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# The knowledge, attitude and practice of local Sabahan in Malaysia on Sunda pangolin

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**Abstract.** *Jomes EE, Tuh F, Lingtangah W, Sompud J. 2023. The knowledge, attitude and practice of local Sabahan in Malaysia on Sunda pangolin. Biodiversitas 24: 4702-4710.* The IUCN Red List of Threatened Species listed Sunda pangolin (*Manis javanica*) as critically endangered and they remained among the most traded mammals and other pangolin species. In Sabah, various conservation works on this species have been conducted these past years through government and NGO works. Nevertheless, their population is still declining despite all the efforts. To date, little to nothing is known about the local perception regarding Sunda pangolin conservation. Therefore, through the Knowledge, Attitude, and Practice (KAP) approach, this study evaluates Sabahan's awareness level regarding the Sunda pangolin conservation. A total of 109 Sabahan respondents were interviewed from all across Malaysia to investigate their perception of Sunda pangolin conservation. The KAP index score shows that respondents' attitude toward Sunda pangolin conservation is the highest (93.34%), followed by Knowledge (81.15%) and Practice (79.63%), of which all three fall within good KAP score. They also agreed that spreading awareness and being proactive in supporting conservation work helps to prevent this species from extinction. Interestingly, the correlation analysis using Spearman rho's coefficient shows a positive relationship between KA and education but not for Practice. Generally, Sabahans had a positive understanding of the Sunda pangolin's current status and the legal information regarding this species. This research may help improve species conservation strategies, particularly in Sabah, Malaysia. There is an urgent need to improve the Sunda pangolin conservation program in the future. Factors that influence Practice need to be identified and scrutinized. Public awareness is not the only factor that needs to be considered for improvement in conservation works. More importantly, the people who work in the conservation field.

**Keywords:** Awareness, conservation, critically endangered species, legislation, *Manis javanica*

## INTRODUCTION

Pangolins are extraordinary placental mammals with a similar ecological niche as anteaters and armadillos, whose skin is covered in keratinous hard scales (Ganguly 2013). They are highly specialized feeder that only feeds on termites, ants, and larvae as well as the eggs of the termites and ants (Vallianos 2015; Phillipps and Phillipps 2018; Challender et al. 2019). Regrettably, despite their uniqueness, all pangolin species are in danger of extinction. Threats such as habitat destruction and overhunting, especially illegal trade, have endangered the pangolin population for years (Vallianos 2015). The subsistence hunting of pangolins by indigenous people has been prevalent for centuries (Pantel and Yun 2009; Xing et al. 2020), while commercial hunting only appeared decades ago as values of the species increased (Vallianos 2015; Chong et al. 2020). In Peninsular Malaysia, the Temuan, one of the oldest indigenous tribes which have been around in the past 4000 years ago, has been utilizing natural resources around them for subsistence and medicinal purposes, and among the wildlife they utilize is the Sunda pangolin (Azliza et al. 2012). However, as the value of this species increases over time, hunting for local use is being replaced by commercial purposes (Vallianos 2015).

Moreover, pangolins' biological and ecological characteristics also make them vulnerable to threats as they have a slow reproduction rate and are easy to hunt (Pantel and Anak 2010; Challender et al. 2019). Among the eight species of pangolin worldwide, the Sunda pangolin (*Manis javanica*) and Chinese pangolin (*Manis pentadactyla*) are two of the most widely traded, usually to supply the traditional Chinese medicine practitioners and as delicacies in China (Cabana et al. 2017; Xing et al. 2020). Although it was scientifically proven that its scales and meat have no medicinal properties (Jin et al. 2021), the uses of pangolin's derivatives in traditional medicines in Asia are mostly due to cultural beliefs (Xing et al. 2020).

Apart from being home to the Sunda pangolin, Malaysia is one of the transit countries for the international trade of pangolin species along with other body parts of wildlife species such as rhinoceros horn and ivory from Africa (Cheng et al. 2017; Trade Records Analysis of Flora and Fauna in Commerce (TRAFFIC) 2017). It was recorded that at least four significant seizures of African pangolin scales have occurred since 2014, involving Malaysia as part of the trade chain (Krishnasamy and Shepherd 2017). Many studies reported that the pangolin trade in Peninsular Malaysia was already established in correspondence with the decline of their population in the wild (Pantel and Anak 2010). However, their trade

networks in different regions are complex, thus making it challenging to track poachers and individuals involved.

Realizing the urgency for better safeguards for the species, Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) members unanimously approved a petition to comprise all pangolin species to Appendix I of the CITES (Ariffin and Nan 2018), which trades any parts of the species with commercial purposes are strictly prohibited (CITES 2022). In Sabah, the decreasing number of Sunda pangolins in the wild has prompted the government and various non-governmental organizations (NGOs) to join forces to prevent extinction. Moreover, law enforcement officials are now addressing animal crimes more sternly, acknowledging that they're as terrible as other crimes like the drug trade (Scanlon 2013). Reports from United Nations Office on Drugs and Crime (UNODC) (2016) also stated that illegal wildlife markets are similar to any other illicit markets. The information from numerous research is critical in strengthening the pangolin educational and awareness-raising programs, which will supplement law enforcement operations.

Besides scientific knowledge of Sunda species, local knowledge is equally essential, particularly since they can contribute to community-based conservation as the locals may often give vital information about other species that use the same habitats (Archer et al. 2020). Furthermore, the public is one of the major stakeholders in wildlife conservation, as the information sought from their perception of the issues of concern helps in devising effective educational intervention programs (Ariffin and Nan 2018).

Despite international and national legal protection and broad efforts to raise public awareness of Sunda pangolin conservation, their population in the wild continues to decline (Vallianos 2015; IUCN 2022). Non-governmental organizations such as 1Stop Borneo are actively promoting the Sunda pangolin conservation through various online media platforms such as Facebook and Instagram (1StopBorneo 2023). Currently, there is only one published study by Ariffin and Nan (2018) on Malaysian perception regarding this species. However, the study only discusses the legislation and trade-related crime of Sunda pangolin in Malaysia, specifically in Kedah. Moreover, there are few to almost no published studies on the local perception of Sunda pangolin conservation in Malaysia. The lack of studies looking into the public perception regarding this species makes it difficult to strategize effective solutions to tackle the current conservation issues of the Sunda pangolin.

Consequently, knowing their awareness level of Sunda pangolin conservation is critical in improving the effectiveness of the existing conservation strategy as it helps to narrow down the factors that may contribute to the decline of this species' population. Besides, baseline information regarding public awareness helps identify target groups for conservation activities such as workshops and educational awareness campaigns. Unlike previous research, which primarily focused on the ecological knowledge of the pangolin species (Nash et al. 2016), this study uses the Knowledge, Attitude, and Practice (KAP) approach to assess the awareness level of Sabahans based on their knowledge, attitude, and practice concerning the conservation of Sunda pangolin.

## MATERIALS AND METHODS

### Study area

This study was online cross-sectional research that sampled Sabahans throughout Malaysia who were selected randomly by distributing an invitation to participate in the survey. For data collection, the Google Form tool was utilized to create a questionnaire of Knowledge, Attitude, and Practice. Invitation link to participate in the survey was then shared through various social platforms such as WhatsApp, Facebook and Instagram so that any Sabahans across Malaysia could access and answer the survey. The sampling method used to conduct the survey was convenience sampling: the researcher announces the study and participants self-select if they wish to participate (Stratton 2021). Furthermore, the population is too large for a census-based study. Hence, convenience sampling is employed to collect data that are presumed to be representative of the population (Stratton 2021). Moreover, researchers have widely used online surveys to sample the general public from different places (Fricker 2016). The study was conducted from April 2022 until June 2022 and evaluated the respondents' demographics as well as their KAP towards Sunda pangolin conservation in Sabah. Ethical approval was obtained from all respondents. Information describing the study objectives was provided at the beginning of the survey to the participants, who were reassured that their responses would be anonymous and only used for study purposes. They were also well-assured that the information that they shared was strictly confidential and would not be disclosed to third parties.

### Procedures

*KAP survey design*

A standardized questionnaire was used to interview all respondents and examine their knowledge, attitudes, and practices regarding the conservation of Sunda pangolin in Sabah. The KAP questions were developed based on the Sunda pangolin's current conservation status and issues, with each question carefully written in English and Bahasa Melayu to eliminate words or phrases that may have complicated the responses as well as to ease respondents' answering process. The survey was created in two parts: KAP components that evaluate Sabahan's perception of Sunda pangolin conservation consisting of knowledge (composed of four questions), attitude (composed of three questions) and practice (composed of three questions), as well as one open-ended question that asks respondents' ways that help prevent the extinction of Sunda pangolin; Sociodemographic descriptors: All items in the first section of the survey were graded on a 5-point Likert scale ranging from 5 to 1, with five indicating strongly agree and one indicating strongly disagree. Studies with objectives of understanding the perceptions or opinions of individuals are best measured using the Likert scale (Joshi et al. 2015).

*KAP components*

The minimum number of question items in each of the KAP components is three to ensure that it is sufficient to be used to assess the KAP (Du Monde 2016). Besides, during the preparation process of the questionnaire, the number of items was also decided through a validity test using Spearman correlation and a reliability test using Cronbach's Alpha coefficient. The first component of the questionnaire, the knowledge category, was created to determine the extent to which individuals from diverse backgrounds are well-informed about Sunda pangolin conservation action and educational information. The knowledge component is one of the critical factors in determining the level of community awareness of biodiversity conservation, especially endangered species (Jalil and Sharif 2018). Next, as mentioned by Du Monde (2016), attitude is a state of being, a posture that demonstrates one's inclinations or behaviours toward a stimulus. In a more straightforward phrase, attitude is one's way of thinking against other ideas, policies, or concepts (Gure 2015). Hence, the context of attitude in this study was focused on finding the tendencies and beliefs elements associated with Sunda pangolin conservation. The attitude element in a survey can explain how one's perspectives and interpretation of knowledge influence one's decisions and actions in a particular manner. Moreover, the practice context in this study focuses on the respondent's actions related to Sunda pangolin conservation, from their engagement in law enforcement and implementation to participating in the awareness program.

**Data analysis**

Data obtained from this study were sorted out using Microsoft Excel and then analyzed using the R Studio. The Microsoft Word Pro Word Cloud extension was used to visualize the most used phrases of the responses in the open-ended question. The word cloud layout algorithm was set as follow; maximum words: 100, image size (pixel): 600 by 400, layout: mostly horizontal, font: Tank and common words were removed. Sabahan's responses were sorted into themes representing their ideas and then coded into suitable phrases. These phrases were then used as input for the word cloud visualization. The result of the word cloud is as follows: the phrase's size determines its frequency being mentioned in the responses.

Next, we summarized the demographic information of the respondents using descriptive analysis. The analysis of the KAP method in this survey is adapted from the quantitative approach designed by Jia et al. (2017). Following the study needs, only KAP component mean scores, KAP index scores and correlation analysis were used to describe the sample data. The respondents' KAP index scores were calculated proportionally based on each KAP component. The score for each of the component questions was counted based on the following equation with reference to Jia et al. (2017):

$$\text{The mean score of each component question} = \frac{\text{(Sum of scores from respondents)}}{\text{(Number of respondents)}}$$

Respondents' total scores were added for each component question and then divided by the total number of respondents. Mean scores for each KAP component question determine the question grade based on the Likert scale. The purpose of evaluating the mean scores of each question in the KAP components is to measure the public understanding of each question. Next, the KAP index score was calculated based on the following equation with reference to Jia et al. (2017):

$$\text{KAP index} = \frac{\text{( Mean scores of all respondents)}}{\text{(Highest total score of responses)}} \times 100,$$

The KAP index for each component in this survey was calculated based on the above equation. The KAP index scores of respondents were calculated by summing up all the mean scores of each question in a component, then divided by the highest total score of responses in that component, and the final value was converted into a percentage. The index score of KAP is as follows: a score of >75% is considered good, 50-75% fair, and <50% poor (Jia et al. 2017). The KAP index was calculated to assess the respondents' perception level of the Sunda pangolin conservation based on each KAP component.

**Table 1.** Question items on each KAP component

| | Items |
|---|---|
| Knowledge | |
| Q1. | Sunda pangolin is a type of lizard |
| Q2. | The body of Sunda pangolin is covered with numerous scales |
| Q3. | Sunda pangolin is listed as critically endangered species |
| Q4. | Sunda pangolin can be found in Gaya Island, Kota Kinabalu, Sabah |
| Attitude | |
| Q5. | I like to hunt and sell Sunda pangolin |
| Q6. | I believe that Sunda pangolin is important to Malaysian biodiversity |
| Q7. | I don't care about pangolin |
| Practice | |
| Q8. | Only government and NGOs are responsible to conserve Sunda pangolin |
| Q9. | I am willing to donate RM5-50/ month to support the Sunda pangolin's conservation efforts in Malaysia |
| Q10. | I am willing to report to the authority if there are any illegal activities pertaining Sunda pangolin in Malaysia |

Next, we conducted correlation analyses for this study to investigate if the demographic factors influence the KAP components and to find out if there is any relationship within the KAP components. Demographic variables were sorted into categories and coded numerically before running for correlation analyses in R Studio. Interpretation of Spearman's rho correlation coefficient was adapted from Dancey and Reidy (2004). Besides that, we have also conducted the reliability and validity test to ensure that only the necessary question items for the survey are included and relevant to the objectives of this study. The validity test using the Spearman correlation for this survey is 0.689 and is significantly correlated ($\rho < 0.05$). The Cronbach's Alpha was used to investigate the internal consistency of the KAP components in this survey as it is one of the most used statistical coefficients in investigating the reliability of studies assessing the interests of a group of individuals (Taber 2018). The value of Cronbach's Alpha in this study is 0.686, which according to Griethuijsen et al. (2014), falls within the acceptable score. The possible reason for the low alpha value is due to the low number of items in the questionnaire (Herman 2015). Therefore, it is still considered within tolerable limits. All statistical tests were deemed significant at $\rho < 0.05$.

## RESULTS AND DISCUSSION

### The sociodemographic information

A total of 109 respondents participated in this study. The sociodemographic survey shows that most respondents are female (Table 2). The highest percentage of respondents' age falls in the range of 25-50 (67.9%), while the lowest is the respondents with an age range >50 (7.3%). One of the reasons behind the small number of respondents in this particular age range is that they may belong to the non-tech savvy audiences, making them less familiar with innovative research survey that uses technology as a medium. For education level, respondents with degrees and higher levels of study holder have the highest percentage (65.1%), whereas the lowest is those with lower secondary education PMR/PT3 (3.7%). Most of the participants in this study are white collared workers (those who work in office settings and are involved in clerical, administrative or management roles) (43.8%). Lastly, most respondents reside in Sabah (75.2%), while the rest are scattered across Malaysia.

**Table 2.** Sociodemographic information of the respondents

| **Demographic variable** (n = 109) | **Response rate (%)** | **Frequency** | **%** |
|---|---|---|---|
| **Gender** | 100 | | |
| Female | | 63 | 57.8 |
| Male | | 46 | 42.2 |
| **Age** (years) | 100 | | |
| <25 | | 27 | 24.8 |
| 25-50 | | 74 | 67.9 |
| >50 | | 8 | 7.3 |
| **Education** | 100 | | |
| Penilaian Menengah Rendah (PMR)/Pentaksiran Tingkatan 3 (PT3) | | 4 | 3.7 |
| Sijil Pelajaran Malaysia (SPM) | | 15 | 13.8 |
| Diploma/Matriculation/Foundation | | 19 | 17.4 |
| Degree and higher levels | | 71 | 65.1 |
| **Occupation** | 100 | | |
| White collared worker (Office settings worker) | | 53 | 48.6 |
| Blue collared worker (Manual labour worker) | | 21 | 19.3 |
| Retiree | | 3 | 2.8 |
| Student | | 32 | 29.4 |
| **Residing state** | 100 | | |
| Johor | | 3 | 2.8 |
| Pahang | | 2 | 1.8 |
| Penang | | 2 | 1.8 |
| Sabah | | 82 | 75.2 |
| Sarawak | | 5 | 4.6 |
| Selangor | | 4 | 3.7 |
| Terengganu | | 2 | 1.8 |
| Wilayah Persekutuan Kuala Lumpur | | 8 | 7.3 |
| Wilayah Persekutuan Labuan | | 1 | 0.9 |

## KAP assessment

*Knowledge*

The knowledge component of this KAP survey consists of four questions which are as follows: "Sunda pangolin is a type of lizard", "The body of Sunda pangolin is covered in numerous scales", "Sunda pangolin is listed as a critically endangered species", and "Sunda pangolin can be found in Gaya Island Kota Kinabalu, Sabah" with each question labeled as Question 1, Question 2, Question 3, and Question 4 respectively (Figure 1). In this category, all respondents can recognize Sunda pangolin through their morphological features (Question 2) and the population status of this species (Question 3), with a mean score of 4.61 and 4.60, respectively. However, the respondents have an average score of 3.66 on Sunda pangolin biological knowledge (Question 1) and only 3.37 on the locality of Sunda pangolin in Sabah (Question 4). Overall, based on their mean scores for each item, it shows that respondents have a good understanding of the questions in the knowledge component.

*Attitude*

A total of three questions were made in the attitude component of this survey; "I don't like to hunt and sell Sunda pangolin", "Sunda pangolin is important to Malaysian biodiversity", "I care about pangolin", of which each labeled as Question 5, Question 6, and Question 7, respectively. Based on the result, the mean scores of questions in the attitude category are above the score of four, indicating they have a good understanding of a positive attitude toward Sunda pangolin conservation. Next, Question 7 has the highest mean score (4.80), followed by Question 5 (4.77), with only a 0.03 difference, while Question 6 has the lowest mean score of 4.52 (Figure 2).

*Practice*

There were three questions in the Practice category; "Only government and NGOs are responsible for conserving Sunda pangolin", "I am willing to donate RM5-50/month to support the Sunda pangolin conservation efforts in Malaysia", "I am willing to report to the authority if there are any illegal activities pertaining Sunda pangolin in Malaysia". Each question was labeled as Question 8, Question 9, and Question 10, respectively. From the result (Figure 3), Question 10 has the highest mean score (4.44), followed by Question 8 (3.87), and then Question 9 with the lowest mean score of 3.63. Based on these values, respondents understand that good behaviour helps in Sunda pangolin conservation.

## KAP index score

From the results obtained, the respondents show good knowledge, attitude, and practice towards the Sunda pangolin conservation in Sabah. Among the three KAP components, Sabahan shows an excellent attitude with a KAP index of 93.94%, followed by knowledge at 81.15% and the practice component the lowest with 79.63% (Figure 4).

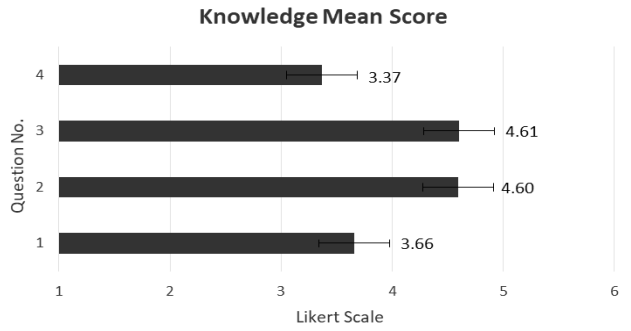


**Figure 1.** Mean score of knowledge component

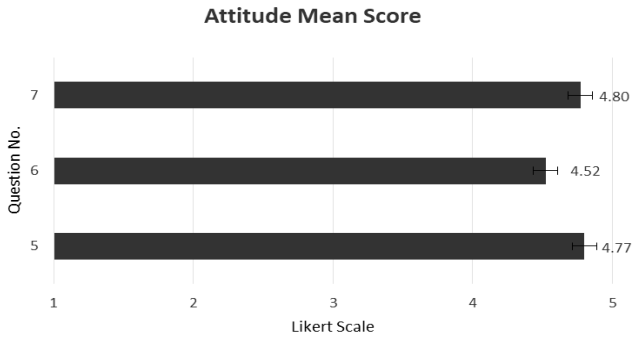


**Figure 2.** Mean scores of attitude component

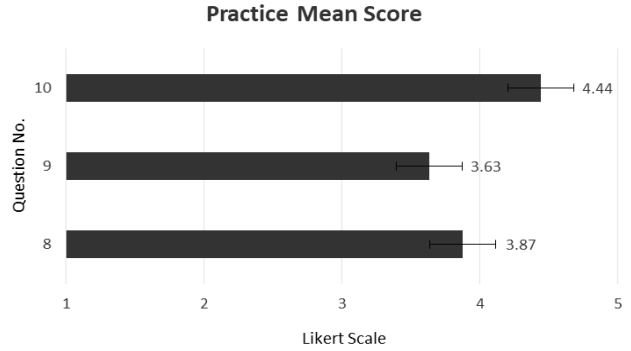


**Figure 3.** Mean score of practice component

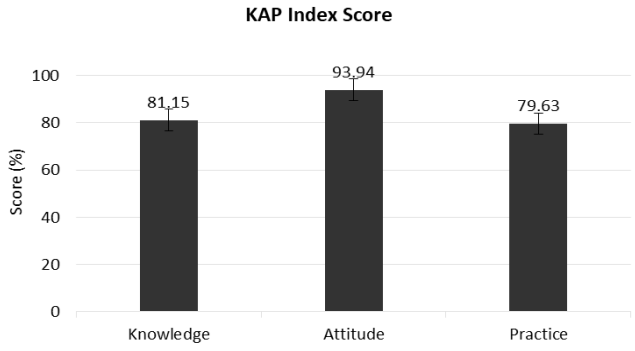


**Figure 4.** KAP Index Score of Sabahans

*Correlation analysis*

The correlation analysis of KAP components and sociodemographic variables (Table 3) shows that KAP index scores for attitude and practice were significantly affected by the Sabahans' knowledge scores of Sunda pangolin conservation, respectively ($\rho = 0.41$ and $\rho = 0.46$). Furthermore, the practice component was also influenced by the score of the attitude component ($\rho = 0.29$). As for the sociodemographic variables, only education influenced the knowledge and attitude scores with $\rho = 0.23$ and $\rho = 0.25$, respectively. The sociodemographic variables did not significantly influence the scores of the practice category.

**Public opinion on ways to prevent the Sunda pangolin's extinction**

Ten phrases have been used to code the responses to this KAP survey's open-ended question: law implementation, enforcement, protection, knowledge, research, practice, awareness, conservation, education, and unsure. Based on the word cloud visualization (Figure 5) of the open-ended question of this KAP survey, most respondents agreed that spreading awareness of the Sunda pangolin is vital in preventing this species from being threatened by extinction. This result is followed by good practice in supporting Sunda pangolin conservation. Others believed that strict law implementation and educating the public about this species could prevent their extinction. Nevertheless, a minority of the respondents are unsure of how to prevent the Sunda pangolin from the brink of extinction.

**Discussion**

Based on the result of this study, the public believes that spreading awareness can help in Sunda pangolin protection. Pantel and Anak (2010) state that any educational and awareness-raising campaign should involve engagement with local communities to ensure efficient law enforcement actions. In terms of knowledge, the public is well-informed of the Sunda pangolin's general morphology, indicating they can identify this animal if spotted. The public needs to be able to recognize the species to allow for species conservation through law enforcement. As Hiwasaki et al. (2014) mentioned, integrating local knowledge into scientific research, policy-making, and planning can lead to a successful implementation of environmental strategies. Many parties are working hard to ensure the public recognizes this species by extensively sharing informative photos and videos on various online and physical media platforms. For example, a mural of the Sunda pangolin is painted on the walls in the malls in the capital of Sabah state. Sunda pangolin statue, along with other endangered species of Sabah, is erected there. In addition, local communities are up to date on the Sunda pangolin IUCN conservation status as a critically endangered species. However, not many are aware of the existence of Sunda pangolin in Gaya Island Kota Kinabalu, Sabah, despite the recent study by Sompud et al. (2019).

**Table 3.** Spearman's rho correlation of KAP components and sociodemographic variables

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 1. Knowledge | 1.00 | | | | | | | |
| 2. Attitude | 0.41** | 1.00 | | | | | | |
| 3. Practice | 0.46** | 0.29* | 1.00 | | | | | |
| 4. Gender | 0.10 | 0.16 | 0.04 | 1.00 | | | | |
| 5. Age | -0.08 | 0.08 | -0.13 | 0.08 | 1.00 | | | |
| 6. Education | 0.23* | 0.25* | 0.19 | 0.12 | 0.12 | 1.00 | | |
| 7. Occupation | 0.05 | 0.14 | -0.04 | 0.06 | 0.47 | -0.18 | 1.00 | |
| 8. Residing State | -0.27 | -0.13 | -0.14 | -0.19 | 0.05 | -0.03 | -0.16 | 1.00 |

Note: **Strong correlation of Spearman's rho coefficient ($p<0.01$). *Acceptable correlation of Spearman's rho coefficient ($p<0.05$)


**Figure 5.** Word cloud visualization

Communities' attitude toward biodiversity conservation helps to address the rising challenges and further examine people's acceptance of the current conservation measures and management. Moreover, it is critical to assess one's view in establishing policies and strategies and boosting public awareness (Ariffin and Nan 2018). The result showed that respondents do not like to hunt or sell pangolin, which indicates that they are well-informed that the Sunda pangolin is protected by law in Malaysia, and any commercial and trading activities related to this species are strictly prohibited. However, in Sabah and Sarawak, indigenous minorities hold customary rights and are permitted to hunt without a license for subsistence (Aiken and Leigh 2015; Nuar and Lunkapis 2019). Nevertheless, commercial uses or profitable activities related to the Sunda pangolin remain illegal (Pantel and Anak 2010). In this current study, whether the Sabahans prefer not to hunt or sell because of their fear of the law penalties or because they genuinely want to be proactive in protecting this species is inconclusive. However, the outcome of their attitude still positively impacts conservation efforts. Next, the public knows that Sunda pangolin is essential to Malaysia's biodiversity. As stated by Vallianos (2015), pangolins primarily feed on ants and termites, which helps to keep the termite population in check by serving as natural pest controllers in the forest. Besides, learning more about the ecosystem role of this species indicates that participants care about their existence in the wild.

Regarding the practice towards Sunda pangolin conservation, most respondents are committed to reporting any occurrences involving Sunda pangolin to the authorities to demonstrate their disapproval of any illegal trade of the species. Sunda pangolin is currently protected by three main legislations in Malaysia, which are *Wildlife Conservation Act 2010* (applicable only to Peninsular Malaysia), *Wildlife Conservation Enactment 1997* (applicable only to Sabah), and *Wildlife Protection Ordinance 1998* (applicable only to Sarawak) as stated by Mohd-Azlan (2014). Although their mean scores fall within the 'not sure' Likert scale, the KAP Index score still falls within the good range. Furthermore, their readiness to support species conservation through donation shows that they don't just rely on governments or NGOs to protect this species. This finding may indicate that Sabahans understand that their active involvement in conservation works will help to improve the effectiveness of the regulations implemented.

The respondents' KAP index score for all components falls within the reasonable range, although practice component scores were barely above the borderline of good scores. This finding may indicate that being well-informed on the knowledge related to Sunda pangolin conservation and having a good and positive attitude towards the conservation does not make individuals immediately adopt good practices. As Salas-Zapata et al. (2018) state, the KAP model integrates cognitive, emotional, and behavioural aspects influenced by communication activities that expand knowledge levels, shift attitudes, and improve practices.

Identifying the correlation between the KAP components and other variables, such as demographic data, might help to recognize which factors are essential and positively impact Sunda pangolin conservation. The results show that having good knowledge helps promote proactive actions toward maintaining and improving Sunda pangolin conservation. Good knowledge might boost individuals' awareness and interest in the environment and its problems. Thus, they eventually demonstrate their concern for solving and supporting biodiversity protection (Jalil and Sharif 2018). Apart from that, being knowledgeable and having a good understanding of the issues and problems related to endangered species, such as the Sunda pangolin, tend to make individuals more concerned about the extinction threats of the species (Prokop et al. 2009). However, having a good attitude does not necessarily mean they are willing to participate in the conservation of the Sunda pangolin. This issue might be due to the lack of efforts in resolving unreliable and misleading information related to the Sunda pangolin, such as their habitat and the belief that this species possesses medicinal properties.

Mobley et al. (2010) stated that individual education level positively influences people to be more concerned about biodiversity issues and behave responsibly. Their findings are similar to our results. However, only knowledge and attitude were positively influenced by education level. This finding may show that having a good educational background helps to understand the issues regarding Sunda pangolin conservation better. Besides, Keller et al. (2012) also mentioned that individuals who do not possess adequate knowledge cannot judge environmental issues. Marquart-Pyatt (2018) also stated that environmental concern depends on the individuals' knowledge of the occurrence of environmental problems.

Awareness can be defined as concern or interest concerning specific issues of a situation or development (Mariki 2016). Hence, the term biodiversity conservation awareness, which is widely used to address people's sensitivity towards environmental problems, refers to the impact of human actions on biodiversity and the ways to solve the problem (Jalil and Sharif 2018). This survey shows that most respondents believe that awareness is one of the most impactful strategies to prevent the extinction of Sunda pangolin. This approach may seem like the typical 'problem solver' to some. However, in the long run, government agencies and NGOs are at the heart of the solution in conducting awareness campaigns. Ariffin and Nan (2018) stated that this method is one of the effective measures in wildlife conservation due to its ability to reach individuals from various sociodemographic backgrounds. This approach is also the same in educating the public on the ecological knowledge of the Sunda pangolin, especially in debunking the ancient beliefs that this species possesses medicinal properties through activities such as workshops and talks. In addition, the respondents also agree that actively participating in Sunda pangolin conservation by supporting the NGOs and government efforts in reducing the illegal trade of the species helps protect its habitat. One way of being proactive in conservation works is by not taking part in the supply-demand chain activities, which

may reduce the illegal trade of this endangered species. Furthermore, the locals are highly aware of the legislation and regulations regarding the Sunda pangolin, although opportunistic hunting still occurs widely (Pantel and Anak 2010). Therefore, for species conservation to be successful, it requires ecological knowledge and public willingness to comply with the existing legislation (Cooney et al. 2017).

Sunda pangolin has been in the limelight for the past years due to the alarming rate of their population decrease (Chong et al. 2020). Director of Sabah Wildlife Department, Agustine Tuuga, through Pertubuhan Berita Nasional Malaysia (BERNAMA 2022) news, stated that there is fear of Sunda pangolin becoming extinct in the Sabah wilderness as trades of this species are still ongoing. He further stated that the number of arrests made in the past years does not reflect the real scenario of the current statistical trends, as research shows that only 30% of the criminals were caught (BERNAMA 2022). This statement indicates that the trades are unfortunately still ongoing and may be increasing despite all the efforts made to curb down the trades. One of the major reasons for the ongoing trade of Sunda pangolin may be due to the well-established trade networks in Malaysia to supply demands from Southeast Asia countries, especially China (Pantel and Anak 2010; Ariffin and Nan 2018).

Based on the KAP index score of this study, Sabahans have a good awareness of the Sunda pangolin conservation, which may indicate that conservation works are well implemented among Sabahans. Moreover, Sabahans' awareness of Sunda pangolin conservation should impact these numbers because clearly, they show a good understanding of the conservation indicated by our current study. It was expected that if the public does not have a good understanding or lacks awareness of this species' conservation, the number of illegal trades will continue to rise as conservation efforts might not be implemented strategically. However, this survey shows the opposite: illegal trades are still ongoing despite public awareness and actively participating in Sunda pangolin conservation. As such, it may indicate that one factor affecting this situation lies among the practitioners, law enforcers, and people who work in the conservation field. Advocating conservations through various programs, extensive scientific research, and tightening the laws and regulations related to Sunda species become pointless if the people themselves are taking part in the illegal trades by aiding the smugglers or turning a blind eye to them for the sake of getting extra income.

The protection of the Sunda pangolin necessitates a comprehensive strategy from several parties, with success only possible if the general public participates equally in all initiatives introduced at the global, national, and local levels. NGOs, educators, and researchers must all work together to fulfill the government's function as an enforcement agency in the execution of related policies, laws, and regulations. The public's cooperation is also essential since it can lessen criminals associated with the smuggling and illegal trade of Sunda pangolin while also helping to safeguard the species. The significance of education and mass media in spreading awareness and knowledge and encouraging good attitudes among people has to be stressed at all age levels. Good practices are anticipated to support the preservation and conservation of this critically endangered species with the advancement of knowledge and a positive mindset.

This study has a few limitations that should be addressed for future research, such as increasing sample data as the number of respondents collected from this survey cannot represent the whole Sabahans. Moreover, increasing the number of respondents from diverse sociodemographic backgrounds for KAP survey is also needed. For example, respondents of older age groups may respond to the survey differently as they have witnessed and experienced the changes in generation (politics, regulations, etc). Therefore, improving the survey in terms of sample data with diverse demographic backgrounds will provide more comprehensive insights into their awareness and engagement in Sunda pangolin conservation. Furthermore, adding more relevant and specific items in the questionnaire related to Sunda pangolin conservation efforts will help recognize factors or variables influencing public awareness. This study can be further improved to provide a robust and impactful result that will benefit the conservation of the Sunda pangolin. We need a study investigating factors influencing Practice to improve the Sunda pangolin conservation program.

In conclusion, this study has provided an overview of how the Sabahans perceived the Sunda pangolin conservation regarding their knowledge, attitude, and practice. Education improves knowledge and attitude but not practice. There is an urgent need to improve the Sunda pangolin conservation program in the future. Factors that influence practice need to be identified and scrutinized. Public awareness is not the only factor that needs to be considered for improvement in conservation works, but more importantly, the people who work in the conservation field.

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