Public perceptions of risk and government performance regarding bear management in Japan

Ryo Sakurai\textsuperscript{1,4}, Susan K. Jacobson\textsuperscript{2}, and Gouhei Ueda\textsuperscript{3}

\textsuperscript{1}School of Natural Resources and Environment, Department of Wildlife Ecology and Conservation, University of Florida, PO Box 110430, Gainesville, FL 32611-0430, USA
\textsuperscript{2}Department of Wildlife Ecology and Conservation, Program for Studies in Tropical Conservation, University of Florida, PO Box 110430, Gainesville, FL 32611-0430, USA
\textsuperscript{3}Toyooka Agriculture, Forestry, and Fisheries Office, Hyogo Prefectural Government, Saiwai-cho 7-11, Toyooka City, Hyogo 668-0025, Japan

Abstract: Human–wildlife conflict challenges wildlife managers globally. In Japan, the Asiatic black bear (\textit{Ursus thibetanus}) is listed as a vulnerable species under IUCN’s \textit{Red List of Threatened Species}. In Hyogo Prefecture it is listed as an endangered local population, but bears are considered a nuisance because of agricultural damage and occasional human casualties. The bear population in the prefecture is increasing, and human–bear conflicts are also increasing. We conducted a mail survey in July 2010 of residents in 58 villages \((n = 2,315)\) to examine their perceptions of risks, government performance, and acceptance of bears. Survey response was 52\% \((n = 1,210)\). Eighty-one percent of respondents reported that risks from bears had increased and 83\% believed there were too many bears around their village. Risk perception was negatively correlated with acceptance capacity of bears. In contrast to our prediction, increased agreement that government provided necessary information was associated with greater perceived risk from bears. However, agreement that the government listened to people's concerns was a significant factor predicting respondents’ behavior in taking preventive actions such as reporting bear sightings. This study suggests that, by providing problem-prevention information and adequate opportunities for residents to voice their concerns, government officials may be able to increase residents’ confidence in their ability to prevent bear-related problems and their tolerance of interactions with bears. If widespread, such outcomes would improve conservation of bears of Japan.

Key words: Asiatic black bear, government performance, Japan, risk perception, survey, \textit{Ursus thibetanus}, wildlife acceptance capacity


Human–wildlife conflict stemming from economic damage to agriculture and forestry as well as human casualties occurs worldwide (Bruskotter and Shelby 2010, Thornton and Quinn 2010). In Japan, human–bear conflicts resulting from agricultural damage and occasional livestock and human casualties have been a serious problem (Roy 1998, Japan Bear Network 2007a, Sakurai and Jacobson 2009).

The Asiatic black bear (\textit{Ursus thibetanus}) is categorized as vulnerable by the International Union for the Conservation of Nature (IUCN) \textit{Red List of Threatened Species}, and international trade is controlled by the Convention on International Trade in Endangered Species (Japan Bear Network 2007a).

Asiatic black bears rely on mast and other foods such as herbaceous plants, fruiting trees such as Japanese bird cherry (\textit{Prunus grayana}), and invertebrates, and are known to travel from forested areas to look for food in lean years when mast production is relatively low (Yokoyama 2009). When natural foods are scarce, human–bear conflicts increase (Howe et al. 2010). Because of natural food shortages, bears were particularly common near human settlements in 2004, 2006, and 2010. During 2006, more than 4,340 bears, estimated to be almost half of the entire population in Japan (Japan Bear Network 2007a), were captured and most were killed (Ministry of Environment 2008). Management of the bear population with minimum human–bear conflicts has been a challenge for Japanese wildlife.
managers (Japan Bear Network 2007a, Sakurai and Jacobson 2011). One of the biggest challenges in wildlife conservation is garnering and maintaining the public’s support and understanding (Barlow et al. 2010, Bruskotter and Shelby 2010). For this reason, human values and attitudes must be considered if bear management programs are to be successful and sustainable (Fulton et al. 2004, Thornton and Quinn 2010).

In Japanese culture, black bears are traditionally associated with the mountain spirit or gods of mountains, and are characterized as ‘mountain man’ (yamaotoko) or ‘lonely person’ (sabishigariya) because of the resemblance of the characteristics of bears with humans (Knight 2000). However, currently in Japan, local residents’ attitudes toward bears are generally negative and bears are seen as fierce animals because of occasional human casualties (Knight 2006, Japan Bear Network 2007a, Sakurai and Jacobson 2011). From April 2006 to March 2007, 142 people were injured and 3 were killed by black bears (Ministry of Environment 2008). Although government managers ask residents to take preventive action such as reporting bear sightings and conducting interventions to minimize conflicts (Ministry of Environment 2008), residents tend to ask the government to kill bears rather than personally taking preventive action (Huygens et al. 2001). Residents’ negative attitude toward bears is a major obstacle to bear conservation in Japan (Roy 1998).

To better understand Japanese perceptions toward black bears, we surveyed residents in northern Hyogo Prefecture to examine their perceptions of risks and acceptance of bears and the influence on these of perceptions of government performance. We based our research on a framework using studies of risk perception (Slovic 1987, Gore et al. 2009), social trust in management agencies (in our case, perception of government performance [Siegrist et al. 2000]), and wildlife acceptance capacity (Decker and Purdy 1988, Gigliotti et al. 2000). In Japan, few surveys have been undertaken to understand the cognitive components affecting people’s perception of risk and social trust in government in the field of natural resource management. Literature on these factors outside of the US and Europe is lacking (Viklund 2003). Also, despite the broad array of human–wildlife interactions in Japan, few studies of wildlife acceptance capacity have been conducted. This study is one of the first to examine the relationship between social trust, risk perception, and wildlife acceptance capacity in Japan.

Conceptual framework

Risk perception

Risk assessment can be conducted by evaluating the risk itself and by evaluating conceptualized or perceived risk that individuals express about the threat they believe they are facing (Renn 1998, Jaeger et al. 2001). Risk perception studies have examined people’s evaluation of threats, dangerous activities, technology (Slovic 1987), and more recently, wildlife risks (for review, see Gore et al. 2009).

People often misjudge the level of risk, overestimating relatively infrequent risks with catastrophic consequences (such as airplane crashes) and underestimating more frequent but less consequential risks (such as the negative effects of excessive dieting; Jaeger et al. 2001). This misjudgment contributes to the gap between the perceived risk of the lay, non-expert public, which is not necessarily based on the technical probability of hazards, and that of experts, which is more likely correlated with technical risk estimates (Slovic 1987, Kleinhesselink and Rosa 1991). An encounter with or being attacked by wildlife (e.g., bears) is a low probability–high consequence event (Thornton and Quinn 2010).

To understand public perception of risk regarding human–bear conflicts, we measured perceptions of frequency: “human–bear conflicts are increasing,” and personal risk: “concerns over the safety of children because bears may live nearby,” “concerns about agricultural damage by bears,” and “worry of walking outside where bears may live nearby.” These variables were selected based on previous studies (e.g., Riley and Decker 2000, Gore et al. 2006) and through discussion with local wildlife managers for applicability to human–bear conflicts at the study site.

Perception of government performance

Another significant factor that influences people’s perceptions of risk is social trust, defined as a willingness to depend on agencies or individuals responsible for managing environmental or public health and safety (Siegrist et al. 2000, 2005). Differences in perceived risk between experts and lay people are caused not only by misjudgment of the public, but also the level of trust the public has toward experts, agencies, and industries (Sjoberg

1999). Greater social trust is associated with greater support for managing agencies’ practices (Cvetkovich and Winter 2003). Vaske et al. (2004) found that hunters who did not participate in hunting because of concerns about chronic wasting disease (e.g., fear that chronic wasting disease might infect humans) were less trusting of the managing agency.

A lack of trust in agencies can have critical consequences as people start to doubt management decisions and instead rely on less valid sources of information (Needham and Vaske 2008). Moreover, communication programs conducted by wildlife management agencies can be ineffective if people have distrust or high risk perceptions (Sjoberg 1999). Although the concept of risk perception has started to gain attention from wildlife managers (Gore et al. 2009), there have been limited studies conducted to understand public risk perception and social trust in the field of wildlife management (Needham and Vaske 2008).

Vaske et al. (2004) measured social trust toward a wildlife agency by measuring perceptions of performance using items about the agency’s credibility based on their provision of opportunities to listen to people’s concerns and items about the believability of types of information provided by the government. In a study investigating public trust toward the government in Japan, Maeda and Miyahara (2003) found that 2-way communication between agencies and citizens rather than just information disclosure was important for establishing trust. In our study, we used questions designed to determine if town or regional prefectural governments provided adequate information to residents about bears and if the governments provided adequate opportunities to listen to people’s concerns.

In our study site, wildlife managers in both the town and prefectural government asked residents living adjacent to bear habitats to report sightings and signs of bears to help the government take preventive measures. Measures included radio broadcasts warning of nearby bears and information to prevent damage by bears, such as protecting persimmon (Diospyros kaki) and other fruit trees from bears, which are the main attractants of bears to villages (Hyogo Prefecture 2009). We examined whether providing information from the government and providing opportunities to listen to people’s concerns influenced residents’ propensity to report bear sightings and take prevention actions as well as their self-assessed knowledge about reducing bear conflicts.

Wildlife acceptance capacity

Wildlife acceptance capacity is the maximum wildlife population level that people find acceptable in an area (Decker and Purdy 1988). It is important for wildlife managers to understand public perceptions of the appropriate and acceptable population numbers of wildlife species because wildlife habitats include both public and private lands, and democratic governments must consider public wants and needs (Zinn et al. 2000). Generally, wildlife acceptance capacity decreases as people perceive more risk (Riley and Decker 2000). We measured wildlife acceptance capacity by asking about people’s preferences about current bear population numbers (e.g., Riley and Decker 2000).

Hypotheses

We tested 3 hypotheses based on theories of risk perception, perception of government performance, and wildlife acceptance capacity:

1. Perception of government performance is negatively correlated with perceptions of risks from bears.
2. Perception of government performance is correlated with (a) engagement in more behaviors to prevent human–bear conflicts, and (b) greater self-assessed knowledge of ways to keep bears away from homes.
3. Increased risk perception is correlated with less acceptance capacity for bears.

Methods

Study site

We chose Hyogo Prefecture as our study site because, as the site of one of the most extensive government bear management programs in Japan, it was a suitable area for investigating residents’ perceptions of bear issues and their behaviors for mitigating human–wildlife conflicts. Within Hyogo, we chose 2 towns, Kami and Tanto (Fig. 1), because they had the highest number of bear appearances as well as damage. Kami occupied 369 km² and included 74 villages with 19,696 residents, whereas Tanto occupied 162 km² and included 42 villages with 4,933 residents (General Affairs Department of Toyooka City 2011, Kami Town 2011). The bear population in Hyogo Prefecture decreased to <100 in the 1990s because of hunting and depredation kills as well as habitat degradation (Wildlife Management...
Hunting has been prohibited since 1996, and the population was listed as an endangered local population in 2003 (Hyogo Prefecture 2009). Conservation efforts were made under the Specified Wildlife Conservation and Management Plan of Hyogo Prefecture enacted in 2003 (Hyogo Prefecture 2009), and the population of bears subsequently increased to approximately 650 (Sakata et al. 2011). With the increased bear population, the status of bears in Hyogo Prefecture was revised from endangered to vulnerable local population in 2011 (Hyogo Prefecture 2011); human–bear conflicts have been increasing as well in these regions (Yokoyama et al. 2008). In the high bear appearance year of 2006, agricultural damage amounted to about $180,000 (Hyogo Prefecture 2009). During 1998–2009 there were 5 cases of reported human casualties caused by bears in Kami but no casualties in Tanto (Hyogo Prefecture 2009). In 2010, a lack of food resources in forests resulted in reports of 1,623 bear sightings around the towns (Wildlife Management Research Center, Hyogo 2011) and 5 human casualties in Hyogo Prefecture, the highest on record (Ministry of Environment 2011).

In Hyogo Prefecture, both town government and prefectural governments dealt with bear management in different capacities. Managers in the town government had more direct communication with residents when human–bear conflicts occurred. In many cases, town staff went to the damage sites first to investigate. In both Kami and Tanto, the town government warned residents through radio broadcasts when bears appeared near settlements. In Kami, the town government mailed fliers with
information about bears to all households every year. Managers at the prefectural government organized broader-scale interventions such as education seminars and participatory management programs in villages or certain regions of town. Researchers at the Wildlife Research Center associated with the prefectural government released captured bears after aversive conditioning (e.g., scaring bears by making noise). In Hyogo, the prefectural government had the authority to allow the capturing of bears. The Specified Conservation and Management Plan provided criteria of whether to release or kill the captured bears, and the prefectural and town governments as well as the Wildlife Research Center decided which criteria applied to the situation after the discussion. Hyogo was one of the only prefectures in Japan with a governmental wildlife research institution with trained staff to communicate with residents and conduct interventions to minimize human–wildlife conflicts (Japan Bear Network 2007b). In our survey, we distinguished between the local town and prefectural governments in questions regarding perceptions of government performance to understand differences in people’s perceptions of these agencies’ performance.

Survey instrument

Prior to developing the survey instrument, we conducted personal interviews with 55 stakeholders, including residents, hunters, village chiefs, and town office managers in the study area (Sakurai et al. 2011). Survey design followed conventional guidelines (Dillman 2007) and was pilot-tested using a small number of residents and revised for clarity. The survey had 50 items, including 4 questions on risk perceptions, 4 on perception of government performance, 1 on self-assessed knowledge, 1 on wildlife acceptance capacity, 2 on behavior, and 2 on demographics (Appendix).

With the help of village chiefs and district leaders, we distributed 2,315 copies of the written, self-administered survey in July 2010, including each household in all 42 villages in Tanto and in 16 of 74 villages in Kami (those with a high occurrence of reported human–bear conflicts based on information from government officials). Each survey was delivered to the post box at every house and was subsequently collected from each house by village chiefs and district leaders after 2–4 weeks. We were unable to test for non-response bias because the survey was conducted anonymously and we could not identify non-respondents. The district leaders who assisted with survey distribution belonged to the residents’ association, which was distinct from the town or prefectural governments; thus, we believe that any response bias for respondents to answer in a pro-government way was limited.

Analysis

We measured internal consistency of variables in the two categories perceptions of government performance and risk perception by reliability analysis quantified as Cronbach’s $\alpha$, which measures the extent of correlation among questionnaire items. We used linear and logistic regression to measure the association among variables (e.g., perceptions of government performance, risk, and wildlife acceptance capacity). We conducted linear regression analysis if the dependent variable had multiple scales (1 = disagree, 2 = slightly disagree, 3 = neither option, 4 = slightly agree, 5 = agree) and logistic regression analysis if the answer had bivariate scale (1 = yes, 0 = no). We included demographic characteristics as independent variables in regression analyses. We used t-tests to compare mean perceptions of government performance among gender groups and ANOVA to compare these among age groups. We considered tests significant at $\alpha = 0.05$. We used SPSS Version 18 (IBM, Inc., Chuo, Tokyo, Japan) for the statistical analysis.

Results

We received 1,210 completed surveys (52.3% response rate).

Demographic variables

Among respondents, 72% were male and 61% were $\geq 60$ years old. According to the most recent census, the male population was 45% in Kami and 48% in Tanto, and about 35% of residents were older than 60 in both Kami and Tanto (Ministry of Internal Affairs and Communication 2005, Kami Town 2011).

Distribution of cognitive variables and behaviors

In general, people thought town governments were doing a better job than the prefectural governments in providing information about bears (mean score: town = 2.98, prefecture = 2.51) and
opportunities to listen to people’s concerns (mean score: town = 2.87, prefecture = 2.50; Table 1). The 4 variables of perception of government performance had a Cronbach’s $\alpha$ of 0.89, and removing any item lowered this value. Most respondents felt that human–bear conflicts were increasing and expressed concern over children’s safety, crop damage, and walking outside. The $\alpha$ reliability for 4 risk perception items was 0.85, and deleting any of the variables did not improve it. The mean score of self-assessed knowledge was 1.93, meaning only a small portion of respondents agreed that they knew how to keep bears away (Table 1). Eighty-three percent of respondents thought that there were too many bears, and 29% reported sightings of bears. The majority of respondents (83%) had persimmon, chestnut, or both types of trees in their backyard, and among those respondents, about half (46%) conducted activities to prevent wildlife damage.

The perception of government performance index was higher among women ($t = 4.957, P < 0.01$) than among men. Respondents >70 years old had significantly higher approval of government performance than did those in their 50s and 60s ($P < 0.05$). There were no significant gender differences in reporting bear sightings ($\chi^2 = 0.548, P = 0.459$) or conducting interventions to prevent damage by bears ($\chi^2 = 0.114, P = 0.736$). Age groups did not differ in reporting sightings ($Wald = 0.227, P = 0.634$); however, older people were more likely than younger people to conduct interventions to prevent damage by bears ($Wald = 11.210, P < 0.01$).

### Table 1. Residents’ average scores based on a 5-point scale of perception of government performance (1 = disagree, 2 = slightly disagree, 3 = neither option, 4 = slightly agree, 5 = agree), risk perception regarding bear issues, and self-assessed knowledge of avoiding bear conflicts in Hyogo Prefecture, Japan, July 2010.

<table>
<thead>
<tr>
<th>Perception of government performance</th>
<th>Mean</th>
<th>SD</th>
<th>Cronbach’s $\alpha$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Town government provided adequate information about bears ($n = 1,103$)</td>
<td>2.98</td>
<td>1.33</td>
<td>0.89</td>
</tr>
<tr>
<td>Prefectural government provided adequate information about bears ($n = 1,091$)</td>
<td>2.51</td>
<td>1.22</td>
<td></td>
</tr>
<tr>
<td>Town government provided opportunities to listen to people’s concerns regarding bear issues ($n = 1,088$)</td>
<td>2.87</td>
<td>1.27</td>
<td></td>
</tr>
<tr>
<td>Prefectural government provided opportunities to listen to people’s concerns regarding bear issues ($n = 1,081$)</td>
<td>2.50</td>
<td>1.20</td>
<td></td>
</tr>
<tr>
<td>Risk perception</td>
<td></td>
<td></td>
<td>0.85</td>
</tr>
<tr>
<td>Human–bear conflicts are increasing ($n = 1,125$)</td>
<td>4.16</td>
<td>1.13</td>
<td></td>
</tr>
<tr>
<td>Concerned about the safety of children ($n = 1,124$)</td>
<td>4.26</td>
<td>1.08</td>
<td></td>
</tr>
<tr>
<td>Concerned about agricultural damage ($n = 1,118$)</td>
<td>3.93</td>
<td>1.24</td>
<td></td>
</tr>
<tr>
<td>Worried about walking outside in my neighborhood ($n = 1,132$)</td>
<td>4.27</td>
<td>1.05</td>
<td></td>
</tr>
<tr>
<td>Self-assessed knowledge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I know how to keep bears away from my house ($n = 947$)</td>
<td>1.93</td>
<td>1.20</td>
<td></td>
</tr>
</tbody>
</table>

### Relationships between perception of government performance and risk

Among the perceptions of government performance variables, “town government provided information” ($P < 0.05$) and “prefectural government provided information” ($P < 0.05$) were significantly associated with people’s perceptions of an increase of human–bear conflicts (Table 2). Respondents who agreed that the town government provided information felt more risks from bears, whereas respondents who thought the prefectural government provided information felt less risk. Women had more concerns over children’s safety ($P < 0.05$), crop damage ($P < 0.05$), and walking outside ($P < 0.01$) than did men. Elder people were more concerned about crop damage ($P < 0.05$). Overall, the degree of predictability of risk perception based on these variables was minimal. Only 1.1% of the variability was explained by perception of government performance and demographic variables for perceptions of bear-related risks or concerns (Table 2).

### Relationship between risk perception and acceptance capacity

All 4 risk perception variables were negatively correlated with acceptance capacity of bears ($P < 0.01$; Table 3). Respondents who had more concerns over children’s safety ($P < 0.05$), concerns about crop damage ($P < 0.01$), and worry about walking outside ($P < 0.05$) were more likely to believe that there were too many bears than residents who did not have these concerns. Age was a significant
predictor of acceptance capacity. Adjusted $R^2$ value showed that 16.7% of variability in people’s acceptance of bears was explained by risk perception and demographic variables.

**Relationships between perception of government performance and behaviors**

Among the 4 variables assessing perception of government performance, only “town government provided adequate opportunities to listen to people’s concerns” was associated with people’s likelihood of reporting sightings of bears ($P < 0.05$; Table 4). Respondents who thought that the town government listened to people’s concerns more likely reported sightings of bears than residents who did not think that way. Although perception of government performance was not significantly associated with performing interventions to prevent bear damage, age was associated with people’s behaviors ($P < 0.05$); older people were more likely to use interventions to prevent bear damage than younger people (Table 5).

All 4 variables measuring perception of government performance were significantly correlated with people’s self-assessed knowledge (Table 6). Respondents who thought that the town government listened to people’s concerns were more likely to report that they knew how to keep bears away. Six percent of self-assessed knowledge variability was explained by perception of government performance variables and demographic variables.

**Discussion**

**Relationship between perception of risk and government performance**

Over 80% of respondents in this study felt they were threatened by human–bear conflicts and
believed there were too many bears around town, thus exceeding residents’ tolerance or Wildlife Acceptance Capacity (Gigliotti et al. 2000). Women were more likely to report that the government is doing a good job in providing information and listening to people’s concerns regarding bear management. Studies conducted in Western countries have found that men reported more social trust in government agencies and scientists than women (Siegrist 2000), suggesting a possible cultural difference between Japan and the West. Respondents >70 years old more likely had positive perceptions of government performance, which has been reported in other studies (Zenkyo 2009, Ooyama 2010), and were more likely to conduct interventions to prevent bear damage.

Several measures of perception of government performance were significant factors in predicting risk perception regarding bear issues, and risk perception was significantly associated with wildlife acceptance capacity. Higher agreement that the town government provided information was associated with an increase of risk perception. This does not support our first hypothesis or results of previous studies (Siegrist et al. 2000, Vaske et al. 2004). A cross-cultural study by Viklund (2003) revealed that people’s perceived risk of nuclear radiation risks and other general risks decreased as social trust increased in the UK, France, and Sweden. In our study, increasing perceived risk with increasing perception of government performance may stem from the type of government information provided to residents in the area. The town government office usually uses radio broadcasts to alert people when bears appear around residential areas and warns people to be careful. This study indicates that the town effectively warned people of bear threats, yet concomitantly increased their perception of risk.

In contrast, perceptions of higher performance of the prefectural government were associated with a decrease in risk perception. Public interventions and interactions by the prefectural government differed from the town government. The prefectural government organized general bear education seminars and outreach activities that were usually not related to specific bear damage, whereas the town government provides broadcasts and warns residents whenever there are bear incidents.

Perceptions of performance of different levels of government often vary. In our study, residents reported more negative perceptions of the prefectural government than town government. Previous studies in Japan found that people’s social trust of the central government is generally lower than that

Table 3. Multiple regression analysis with acceptance capacity of bears as a dependent variable and risk perception and demographic variables as independent variables for a July 2010 study in Hyogo Prefecture, Japan. \( \beta \) = standardized coefficient.

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>( \beta )</th>
<th>( r )</th>
<th>( R^2 )</th>
<th>Adjusted ( R^2 )</th>
<th>( n )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase of human–bear conflicts</td>
<td>−0.07</td>
<td>−0.30a</td>
<td>0.174</td>
<td>0.167</td>
<td>718</td>
</tr>
<tr>
<td>Concerns over children’s safety</td>
<td>−0.11b</td>
<td>−0.34a</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concerns for crop damage</td>
<td>−0.19d</td>
<td>−0.37a</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worry of walking outside</td>
<td>−0.10b</td>
<td>−0.33a</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>−0.03</td>
<td>−0.08b</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>0.09a</td>
<td>−0.10a</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\( aP < 0.01 \)

\( bP < 0.05 \)

Table 4. Logistic regression model to predict people’s behavior to report sightings of bears with perception of government’s performance and demographic items as independent variables (\( n = 576 \)) for a July 2010 survey in Hyogo Prefecture, Japan. \( \beta \) = standardized coefficient. \( e^\beta \) = odds ratio.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Wald</th>
<th>( \beta )</th>
<th>( e^\beta )</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Town government listened to people</td>
<td>4.693</td>
<td>0.26</td>
<td>1.30</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Prefectural government listened to people</td>
<td>2.764</td>
<td>−0.24</td>
<td>0.79</td>
<td>0.10</td>
</tr>
<tr>
<td>Town government provided information</td>
<td>0.467</td>
<td>0.07</td>
<td>1.08</td>
<td>0.49</td>
</tr>
<tr>
<td>Prefectural government provided information</td>
<td>0.060</td>
<td>−0.03</td>
<td>1.03</td>
<td>0.81</td>
</tr>
<tr>
<td>Gender</td>
<td>0.269</td>
<td>−0.11</td>
<td>0.89</td>
<td>0.60</td>
</tr>
<tr>
<td>Age</td>
<td>0.009</td>
<td>0.01</td>
<td>1.01</td>
<td>0.92</td>
</tr>
</tbody>
</table>
of local government due to less transparency in the central government (Ikeda 2010). In contrast, in Australia, people’s trust of state government was higher than that of local government (Mazur and Curtis 2006). Our results may reflect general trends in Japan regarding the central government or may indicate less interaction or satisfaction with the Hyogo prefectural government in their management of bears.

**Relationship between perception of government performance and behaviors**

The perception of government performance variable, “town government provided opportunities to listen to residents’ concerns about bears,” was a significant factor in explaining residents’ reaction to report bear sightings, supporting our second hypothesis. The fact that “town listened to residents’ concerns” was more important in explaining the reaction than “town provided information,” suggests that a 2-way dialogue with citizens is important for building trust (Maeda and Miyahara 2003). Because people’s perceptions of government performance are correlated with the degree of social trust people have (Ooyama 2010), it will be vitally important for both town and prefectural government in Japan to increase public trust by improving activities to foster people’s behaviors to prevent bear damage. Perception of government performance was correlated with residents’ self-assessed knowledge of how to keep bears away. In the short term, improving residents’ perceptions of government performance through more effective interaction may encourage people to engage in preventive behaviors such as reporting sightings and protecting crops, and may give confidence to residents in controlling and preventing bear conflicts. Taking action and believing that they can prevent the conflict are the first steps to create a community where residents feel that they can mitigate bear conflicts (Yokoyama 2009). It is important for residents to realize that they can prevent bear problems because a lack of perceived control in handling problems can foster more negative attitudes toward bears (Huygens et al. 2004).

Our findings revealed that people’s acceptance capacity of bears decreased as risk perceptions increased, which supports our third hypothesis. However, residents’ acceptance capacity of bears needs to increase before a sustainable bear population can be achieved. This suggests that decreasing both real and perceived risk would affect residents’ acceptance capacity of bears (Decker et al. 2001). This also suggests that the town government’s long-term policy to increase basic warnings about bears needs to include more detailed information and

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### Table 5. Logistic regression model to predict people’s behaviors to conduct interventions to prevent bear conflicts with perception of government’s performance and demographic items as independent variables (n = 799) for a July 2010 survey in Hyogo Prefecture, Japan. $\beta =$ standardized coefficient. $e^\beta =$ odds ratio.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Wald</th>
<th>$\beta$</th>
<th>$e^\beta$</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Town government listened to people</td>
<td>1.695</td>
<td>0.12</td>
<td>1.13</td>
<td>0.19</td>
</tr>
<tr>
<td>Prefectural government listened to people</td>
<td>0.445</td>
<td>-0.06</td>
<td>0.93</td>
<td>0.51</td>
</tr>
<tr>
<td>Town government provided information</td>
<td>1.928</td>
<td>0.12</td>
<td>1.13</td>
<td>0.17</td>
</tr>
<tr>
<td>Prefectural government provided information</td>
<td>0.773</td>
<td>-0.09</td>
<td>0.92</td>
<td>0.38</td>
</tr>
<tr>
<td>Gender</td>
<td>0.069</td>
<td>-0.05</td>
<td>0.96</td>
<td>0.79</td>
</tr>
<tr>
<td>Age</td>
<td>7.076</td>
<td>0.17</td>
<td>1.18</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

### Table 6. Multiple regression analysis with self-assessed knowledge of how to keep bears away as a dependent variable and perception of government’s performance and demographic items as independent variables for a July 2010 survey in Hyogo Prefecture, Japan. $\beta =$ Standardized coefficient.

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>$\beta$</th>
<th>$r$</th>
<th>$R^2$</th>
<th>Adjusted $R^2$</th>
<th>$n$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Town government listened to people</td>
<td>0.13$^b$</td>
<td>0.23$^a$</td>
<td>0.063</td>
<td>0.057</td>
<td>869</td>
</tr>
<tr>
<td>Prefectural government listened to people</td>
<td>0.03</td>
<td>0.20$^a$</td>
<td>0.063</td>
<td>0.057</td>
<td>869</td>
</tr>
<tr>
<td>Town government provided information</td>
<td>0.08</td>
<td>0.21$^a$</td>
<td>0.063</td>
<td>0.057</td>
<td>869</td>
</tr>
<tr>
<td>Prefectural government provided information</td>
<td>0.04</td>
<td>0.19$^a$</td>
<td>0.063</td>
<td>0.057</td>
<td>869</td>
</tr>
<tr>
<td>Gender</td>
<td>0.00</td>
<td>-0.03</td>
<td>0.063</td>
<td>0.057</td>
<td>869</td>
</tr>
<tr>
<td>Age</td>
<td>0.05</td>
<td>0.07$^b$</td>
<td>0.063</td>
<td>0.057</td>
<td>869</td>
</tr>
</tbody>
</table>

$^aP < 0.01$

$^bP < 0.05$
outreach activities to reduce conflicts, lest it fail to build a community where residents are more wildlife tolerant and can coexist with bears.

**Limitation of study**

A limitation of this study is the difference of sampling in each town. While all 42 villages in Tanto were included, 16 villages with high bear damage were purposefully selected in Kami Town for the survey. However, results showed that a similar proportion of residents experienced agricultural damage by bears in each town (Tanto: 40.3%, Kami: 40.0%), which suggests residents had similar experiences with bears. Additionally, because more male and elderly people responded to the survey than the population as a whole, there is a possibility that mean perception of government performance might be more positive, and people engaged in interventions might be lower for the general population.

Another limitation is the small number of variables that were used to measure perception of government performance. Other studies have included additional aspects of social trust (Vaske et al. 2004), such as agency credibility and trustworthiness. In our study, we included 2 variables and 2 levels of government, but because of space limitations we were not able to incorporate additional facets of social trust. The explanatory power of the perception of government performance index also was relatively small in its association with risk perception and self-assessed knowledge. Future studies should explore additional variables to fully explain these factors.

**Management implications**

For government entities charged with protecting public safety and managing wildlife, there is a balancing act between sufficiently warning residents of threats from bears to encourage preventive actions and not encouraging more negative attitudes and lowered acceptance capacity. It is important that engaging in preventive behaviors become the social norm in the region, so that interpersonal communications among rural residents support efforts by government education and outreach programs to reduce conflicts (Pretty 2003, Pretty and Smith 2004).

Only 13% of respondents reported knowledge of how to keep bears away from their homes, similar to other studies that have found low public knowledge regarding bears and how to mitigate bear problems in Japan (Huynghens et al. 2001; Japan Bear Network 2007a). According to the theory of planned behavior (Ajzen 1985), residents will take preventive actions only if they perceive that they have the knowledge and necessary skills to perform them. This suggests the need to communicate more effectively with residents about the characteristics and behaviors of bears so that people will have accurate knowledge about how to reduce conflicts (Marker et al. 2003, Thornton and Quinn 2010), which can potentially improve attitudes toward bear conservation (Espinoza and Jacobson 2012). In response to these findings, the Tajima branch office of Hyogo Prefecture has started a series of bear education seminars and active intervention programs for residents. Because knowledge alone does not necessarily reduce residents’ worry regarding wildlife issues (Riley and Decker 2000, Jacobson 2009), other factors such as social learning, which provides opportunities for the public to participate and work together in reducing barriers and solving problems, may help residents to increase feelings of control and potentially increase the acceptance capacity toward bears (Pretty and Smith 2004). Public participation can also increase people’s acceptance and support for management decisions, as well as the decision making process (Arvai 2003). Efforts made by the Hyogo prefectural government to provide opportunities for residents and managers to engage in a dialogue (Maeda and Miyahara 2003) and participate in goal-setting and management may eventually build a more trusting relationship and support sustainable bear management.

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**Literature cited**


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Appendix. Questionnaire items and response scale for a July 2010 survey of public perceptions of risk and government performance regarding bear management in Hyogo Prefecture, Japan.

Perception of government performance: 1 = disagree, 2 = slightly disagree, 3 = neither option, 4 = slightly agree, 5 = agree
  Town government provided adequate information about bears
  Prefectural government provided adequate information about bears
  Town government provided opportunities to listen to people’s concerns regarding bear issues
  Prefectural government provided opportunities to listen to people’s concerns regarding bear issues

Risk Perception: 1 = should be decreased, 2 = current number is fine, 3 = should be increased
  Human–bear conflicts are increasing
  Concerned about the safety of children
  Concerned about agricultural damage
  Worried about walking outside in my neighborhood

Self-assessed knowledge: 1 = disagree, 2 = slightly disagree, 3 = neither option, 4 = slightly agree, 5 = agree
  I know how to keep bears away from my house

Wildlife acceptance capacity: 1 = should be decreased, 2 = current number is fine, 3 = should be increased
  Perception of the number of bears living around the town

Behaviors: 1 = yes, 2 = no
  I report sightings of bears and / or traces
  I conduct interventions to protect persimmon trees from wildlife damage

Demographics
  Gender: 1 = female, 2 = male