulations that prohibited the recreational hand feeding of bears. In 1970, 4 people would be injured by grizzly bears and 6 by black bears. Two additional people injured by bears could not identify the species of the attacking bear. In response to these and other human-bear conflicts, 20 grizzly bears and 10 black bears would be captured and killed or sent to zoos in management actions.