Local knowledge and attitude towards the Vulnerable Bhutan takin *Budorcas whitei* among residents living within its seasonal range

TIGER SANGAY, RAJARATNAM RAJANATHAN, KARL VERNES and MATTHEW TIGHE

Abstract We assessed local knowledge of and attitudes towards a large, endemic bovid, the Bhutan takin *Budorcas whitei*, within its seasonal range in Jigme Dorji National Park, Bhutan. Using semi-structured questionnaires, data were collected in March 2015 from interviews with 169 park residents. A conditional inference tree analysis was used to explore associations between demography, locality, and secondary response variables through questions relating to respondents' knowledge of the takin's status as a protected species, a Vulnerable species, and as the national animal. Most respondents knew the takin was Bhutan's national animal, and of those, a significantly high proportion also knew of its protected status. Significantly more respondents residing in the species' summer, rather than winter, range were aware of the takin's Vulnerable status. Most respondents expressed positive feelings towards the takin and supported its protection. This strong positive attitude, in conjunction with awareness-raising efforts, could be valuable for promoting the takin as a montane flagship species.

Keywords Attitude, awareness, Bhutan, *Budorcas whitei*, conservation, Jigme Dorji National Park, perception, takin

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Introduction

Bhutan lies within the Eastern Himalayan biodiversity hotspot (Myers et al., 2000) and supports a diverse mammal community comprising lowland Indo-Malayan species such as the tiger *Panthera tigris* and common leopard *Panthera pardus*, and upland Palaearctic fauna such as the snow leopard *Panthera uncia*, red panda *Ailurus fulgens*, and blue sheep *Pseudois nayaur*. The country is also home to several endemic mammals, including Bhutan's national animal, the Bhutan takin *Budorcas whitei* (Leslie, 2011; Sangay et al., 2016), categorized (as *Budorcas taxicolor*) as Vulnerable on the IUCN Red List (Song et al., 2008). More than 80% of Bhutan's land area is naturally vegetated, with > 50% secured in a protected area network (Rajaratnam et al., 2016). Constitutionally mandated to maintain at least 60% of the total land area under native vegetation (RGoB, 2008), Bhutan is an integral conservation landscape in the Eastern Himalayan ecoregion (Olson & Dinerstein, 2002).

Bhutan is predominantly Buddhist, with religious tenets focusing strongly on interdependence between life forms (Brooks, 2010) and valuing the sanctity of life (Rajaratnam et al., 2016). Environmental protection is central to Buddhist philosophy (Zurick, 2006), shaping Bhutanese attitudes towards, and perceptions of, nature. Environmental protection underpins many cultural and religious festivals, reinforcing the value of nature to the Bhutanese people (Pommaret, 2006). More recently, local media has promoted a positive attitude towards nature, reinforcing traditional Bhutanese attitudes and perceptions (Rapten, 2001; Lhamo & Oyama, 2015).

Bhutan's rural populace are agropastoralists (Katel & Schmidt-Vogt, 2011) dependent on natural systems for fuelwood, fodder, water and other ecosystem services (Defries et al., 2010). Livestock and crop loss to wildlife can significantly affect the economic costs of living in a forested landscape rich in wildlife (Karanth et al., 2006; Sangay & Vernes, 2008, 2014). Such loss can lead to negative perceptions of nature and intolerance of wildlife (Oli et al., 1994; Mishra, 1997; Sangay & Vernes, 2008, 2014) as demonstrated elsewhere, where wildlife consume crops (Gadd, 2005; de Pinho et al., 2014) and damage property (Rao et al., 2003). Although retaliatory killing of livestock predators and crop pests can be mitigated by compensation to affected farmers (Gadd, 2005; Sangay & Vernes, 2008, 2014; Karanth & Defries, 2010), wildlife conservation can succeed when accompanied by tangible benefits to rural communities (Kumssa & Bekele, 2014; Mamo, 2015). For example, Bhutan is a popular destination for tourists wanting to explore natural landscapes and the rich biodiversity within the country's protected areas, which are also key to conserving wildlife (TCB, 2016). Bhutanese rural communities benefit directly through porterage services, home stay lodges

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and sale of handicrafts. Understanding and shifting people's attitudes towards wildlife by advocating their positive contribution to livelihoods can enhance regional wildlife conservation (Mir et al., 2015).

The Bhutan takin is the national animal of Bhutan, yet is poorly studied. It migrates seasonally between high altitude alpine meadows in summer and lower subtropical broadleaf forests during winter, coming into contact with agropastoralists engaged in activities such as collecting fuelwood and other forest products. There are, however, no reports of crop losses to takin throughout its range or any other negative interactions with people. Our study investigates knowledge, perception, and attitudes towards the Bhutan takin among the residents of Jigme Dorji National Park, a stronghold for the species. By addressing the human dimension of wildlife conservation, our study contributes towards a comprehensive conservation plan for the takin's long-term survival.

Study area

Our study was conducted in the 4,316 km² Jigme Dorji National Park in north-west Bhutan (Fig. 1). Habitat types and elevations range from subtropical warm broadleaf forest (1,000–2,300 m), evergreen oak forest (1,800–2,600 m), cool broadleaf forest (2,000–2,900 m), mixed conifer forest (2,700–3,200 m), fir forest (3,300–3,800 m), juniper/rhododendron forest (3,700–4,200 m) and alpine scrub (4,000–4,600 m) to snow covered rocky peaks up to 7,300 m in the north (FRMD, 2016). In addition to its rich biodiversity (Thinley & Tharchen, 2015), the Park protects the catchments of four major rivers: Pa Chu, Wang Chu, Mo Chu and Pho Chu.

Methods

Interviews

There is a resident population of c. 5,200 people in Jigme Dorji National Park, distributed across in 13 Geogs (subdistricts) within the five Dzongkhags (districts) of Gasa, Punakha, Wangdiphodrang, Thimphu and Paro (Thinley & Tharchen, 2015; Fig. 1). Our study focused on three Geogs (Laya, Khatey and Khamey) in the Gasa Dzongkhag that overlap with the distribution of the Bhutan takin. Laya's residents are nomadic yak herders in the high alpine meadows encompassing the takin's summer habitat. Khatey and Khamey encompass the takin's winter habitat, where residents are primarily agropastoralists. During our study the population of the three Geogs was 2,505 people in 428 households (Thinley & Tharchen, 2015). Semi-structured face-to-face interviews with 169 respondents (Supplementary Material 1) were conducted in March 2015. In addition to obtaining demographic information, interviews also investigated knowledge and perceptions of, and attitudes towards, the takin.

Data analysis

We analysed response data using *R 3.4.0* (R Development Core Team, 2017) focusing on conditional inference tree analysis using the *cTREE* function in package *party* (Hothorn et al., 2006). We analysed the responses to five questions: (1) Do you know that the takin is Bhutan's national animal? (2) Do you know that the takin is a Vulnerable species? (3) Are you aware that the takin is a protected species? (4) Do you like the takin (a lot, a little, don't care, not at all)? (5) Do you think the takin should be protected?

Responses (dependent variables) to each of the five questions were assessed for association with primary explanatory variables of locality (village and Geog) and demography (gender and age). With the exception of question 3, neither locality nor demography were identified as significant predictors. In these instances, the analyses were re-run using the respondent answers to the other four questions as potential predictor variables (e.g. was respondent's knowledge of takin as a Vulnerable species associated with knowledge of takin as Bhutan's national animal?). This was done to determine significant associations between respondent's knowledge and attitude towards the takin.

We used the adjusted Bonferroni test (Hothorn et al., 2006) as the primary indicator of association strength, with $P < 0.05$ indicating significance. A conditional inference tree analysis compares an assigned dependent variable with explanatory variables in an iterative fashion to identify the explanatory variable with the most power (at $P < 0.05$), and a binary split of the data occurs within that variable to maximize explained variation. The process is then repeated for all subgroups by iterating across all potential explanatory variables. The end result is a hierarchical explanatory tree of pattern explained by variables and subgroups of variables (Hothorn et al., 2006). Results are represented graphically to show the hierarchical significance of variables and the final groups of response values following binary splits.

Results

Respondents comprised farmers, yak herders and school children, of which 91 (54%) were Laya residents and 78 (46%) were Khatey and Khamey residents. Most respondents were 25–50 years of age (69%, n = 117). Youths (< 25 years of age) comprised 17% (n = 28) of respondents, and older adults (> 50 years of age) comprised 14% (n = 24). Most respondents were subsistence farmers (83%, n = 130).

FIG. 1 The locations of villages in Jigme Dorji National Park (JDNP), Bhutan, where people were interviewed regarding the takin *Budorcas whitei*.

Knowledge of the takin as Bhutan's national animal Knowing that the takin is Bhutan's national animal was not significantly explained by demography and locality. When secondary explanatory variables were included, awareness was significantly associated with knowledge of the takin's protected status (Fig. 2), with 85% of respondents knowing the takin is protected. This group of respondents also included a high percentage of respondents who knew the takin's status as the national animal. The 16 respondents who did not know the takin is protected did, however, know that it is the national animal.

Knowledge of the takin's Vulnerable status Locality (Geog) within the seasonal range of the takin was the only significant ($P < 0.05$) primary predictor of knowledge of the takin's Vulnerable status (Fig. 3). Of the interviewees who responded to this question, 61% from Laya in the takin's summer range knew the species to be Vulnerable compared to 39% from Khatoe and Khamey in the takin's winter range.

Knowledge of the takin's protected status Neither demography nor locality explained whether or not respondents knew the takin is protected. With inclusion of secondary explanatory variables, knowledge of the takin's protected status was significantly associated with awareness of Bhutan's Forest and Nature Conservation Act 1995 (Fig. 4). Seventy-six per cent of respondents were aware of this legislation, which corresponded to a high proportion of respondents who also knew the takin was protected (96% or 120 of 125 respondents who were aware of the legislation also knew the takin's protection status). Furthermore, 91% of the respondents who were aware of the legislation also liked the takin 'a lot'. Of respondents who were unaware of the legislation, 49% nevertheless knew the takin is protected. Amongst those who were aware of the legislation, degree of fondness for the takin was significantly associated with knowledge of its protected status: 97% of respondents who were aware of the legislation and liked the takin 'a lot' also knew of its protected status, compared with 82% of respondents who knew the legislation but liked the takin 'a little'.

Fondness for the takin Fondness for the takin was not explained by demography or locality. Following inclusion of secondary explanatory variables, fondness was significantly associated with strong support for its protection (95%, Fig. 5). However, 50% of respondents

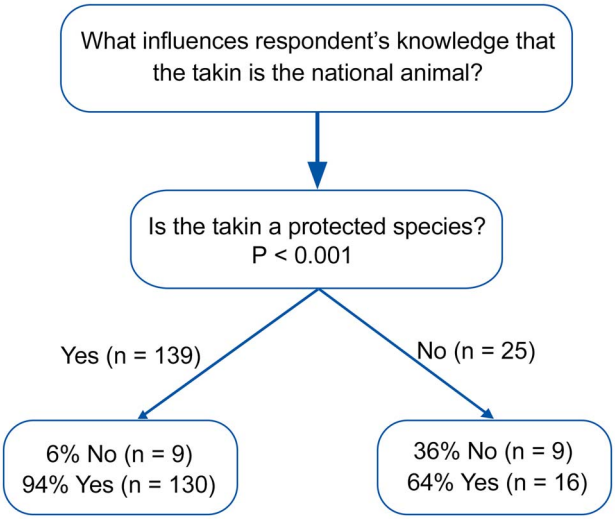

FIG. 2 Conditional inference tree displaying significant explanatory variables for the question 'What determines knowledge that the takin is the national animal?' 164 of 169 possible respondents answered. Respondent's knowledge of takin being a protected species was the only significant predictor.

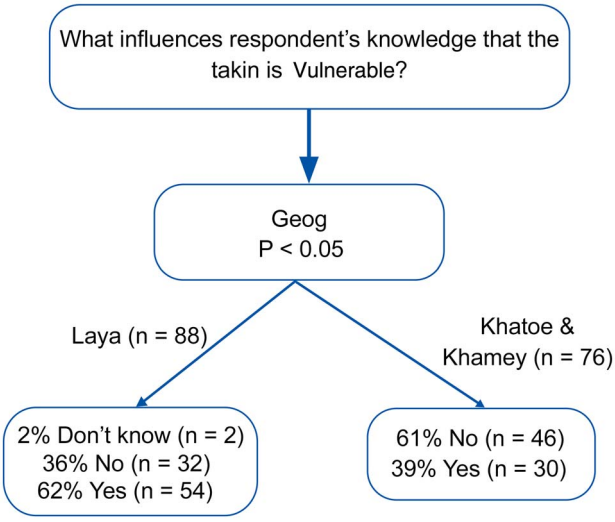

FIG. 3 Conditional inference tree displaying significant explanatory variables for the question 'What determines knowledge that the takin is Vulnerable?' 164 of 169 possible respondents answered. One significant explanatory variable (respondent's locality or 'Geog') and the grouping of responses are displayed.

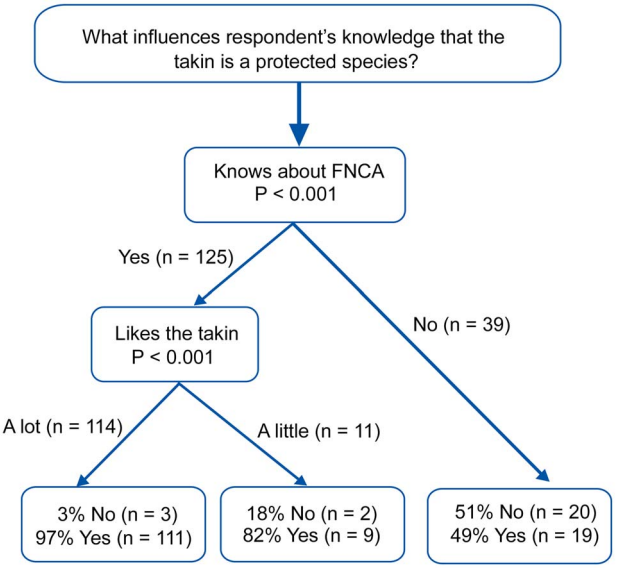

FIG. 4 Conditional inference tree displaying significant explanatory variables for the question 'What determines knowledge that the takin is protected?' 164 of 169 possible respondents answered. Two explanatory variables were significant (respondent's knowledge of the Forest and Nature Conservation Act, FNCA, and respondent's fondness for takin).

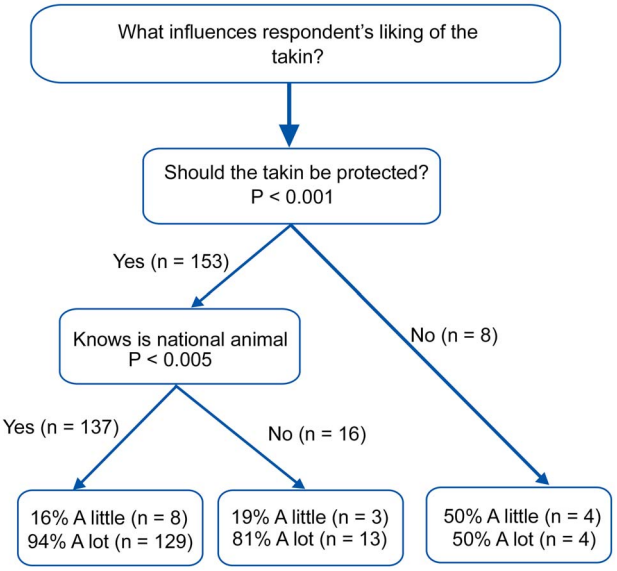

FIG. 5 Conditional inference tree displaying significant explanatory variables for the question 'Do you like the takin?' 161 of 169 possible respondents answered. Two explanatory variables were significant (respondent's attitude towards takin protection, and knowledge of takin as Bhutan's national animal).

who did not support takin protection still liked the takin 'a lot'. Of respondents who believed the takin should be protected most knew that it is the national animal and also liked the takin 'a lot'.

Protection for the takin Demography and locality did not have any significant association with whether respondents thought the takin should be protected. Following inclusion of secondary explanatory variables, support for takin protection was significantly associated with fondness for the species; 91% of respondents liked the takin 'a lot', of which most supported takin conservation (Fig. 6). However, of the few respondents who liked the takin 'a little', only 73% supported its protection. Ninety-six percent

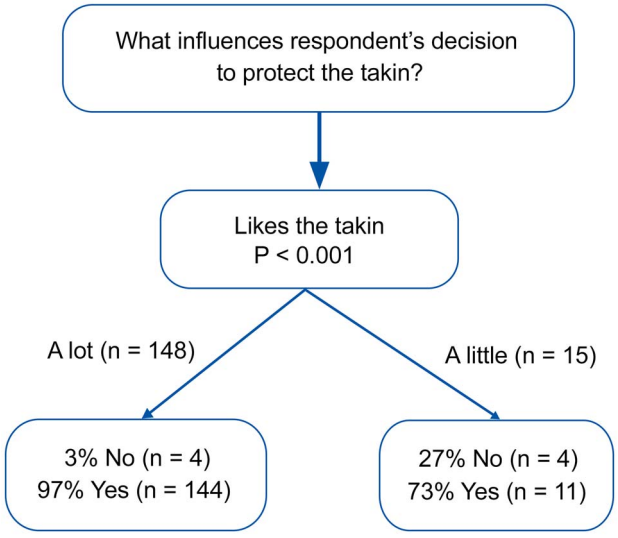

FIG. 6 Conditional inference tree displaying significant explanatory variables for the question 'What determines preference that the takin should be protected?' 163 of 169 possible respondents answered. Respondent's fondness for the takin was the only significant predictor.

of respondents addressed the question of whether the takin should be protected. This cohort comprised residents who were willing to support takin conservation by protecting takin and its habitat (16%; n = 27); being an informant on illegal activities (14%; n = 24); not harming and disturbing the takin (14%; n = 23); providing required assistance (9%; n = 16); contributing labour for takin conservation (8%; n = 13); and spreading awareness of the takin (7%; n = 12).

Discussion

The overall positive perception of the takin by residents of Jigme Dorji National Park could be attributed to the Buddhist religious ethos of respect for life and harmonious coexistence with nature (Brooks, 2010). Similarly, Hindus in India and Nepal share similar views by practicing *ahimsa,* which equates to respecting all life forms (Sahni, 2008). Positive attitudes to snow leopards have been reported in other Himalayan Buddhist regions in Ladakh (Fox & Chundawat, 1988) and Spiti in Himachal Pradesh, India (Bagchi & Mishra, 2006). The Bhutan takin also has local religious and mythological significance that may enhance positive perceptions. Legend has it that the so-called Divine Madman Lam Drukpa Kuenley, a significant religious figure in Bhutan, combined the head of a goat with the body of a cow to create the takin (Downes, 2011), which led to the takin being chosen as Bhutan's national animal.

Awareness of the takin as the national animal was significantly linked to knowledge of its protected status, irrespective of where respondents lived. This can be attributed to conservation education awareness programmes and an agreement with the takin's summer habitat residents to not graze their domestic livestock 1 month prior to the arrival of migrating takin. Bhatia et al. (2017) suggested that conservation education and awareness can be best delivered by reference to the karmic cycle in predominantly Buddhist nations, as exemplified by the annual Takin Festival in Jigme Dorji National Park, at which residents are informed of the benefits of protecting takin habitat in its summer grazing alpine meadows at Tsharijathang. This also helps to facilitate sustainable collection of the highly prized cordyceps *Ophiocordyceps sinensis* fungus and other non-timber forest products (Mukhai et al., 2013; Wangchuk et al., 2013; Wangchuk & Wangdi, 2015). This additional socioeconomic benefit could possibly explain the overwhelming support for takin conservation amongst park residents, in addition to the species' national status and religious significance. Positive perception of the takin by residents in the takin's winter range could be attributed to the fact that this species does not consume crops. The takin prefers forest for shelter (Sangay et al., 2016) and, moreover, agricultural fields are left fallow during winter.

Significantly higher awareness among residents in the takin's summer habitat compared to residents in the winter habitat could be attributed to socioeconomic activity that increases contact with congregating takin herds in the open alpine meadows. The highly valued cordyceps in these meadows are collected in the summer by Laya residents, who have become affluent from the associated trade (Wangchuk et al., 2013; Shrestha et al., 2017) and are able to afford televisions and smartphones (Lhamo & Oyama, 2015; MoIC, 2016; NSB, 2016), thus increasing exposure to conservation messages about the takin. Despite also having access to media, Khatey and Khamey residents are less exposed to takin in the dense broadleaved forested winter habitat, where takin herds fission into small groups that reduce chance encounters with residents collecting non-timber forest produce.

Regionally, the takin is threatened by deforestation, habitat fragmentation and hunting (Song et al., 2008; Dasgupta et al., 2010; Sangay et al., 2016). Despite positive perceptions towards the species, it remains Vulnerable (Song et al., 2008), facing threats from resource competition with domestic yaks, disturbance by free ranging dogs, habitat fragmentation, and indirect effects from cordyceps collection through the influx of people and animals (e.g. pack horses) that impact the fragile alpine meadow ecosystem and disrupt takin migration (Sangay et al., 2016). Yaks, horses and dogs further threaten the takin by potentially spreading zoonotic diseases in the summer habitat (Wangchuk et al., 2015).

Protected areas in developing countries are crucial for the provision of ecosystem services and also contribute to sustaining rural livelihoods by allowing activities such as livestock grazing and collection of forest products (Rajaratnam et al., 2016). The positive perception of the takin and its conservation by residents of Jigme Dorji National Park affirms

acceptance of the species in an environment shared by people and wildlife. The Park's periodic education and awareness campaigns are key to consolidating this harmonious relationship and should be prioritized and supported in the current conservation management plan (Thinley & Tharchen, 2015).

The Bhutan takin could be a suitable montane flagship species for conservation, as it fulfills the 10 criteria for such species proposed by Bowen-Jones & Entwistle (2002). (1) *Geographical distribution* It is endemic to Bhutan and restricted to major river valleys and mineral hot springs in the north, with the main population centred in Jigme Dorji National Park (Sangay et al., 2016). (2) *Conservation status* It is categorized as Vulnerable (Song et al., 2008) and is threatened by development activities, road construction, grazing competition with domestic livestock, and disturbance by free ranging domestic dogs (Sangay et al., 2016). (3) *Ecological role* Its browsing and grazing behaviour influences vegetation structure in both low altitude subtropical forests and high altitude alpine meadows (T. Sangay, unpubl. data). (4) *Recognition* It is officially recognized as the national animal. (5) *Existing usage* Its uniquely shaped head is officially used as the insignia for two national conservation agencies (the Wildlife Conservation Division and the Bhutan Trust Fund for Environmental Conservation). (6) *Charisma* It has charismatic appeal because of its unique and readily recognizable morphology that resembles the head of a goat on the body of a cow, and this study has demonstrated that the Bhutanese have a strong positive perception of the species. (7) *Cultural significance* It has entrenched cultural significance through religious and mythological folklore (Downes, 2011). (8) *Positive associations* It embodies significant pride as the national animal and draws positive attention from foreign tourists through replication on memorabilia such as stickers, fridge magnets and figurines. (9) *Traditional knowledge* It is readily recognized by rural residents in both its winter and summer ranges, with significant knowledge enhancement through the periodic takin festival in Jigme Dorji National Park, and promotion of local knowledge of takin in urban areas through regular features on television and in newspapers. (10) *Common names* It is known as *dronggyemtse* in Dzongkha, the language of Bhutan.

In summary, the endemic Bhutan takin is endorsed as the national animal and locally recognized. It is Vulnerable, morphologically charismatic, and influences forest structure through its feeding behaviour. Prominent national conservation agencies utilize this species as a logo and its strong cultural significance enhances positive perceptions by rural residents within its narrow geographical range. We propose that the Bhutan takin be used as a flagship species to promote montane conservation in Bhutan, with stewardship provided by residents of protected areas.

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Conflicts of interest None.

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