

Insights into medicinal wildlife consumption and bear part use in Rakhine, Myanmar

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ABSTRACT

Myanmar is an area of high diversity with prolific illegal wildlife trade, including trade in bear products for medicine. We focused on Rakhine State, Myanmar, which retains sun bear (*Helarctos malayanus*) populations despite poaching. To better understand why poaching continues to occur and whether poaching is motivated by regional demand for bear products for medicine, we performed a mixed methods study of structured questionnaires (n = 327) and semi-structured interviews (n = 66), in 52 villages. We specifically investigated the extent of traditional medicine use in Rakhine, as well as the consumption of bear bile and other medicinal wildlife products. We found that individuals largely do not use bear bile; however, individuals do use traditional medicine and consume a variety of other wildlife for medicine. Our study reveals that greater research is needed to understand the specific motivations behind the poaching of sun bears in Rakhine, though we suspect that external demand from China fuels trade in bear products within Rakhine. Our study also shows that there is a need for further studies that explore motivations for medicinal use of endangered and threatened wildlife in Rakhine, which can inform campaigns to reduce demand for these products.

1. Introduction

In mainland Southeast Asia sun bears (*Helarctos malayanus*) and Asiatic black bears (*Ursus thibetanus*) exist and, in some cases, overlap in their ranges (Garshelis & Steinmetz, 2016; Scotson et al., 2017), although Asiatic black bears generally occur at slightly higher latitudes compared to sun bears. In lower latitude countries such as Cambodia and Thailand, sun bears appear to be slightly more prevalent (Steinmetz et al., 2013). Both species' bile and gallbladders are consumed for medicinal purposes across Asia, although Asiatic black bear bile tends to be predominantly consumed in the "high consumption" countries of China and Vietnam (e.g. Feng et al., 2009; Crudge et al., 2018). This is possibly a feature of latitude, with Asiatic black bears being more common in China and northern Vietnam, or a feature of the large-scale Asiatic black bear farming that occurs in both countries (Bando et al., 2019; Crudge et al., 2018). Across Asia population estimates of both bear species are challenging to acquire, with sun bears in particular largely under-studied (Crudge et al., 2019). However, others have noted that Myanmar may still retain some of the most stable populations of bears in Asia (Nijman et al., 2017). It is therefore important to understand what

threats these bears may face, particularly as bears are known to be traded in northern and eastern Myanmar (Nijman et al., 2017; Nijman & Indenbaum, 2017). In our specific study area of Rakhine State, in western Myanmar, a four-year investigation into sun bear population and trade found that trade in sun bears was occurring, and that additional, noted increased deforestation and observed declines in sun bear encounters point to a decreasing sun bear population (Istituto Oikos, 2019; L. Gaffi, pers. obs.).

Although bear farms are largely concentrated in China and Vietnam, and consumption is well documented in those countries (Davis et al., 2019a; Dutton, Gratwicke, Hepburn, Herrera, & Macdonald, 2011), the use of both Asiatic black bear and sun bear bile and gallbladder for medicinal purposes has also been documented as occurring at possibly unsustainable rates in Cambodia and Laos (Davis et al., 2016, 2019b) and perhaps also Malaysia (e.g. Gomez et al., 2020). However, information is lacking about the consumption of bear bile in other countries within Asia, including in Myanmar. Although accurate population numbers for both sun bears and Asiatic black bears continue to be difficult to obtain, the scale of consumption across Southeast Asia suggests that current populations cannot withstand this pressure of demand.

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For example, bear farming's effects in Vietnam, rather than mitigating pressure on wild populations, have instead largely seemed to decrease the wild bear populations within-country (Crudge et al., 2016, 2018).

Consumer demand for bear products is therefore one of the biggest threats to both bear species (Crudge et al., 2019), yet bear part consumption within Malaysia, Thailand, Myanmar, and Indonesia is largely unknown. Bear products are certainly for sale in Malaysia, Indonesia, northern Myanmar, and eastern Myanmar, although what products are specifically traded varies, e.g. farmed bear bile medicine and wild gallbladders are more predominant in Malaysia, whereas in Indonesia bear trophies, rather than bear parts for medicine, are more common (Gomez & Shepherd, 2019; Krishnasamy & Shepherd, 2014; Nijman et al., 2017; Shepherd & Krishnasamy, 2013). The trade in northern Myanmar has been documented as being primarily marketed towards Chinese individuals such as tourists, Chinese nationals living in Laos, and across the border to Chinese individuals living within China (Nijman et al., 2017). In eastern Myanmar, trade in Asiatic black bear paws, skulls, and canines has been documented as being primarily directed at domestic tourists to a pilgrimage site, for traditional medicine purposes (Nijman & Indenbaum, 2017).

Bear bile/gallbladder (hereafter "bear bile") is used to treat a variety of ailments in Southeast Asia, with the most common ailments appearing to be "bruising" and "fatigue" (Davis et al., 2019a). According to the traditional Chinese medicine (TCM) pharmacopeia, bear bile is generally prescribed to treat "hot" ailments such as liver disease, fever, and also bruising (Feng et al., 2009). The TCM medicinal system, although similar to other Southeast Asian systems by being holistic in theory and treatment (e.g. Grundy et al., 2016; Westermeyer, 1988), does differ substantially from the present-day traditional medicine (TM) systems of Indic Southeast Asia. In modern Vietnam, Laos, and Cambodia, TM is a "recourse" where scientific medicine fails (e.g. Matsuoaka, Aiga, Rasmey, Rathavy, & Okitsu, 2010). This contrasts markedly with TCM, which has been "idealized" as a proud symbol of "Chineseness" (Hsu, 2008). Although Vietnam, Laos, and Cambodia have sanctified their TM systems, they have largely emphasized scientific medicine over TM as a marker of "advancement" (e.g. Anderson & Pols, 2012). This generally reflects medical pluralism, where individuals use multiple medical systems according to the influence of factors including society, family, and the ailments themselves (Kleinman, 1997). In Myanmar, TM appears to be integrated and utilized, with scientific medicine less well-integrated within the country due to varying reasons including the high cost of treatment (e.g. Diamond-Smith et al., 2016) and the overall strong belief in traditional medicine (Aye et al., 2014). However, regarding the medicinal consumption of bear bile specifically, previous research has indicated that bear bile/gallbladders may not be directly utilized in TM in Myanmar, with poached bears' gallbladder instead traded out to Chinese individuals (Nijman et al., 2017). This could also be a feature of the high price of 1700 USD/kg for full gallbladders in Myanmar (Istituto Oikos, 2020), which acts as a barrier to local Myanmar people purchasing gallbladder for medicine, and as an incentive to gaining that cash in lieu of the perceived treatment. However, this is a lesser price than the price of bear bile/gallbladder quoted in Laos, where use appears to be relatively ubiquitous, of approximately 75 USD for a small sliver of gallbladder (Davis & Glikman, 2020). The countries are comparable in GDP (e.g. Laplace et al., 2019; Moolio & Kong, 2016) and external wildlife demand pressures, e.g. from China (Nijman et al., 2017; Livingstone, Gomez, & Bouhoys, 2018), so this difference is curious.

Myanmar is rich in biodiversity (Rao et al., 2013) and retains many key Southeast Asian species, such as the tiger (*Panthera tigris*), that have been lost in other parts of the region (e.g. Aung et al., 2017). Nonetheless, in Myanmar there is substantial trade in wildlife into China, with the Kachin State noted as a source site for bear products traded into China (Nijman et al., 2017), and the border town of Mong La a popular destination for Chinese "wildlife consumption tourists" who purchase products from rhinos, otters, big cats, elephants, and more (e.g. Nijman & Shepherd, 2014; Nijman et al., 2014; Nijman et al., 2016; Shepherd &

Nijman, 2014; Shepherd et al., 2018). Although this external consumption pressure is well-documented, less is known about the people of Myanmar's own wildlife consumption. However, it has been shown that trade in endangered species, including Asiatic black bears and sun bears, occurs in Myanmar, with wildlife products traded to Myanmar nationals for medicinal purposes (e.g. Nijman & Indenbaum, 2017). Notably, all of this trade is prohibited by both the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and internal Myanmar law, although under Myanmar law animal products may be sold for traditional medicine purposes, if an appropriate permit is obtained (Nijman & Indenbaum, 2017). However, permits rarely seem to be obtained (Nijman & Indenbaum, 2017).

Wild meat is also consumed in Myanmar, with a recent article noting that 66 % of the 342 hunters surveyed practiced subsistence hunting, in that they (and perhaps also their families) would personally eat the food caught (McEvoy et al., 2019). Asiatic black bears were frequently hunted, although McEvoy et al. (2019) did not identify whether they were consumed for subsistence, medicine, or were one of the animals traded out to middlemen. Sun bears were not frequently hunted (McEvoy et al., 2019), which could be a feature of sun bears' elusiveness (e.g. Bisi et al., 2019), or could be because sun bears are not highly demanded by middlemen and, by extension, Chinese buyers (e.g. Nijman et al., 2017). In our study site of Rakhine, poaching of both bear species occurs, though this appears to be infrequent compared to other taxa (Min, 2017).

In this study, our aim is to interrogate the medicinal systems used by individuals in Rakhine State, Myanmar, the wildlife used for medicine, and to provide some understanding into whether bear bile is demanded and consumed in Myanmar for medicinal purposes, by Myanmar nationals. This study was designed to contribute to the core goals of the Global Sun Bear Conservation Action Plan and core objectives of the Myanmar Sun Bear Conservation Action Plan; i.e.; eliminating illegal exploitation of sun bears through robust research into the drivers of demand in sun bear range states (Crudge et al., 2019; Gaffi et al., 2020). We focused on Rakhine State, Myanmar, since we had evidence that sun bears and Asiatic black bears co-existed there (Bisi et al., 2019), although sun bears are found more frequently (Istituto Oikos, 2020). We also knew that poaching of bears was occurring (Min, 2017), but the reasons for poaching were largely unknown.

2. Methods

2.1. Instruments

We used a mixed methods approach of quantitative questionnaires and qualitative, semi-structured interviews. We chose a mixed methods approach because the utilization of both techniques enables understanding of breadth (e.g. "generalizable" patterns) and depth (e.g. context and insights into why such patterns exist) (Rust et al., 2017).

The quantitative questionnaire was designed according to insights from prior bear bile consumption research in Laos (Davis et al., 2016) and Cambodia (Davis et al., 2019a) (Appendix S1). Similarly, the interview guide was adapted from one used to study bear bile consumption in Laos (Davis & Glikman, 2020) and Vietnam (Davis et al., 2019b) (Appendix S2). Both instruments utilized specialized questioning techniques (SQTs), which are methods designed to overcome biases resulting from illegality and/or social undesirability concerns (Nuno & John, 2015). The specific SQTs utilized were unmatched count technique (UCT) and nominative technique (NT), both of which had been tested previously in Cambodia (Davis et al., 2019a). In UCT, the sample is separated into one control group and one treatment group. In this study, the control group was asked how many of five medicinally-related behaviors they had done, while the treatment group was asked about the same medicinal behaviors, including the sensitive behavior of consumption of bear bile.

In NT, individuals are asked about the consumption practices of their

peers. Thus, they do not need to reveal their own consumption, but such questions can give an idea of the behavior prevalence within the sample. Further details around the application of NT can be found in [Davis et al. \(2019a\)](#).

The questionnaire began with demographic questions including age, ethnicity, and level of education, and proceeded into questions about medicinal systems used, with options of “Western medicine”, “traditional medicine”, and “other”. Respondents were then asked about their level of trust in the healthcare opinions of select groups of peers such as family members, close friends, and work colleagues, and their level of trust in certain countries medical systems. Following this, the respondents were asked about their consumption of bear bile using the SQTs and a direct question concerning use. The direct question was followed by subsequent questions around time consumed and the number of times bile/gallbladder was consumed during the period the individual took it. The individual was then asked, using a Likert-scale, about their agreement with a number of belief statements around consumption of bear bile/gallbladder, such as “There are medicinally

effective alternatives to bear bile/gallbladder”. Finally, individuals were asked to indicate “true/false/don’t know” for several knowledge questions, such as “The number of bears in the forest in Myanmar are increasing”.

The semi-structured interview guide was designed to elicit more information around the consumptive practice of bear bile/gallbladder, with greater exploration of the context surrounding an individual’s use. Individuals were asked to describe who suggested the product, as well as how it was obtained, and who (if anyone) it was consumed with. All questionnaires and interviews were conducted in the Myanmar national language, and were kept anonymous. All respondents gave their verbal consent to the surveys and interviews. Ethical permission was obtained from Miami University Ohio IRB for Human Subject Research, Protocol Number FWA00023676, and the Ministry of Natural Resources and Environmental Conservation (MONREC) and Nature and Wildlife Conservation Division (NWCD) of Myanmar gave permission for the research to take place.

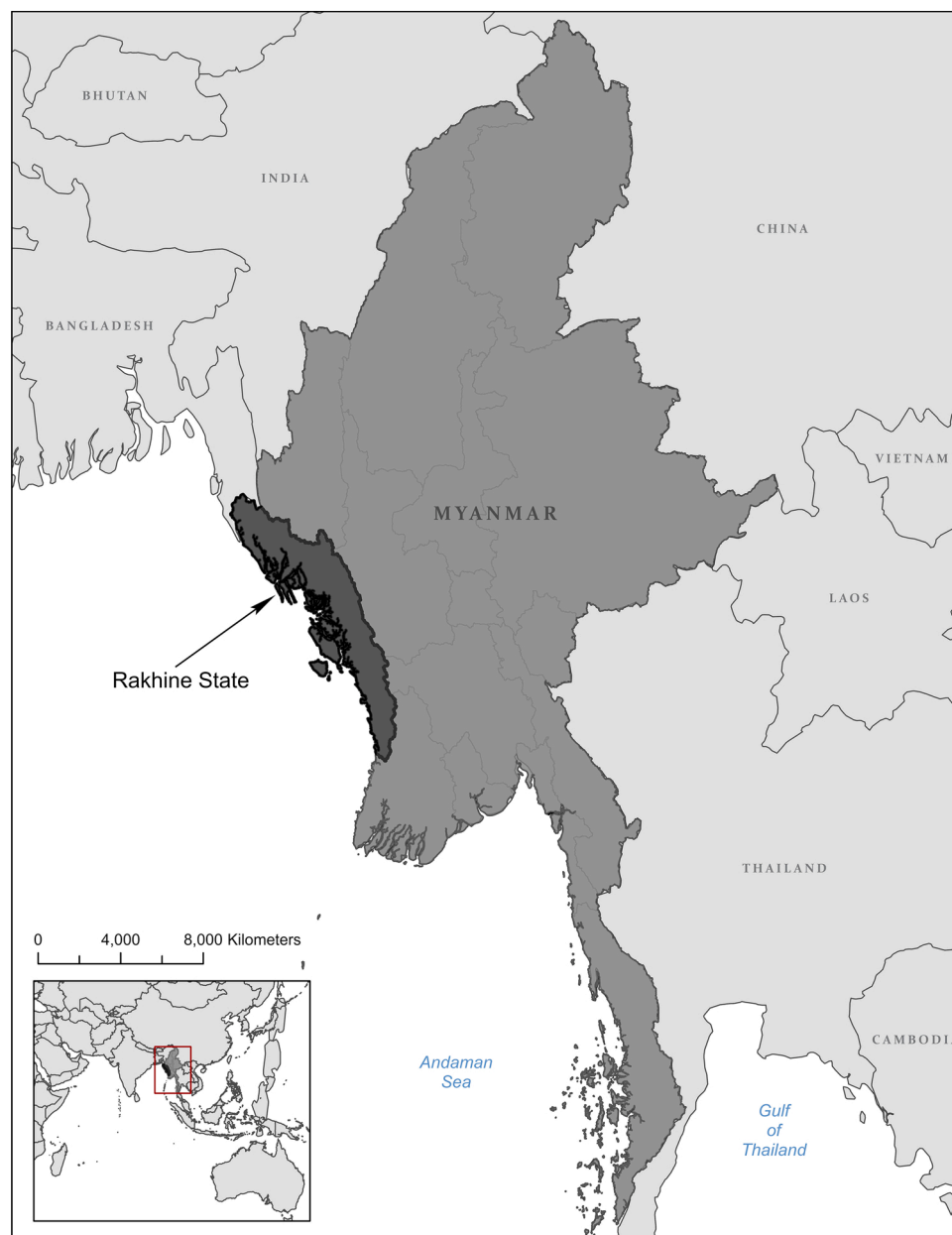


Fig. 1. Map of Myanmar, with Rakhine State indicated (Map created by Jenna Stacy-Dawes).

2.2. Study area

Rakhine State is located between the Indian Ocean to the west and the mountains of the Yoma Range to the east (Fig. 1). It is approximately 323 km away from Yangon, which is about a day's journey by car. It is predominantly Rakhine ethnicity, and Buddhist. It is rich in biodiversity (Bisi et al., 2019), despite the poaching that occurs. Substantial conflict exists in the state (e.g. Kipgen, 2013; Thawngmung, 2016), but this is generally confined to the north.

2.3. Survey protocol

The authors and the Myanmar survey team designed a sampling strategy whereby all 52 villages in a two-hour radius would be targeted. The target sample size was 300 for the quantitative questionnaires, and 50 for the qualitative interviews. The target sample size for each method was divided proportionally between each village. Author TZ, who was the survey team leader, determined randomly where the team would go each day, and by this method they worked through the villages.

In the villages the team mostly performed convenience sampling, and switched off between genders. In one case the survey team performed "purposeful" sampling; an interviewee told a member of the survey team about a traditional medicine (TM) practitioner nearby, so the team member sought that individual out to interview them.

2.4. Data analysis

All figures were created using ggplot2 (Wickham, 2016) in R (R Core Team, 2019). Analysis of the specialized questioning techniques (SQTs) followed the formulas outlined in Davis et al. (2019b). The qualitative data was coded and themed, following Bernard (2011). More advanced statistical analyses were not performed due to the nature of the results.

3. Results

3.1. Demographics

We interviewed 327 individuals. 48 % of the sample were female, and 52 % were male. The average age was 41, with a median of 39. The educational makeup of the sample can be found in Table 1.

The participants were primarily Rakhine ethnicity (87.3 %), followed by Asho Chin (11 %), Bamar (0.6 %), and Chin (0.3 %). Most people were Buddhist (93.6 %). Six percent of the respondents practiced Christianity, and less than one percent practiced Asho Chin animism.

3.2. Medicinal systems in Rakhine

In our sample most individuals practiced medical pluralism (Fig. 2a). Generally, individuals in our sample used a blend of Western medicine and Traditional Myanmar medicine (TMM) (Fig. 2b), although a quarter of the respondents used "village" medicine, which is a more casual form of traditional medicine concocted according to localized tradition rather than an over-arching structure.

The majority of individuals had used Western medicine the most in the past twelve months (Fig. 2c), although nearly a fifth of the

interviewees stated that they had used TMM more than any other medicinal system.

3.3. Prevalence estimates of bear bile/gallbladder use

Bear bile use generally seems to be very low in the sample. When directly asked, prevalence of use was stated to be 0.6 % of the individuals of the sample (95 % CI: -0.23 %, 1.5 %), while the prevalence estimate gained through nominative technique (NT) was 0.4 % (95 % CI: -0.36 %, 1.2 %). Unmatched count technique (UCT) did not appear to work correctly, with a prevalence estimate of -23 % (CI not calculated).

Two individuals directly admitted to use of bear bile/gallbladder. One individual had used it in the past 6–12 months, and the other individual had used it in the past 1–5 years. The individual who had used bear bile/gallbladder relatively recently had used it 2–5 times, while the individual who had used bear bile/gallbladder between 1–5 years ago took it 10–30 times. Both individuals stated that they had received the bear bile/gallbladder as a gift. Two other individuals (0.6 % of the sample) who had not used bear bile stated that they had given it as a gift to others. Generally, bear bile/gallbladder consumption is a low prevalence behavior in Rakhine.

3.4. Beliefs around consumption of bear bile/gallbladder

The respondents to the structured questionnaire most agreed with the statements "There are effective medicinal alternatives to bear bile/bear gallbladder" (3.86, CI: 3.78–3.93) and "Bear bile/bear gallbladder has medicinal value" (3.82, CI: 3.74–3.90), and "Most people I respect have difficulty finding bear bile or gall bladder" (3.77, CI: 3.90 – 3.64). The interviewees disagreed with the statements "It is easy to find places to buy bear bile/bear gallbladder" (1.94, CI: 1.84–2.03) and "The use of bear bile/bear gallbladder is an important part of my culture" (1.78, CI: 1.67–1.90) as well as "Most of the people I respect use bear bile or gallbladder for medicinal purposes" (2.13, CI: 2.24 – 2.01). The individuals in the sample were largely neutral for the statements "Most people I respect prefer bear bile or gallbladder from a sun bear, not a black bear" (2.9, CI: 3.13 – 2.68) and "Most people I respect prefer scientific to traditional medicine" (3.09, CI: 3.2 – 2.98). There were multiple "Don't knows" for each question in Fig. 3a, but these did not exceed 50 % for any question. In Fig. 3b, the majority of individuals stated "Don't know" for the statements "Most people I respect have difficulty finding bear bile or gall bladder" (52 %) and "Most people I respect prefer bear bile or gall bladder from a sun bear, not a black bear" (80 %).

3.5. General knowledge about bear conservation

The participants to the survey were widely knowledgeable about bear conservation, with the majority of responses correct for all four statements, apart from bile extraction being a (at the moment of extraction) non-lethal process (Fig. 4). One concerning finding was that a third of the individuals in the sample believed that bears in the forest in Rakhine are increasing. A surprising insight was that the respondents were knowledgeable about the realities of bear farms, with most individuals recognizing that bears in bile farms have been extracted from the wild.

3.6. Qualitative results

None of the individuals interviewed with the semi-structured questionnaire (n = 66) stated that they had ever used bear bile/gallbladder. Reasons for not using bear bile/gallbladder are presented in Table 2 below. No prevailing reason was given. Most individuals stated that they didn't know why someone wouldn't use bear parts/they could not think of a reason why someone would not use bear parts. However, over a third of the sample did state that bears are now endangered and "should

Table 1
Education level of the sample, by percent. Secondary school was the most common level individuals obtained.

Educational level	Percent of the Sample
None	4.6 %
Primary School	23.2 %
Secondary School	42.5 %
High School	26.3 %
Diploma	0.3 %
Bachelor's degree	3.1 %

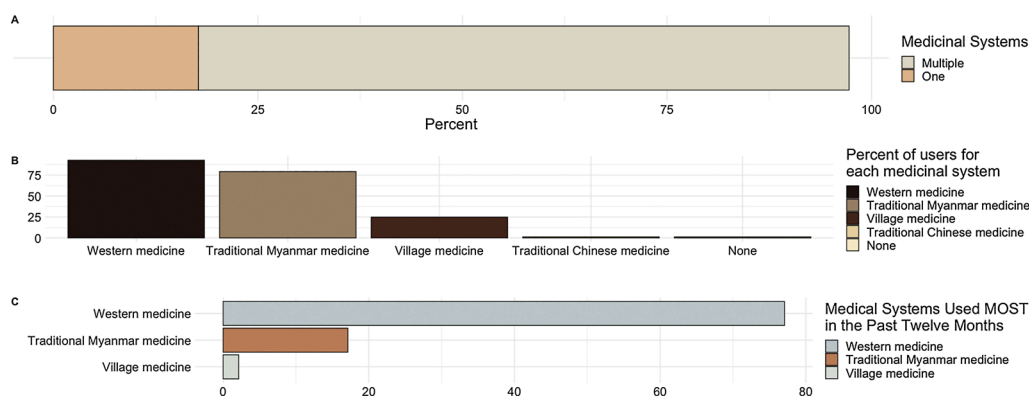


Fig. 2. An overview of medicinal systems used by the sample in Rakhine ($n = 327$). As shown in (a), most individuals in the sample used multiple medicinal systems. (b) shows that the majority of users used Western medicine in the year, but a significant portion used traditional Myanmar medicine as well. Finally, (c) shows that individuals had mostly used Western medicine, alone, followed by just traditional Myanmar medicine, and just village medicine. Note: for (c), medicinal systems practiced by under 2% of the sample were omitted.

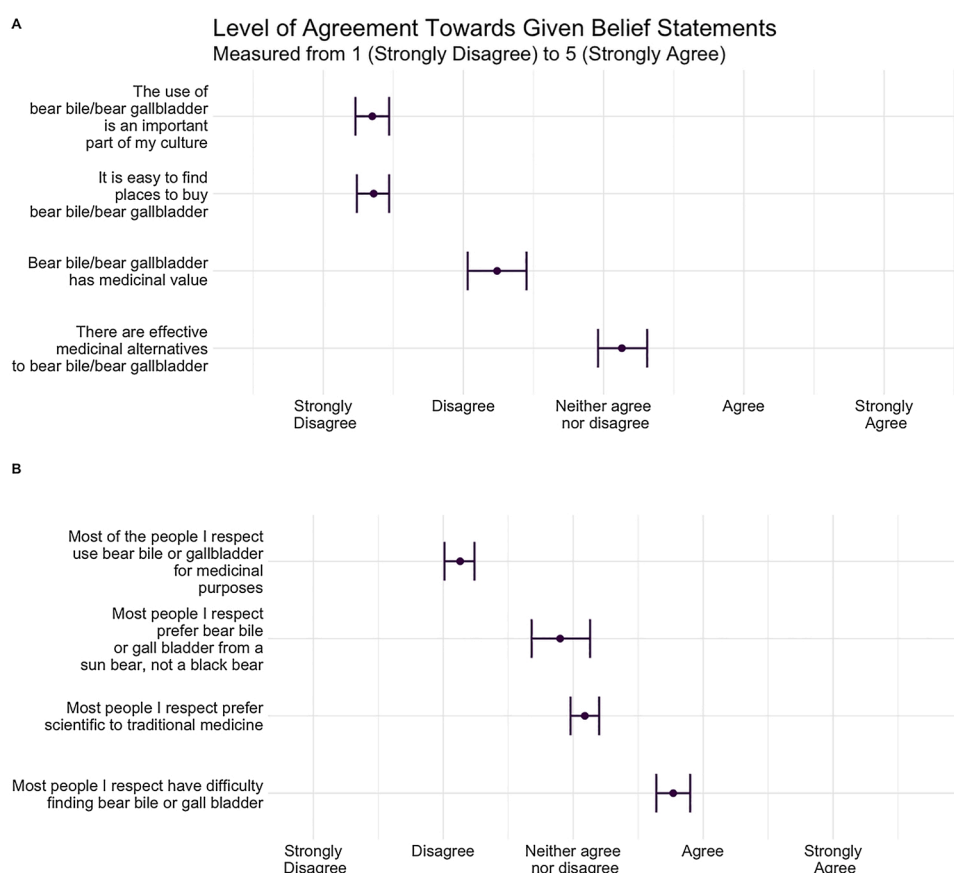


Fig. 3. Average agreement with confidence intervals for eight statements ($n = 327$).

be left alone”, which is hopeful for facilitating conservation efforts around sun bears, by building on such preliminary beliefs.

Interestingly, the respondents were in general medicinal wildlife users, and had used many other wildlife products. Nearly half of the sample (48.5 %, $n = 32$) had used python gallbladder (*Python bivittatus*) for a variety of ailments ranging from strokes to fever, to infant illness. This was followed in popularity by various serow (*Capricornis milneedwardsii*) products, with 24.2 % ($n = 16$) of the interviewees using serow for a similar variety of ailments including stomachache and bruising, a result that has also been found in neighboring Laos (Davis & Glikman, 2020). Other wildlife products that had been consumed for medicinal purposes by one respondent each were pangolin scales, tiger bone and gallbladder, and elephant teeth. A tenth of a viss (roughly equivalent to 0.36 pounds) of pangolin scale was quoted as being 25,000 kyats (\$17), which was approximately the same price quoted for python gallbladder.

Serow was cheaper than both pangolin and python at 15,000 kyat (\$10) for two serow feet. The tiger and elephant products had been received as gifts, so the interviewees did not know how much they were worth. A separate study performed by Istituto Oikos found that sun bear bile was quoted as being 50–200 USD for a measure (Istituto Oikos, 2020). Bear gallbladder was quoted as being \$1700 USD/kg, although it was unclear whether this was attributed to any particular species (Istituto Oikos, 2020).

Finally, in line with their general lack of use of bear bile/gallbladder, the interviewed sample mostly indicated that they did not know whether bear bile/gallbladder constituted traditional medicine or not (62 %, $n = 41$).

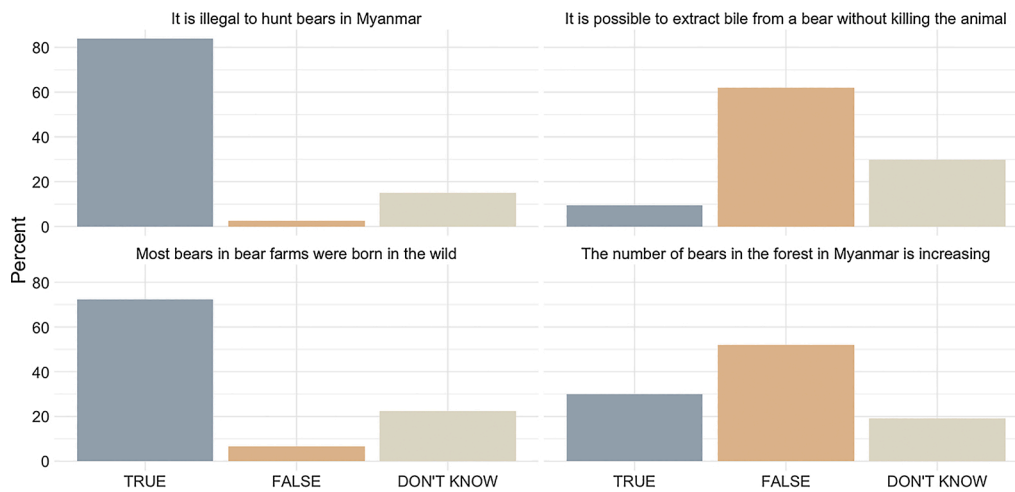


Fig. 4. Knowledge of the sample (n = 327) for four statements.

Table 2

Reasons given by the qualitative sample for not using bear bile/gallbladder (n = 66).

Reason not to use	Percent (%)
Don't know/no reason why not	47
Endangered species now/they should be left alone	34.8
Killing animals is a sin	7.6
Should use if it has medicinal value	4.5
It has no medicinal value	3
Should only use if health problem is serious	1.5

4. Discussion

An important conclusion from these results is that the use of bear medicinal products is substantially low in Rakhine State, Myanmar; therefore, bears that are poached in Rakhine are being consumed for subsistence, and/or traded out to middlemen/the Chinese market to the north (e.g. Nijman et al., 2017). It is possible that bear bile is “easily” obtainable, but as we found, there are cheaper alternatives available (gaur, python gall bladder). Bear gall bladder, therefore, may be considered too profitable for trade to be used locally. If true, this is an interesting contrast with comparable countries such as Laos, where bear bile/gallbladder is still consumed locally, despite the high value of traded bear gallbladder (Davis & Glikman, 2020).

There was no deceit around use, with the specialized questioning technique (SQT) of nominative technique (NT) overlapping with direct questioning (DQ). Based on our other results, this makes sense, as wildlife consumption was generally prevalent in the sample and therefore is likely not considered a socially undesirable act in Rakhine. What is more surprising is the apparent low concern regarding the legality of consumption, considering a number of educational/awareness-raising efforts around the poaching of sun bears has occurred in villages in Rakhine. This is the consequence of two main factors: 1) despite the existence of a legal framework for the protection of wildlife, law is not effectively enforced in rural areas (Gaffi et al., 2020); 2) halting poaching requires deep societal changes, which can take several years (e.g. Eshoo et al., 2018). Educational campaigns are mostly addressed to students and young members of local communities who are more receptive, influenced by more global beliefs, and less likely to yet be hunters (L. Gaffi, pers. obs.). Furthermore, local communities tend to discriminate between “bad” hunting, coming from outside and illegal, in contrast with “good” hunting, practiced by local members, justified by “local tradition”, and incorrectly considered not subject to the official regulation. This vision is reinforced by the lack of law enforcement by the local authority (L. Gaffi, pers. obs.).

It is possible to infer from our results here that individuals associate the awareness-raising efforts with poaching exclusively; in addition, as the poaching of bears is comparatively low (Min, 2017), corresponding concerns about legality may also be low. Finally, we found that unmatched count technique (UCT) did not work at all. This could be because actual consumption was so low (e.g. Ibbett et al., 2019), and/or because individuals simply did not understand the method and did not answer correctly (Hinsley, Keane, St. John, Ibbett, & Nuno, 2019). Based on our other results, it seems to be less likely that the respondents were being actively deceitful in their answers.

The beliefs of our sample supported our conclusion that, overall, bear bile use is not a wide-spread behavior. Respondents did not think highly of it as a medicine, despite the overall ubiquitous use of other wildlife for medicine. They also largely did not think it was easy to obtain. In southern Rakhine, bears were found to be hunted by only 7% of villagers interviewed (Min, 2017), indicating that they are not a consistent catch and, therefore, gallbladder is unlikely to be easily found. Respondents also largely indicated that they were unaware of their respected individuals’ behaviors regarding bear bile use, considering the high level of “don’t knows” in two of the belief statements.

The overall low prevalence rate compared to other estimations of bear bile use in other countries in Southeast Asia such as Laos, Cambodia, and Vietnam (Davis & Glikman, 2020; Davis et al., 2019a, b) has intriguing implications that illuminate the need for further research. Although it is unclear whether the bear bile consumed by individuals in our sample was from Asiatic black bears or sun bears, it is possible that it was from sun bears due to sun bears’ greater predominance in Rakhine (Bisi et al., 2019). Subsequently, individuals in Rakhine may not use bear bile because it is genuinely ineffective if harvested from sun bears. If bile is usually harvested from sun bears, this may be why there has been no medicinal driver for its use within the area. This is a particularly illuminating result in light of the overall prevalent use of wildlife medicine in the area, and the generally high use of, and belief in, traditional medicine (TM). It’s possible that this result is supported by the lower rate of bear bile use in Cambodia (Davis et al., 2019b), where sun bears are more predominant (Steinmetz et al., 2013), compared to such countries as Vietnam where Asiatic black bears and bear farms are more common (Davis et al., 2019a).

However, we note that Asiatic black bears are found in Myanmar, including within Rakhine. It is therefore possible that the bile used by the individuals in our sample was actively obtained from Asiatic black bears, either in a rarer poaching event of an Asiatic black bear in Rakhine, or from outside traders. Therefore, the lower rate of use of bear bile could be a feature of the difficulties inherent in obtaining Asiatic black bear bile in Rakhine. Another alternative explanation could be

that Myanmar is historically relatively isolated compared to the rest of Southeast Asia (Cotterell, 2014). Rakhine State is particularly so, being locked between the Indian Ocean to the west and the mountains of the Rakhine Yoma Range to the east. There may therefore have been very little influence of traditional Chinese medicine (TCM) and its corresponding heritage of bear bile use (e.g. Feng et al., 2009) in Rakhine, and perhaps more generally in Myanmar. This contrasts with Cambodia, which has at least several hundred years of Chinese mercantile heritage (Cooke, 2007), Vietnam, which was partially colonized by China for over a thousand years (Cotterell, 2014), and Laos, which has long been a migration end-point for Chinese ethnic groups (e.g. Culas, 2013), some of whom may have brought aspects of TCM.

Although we did not investigate other type of bear products used within this study, an unpublished investigation conducted by Istituto Oikos found that although sun bears are rarely the main target for poaching events, when they are caught their bile/gallbladder will be sold. However, it is unclear whether the bile/gallbladder is sold in Rakhine, or traded out. Additionally, hunters in Rakhine will sell sun bear paws, with four in total having the highest value, as well as sun bear teeth. Sun bears may not be the focus of hunting effort for consumption of their bile, yet they are clearly valuable for a variety of other consumptive reasons, and will continue to be threatened by poaching.

More broadly, our results indicate that Rakhine is not an area where bear consumption needs to be addressed, despite the poaching that occurs. Although the poaching of bears across Southeast Asia is a challenge that must in general be mitigated (Crudge et al., 2019), it is possible that if deforestation is mitigated and trade networks are disrupted, bear populations could stabilize in Myanmar. Less heartening is the found consumption of other wildlife for medicine, including Critically Endangered and Endangered species like pangolin and tiger (Challender et al., 2019a, b; Goodrich et al., 2015). Wild meat consumption is known to be widespread in Myanmar (McEvoy et al., 2019), and we show here that wild medicine consumption may be just as present in the wider country. Previous studies showed that wildlife is a component of traditional medicine in the Mon state of Myanmar, and among the Mon ethnic group (Nijman & Shepherd, 2017), as well as at sacred Buddhist sites such as “Gold Mountain” in Kyaiktiyo, eastern Myanmar (Nijman & Indenbaum, 2017). Other studies in the north of Myanmar have shown that animals are poached for “traditional medicine”, but have not clarified whether this medicine is intended for endemic consumption, or for Chinese consumers (e.g. Min, 2012; Nijman et al., 2016). This is an important distinction, as they are separate conservation challenges. Trade in Myanmar wildlife to the Chinese market is best addressed through behavior change campaigns within China designed to discourage the consumption of threatened wildlife (e.g. Burgess et al., 2020), as well as community engagement initiatives at noted poaching hotspots in Myanmar, with thoughtful, contextually-appropriate strategies to overcome the economic incentive of poaching (Cooney et al., 2017). Community-engagement initiatives within Myanmar could also be effective at reducing endemic consumption, although this would be best addressed through targeted behavior change campaigns that are tailored specifically to the relevant area and/or ethnic group in Myanmar and their motivations for consuming threatened wildlife (e.g. Kanagavel et al., 2014).

Declaration of Competing Interest

The authors report no declarations of interest.

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