

RESEARCH ARTICLE



Article Info:

Received 13 June 2024

Revised 29 April 2025

Accepted 8 May 2025

Corresponding Author:

Resti Meilani

Department of Forest Resources
Conservation and Ecotourism,
Faculty of Forestry and
Environment

IPB University, Bogor, 16680,
Indonesia

E-mail:

restimeilani@apps.ipb.ac.id

© 2025 Loar et al. This is an
open-access article distributed
under the terms of the Creative
Commons Attribution (CC BY)
license, allowing unrestricted
use, distribution, and
reproduction in any medium,
provided proper credit is given
to the original authors.



Knowledge, Attitude, and Conservation Intention of Snake: A Study on IPB University Students' Perception

Loise Liberta Loar, Mirza Dikari Kusri and Resti Meilani

Department of Forest Resources Conservation and Ecotourism, Faculty of Forestry and Environment, IPB University,
Bogor, 16680, Indonesia

Abstract

Twenty-nine species of snakes, eight highly venomous, inhabit various habitats found in the IPB Darmaga Campus, posing risks to people who have activities on campus. A snake bite case occurred on the IPB Darmaga campus in 2021, causing death. Such a case can incite negative perceptions in people and adversely affect their conservation intention. This study aimed to analyse students' knowledge and attitudes about snakes on the IPB Darmaga campus and draw on their conservation intentions from the data. A Google form was used to collect the data from 374 respondents from nine faculties at IPB University. A comparison was made between the students actively joining the Herpetofauna Observation Group (KPH) and the general students (non-KPH). Knowledge of the presence of snakes on campus was strongly influenced by information availability and student activities. All KPH students had direct encounters with snakes on campus, while only 52.9% of non-KPH students had such encounters. A total of 7.2% of non-KPH students and 58.6% of KPH students correctly identified the types of venomous and non-venomous snakes. Some non-KPH students were afraid of and disgusted by the sight of snakes. In contrast to KPH students, most non-KPH students suggested they would kill snakes upon encounter, showing their lack of conservation intention. Such data suggests the need for snake education for students to improve their conservation intention of the species, while at the same time increasing their ability to protect themselves from the risk of conflicts.

Keywords: biodiversity, campus, environmental education, interaction, snake-human conflicts

1. Introduction

Human-snake encounters are the most common and deadliest incidents in the tropics [1]. Globally, more than 2,7 million people suffered snakebite each year [2], some led to death and permanent disability [3]. Snakes can be found in various habitats, such as forests, marshes, bushes, deserts, and even settlements. There are reports of snake encounters in campuses around the world, such as in Indonesian universities [4–7], India university [8], Chinese universities, New Castle University, and many others. Many university campuses in Indonesia have significant green open spaces that provide habitat for biodiversity, including snakes. Such green open spaces can also be found on the campus of IPB University in Dramaga sub-district, Bogor District.

The existence of the diverse plants, animals, and habitats on IPB Darmaga campus has made the campus one of the urban habitats for biodiversity, which made the Rector of IPB declare the campus as the Biodiversity Campus on 22 April 2016 [9,10]. The declaration emphasizes the importance of biodiversity conservation on the campus. IPB Darmaga campus covers an area of 257 ha, excluding the land outside the campus fences. Inside the fences, the habitat consists of a combination of natural and built environments, such as grasslands, grassy bushes, parks, swamps, lakes, rivers, oil palm patches, rubber tree stands, settlements, yards, riparian stands, and arboreta [10]. At least 22 mammals, 99 birds, 12 amphibians, 38 reptiles, 128 butterflies, 173 plants, 127 medicinal plants, and 40 bamboo species could be found on the campus [10,11].

Among the wildlife found on campus were snakes. Monitoring activities by Uni Konservasi Fauna (UKF; a students' club focusing on fauna conservation) from 2016 to 2021 recorded 29 snake species with 7 being lethal and posing a high risk to humans [12], i.e. white-lipped tree viper (*Trimeresurus albolabris*), Malayan ground pit viper (*Calloselasma rhodostoma*), Javan

spitting cobra (*Naja sputatrix*), banded krait (*Bungarus fasciatus*), Malayan or blue krait (*Bungarus candidus*), banded Malayan coral snake (*Calliophis intestinalis*), and red neck keelback (*Rhabdophis subminiatus*). Most snake species live on or near the ground (terrestrial), except for the white-lipped tree viper and the juvenile king cobra, which spend their lives in the trees (arboreal). Such venomous snakes can be found in various habitats, including disturbed habitats such as agricultural fields, plantations, oil palm plantations, settlement areas [13], and densely populated (urban) areas and campuses such as IPB University, Indonesia University (UI) campus in Depok [5,6], Tanjung Pura University (Untan) campus in Pontianak [14] and Andalas University (Unand) campus in Padang [7]. The existence of snakes in urban areas depends on the availability of microhabitats and prey. The most commonly found snakes in urban areas are the Javan spitting cobra (*N. sputatrix*) and reticulated python (*Malayopython reticulatus*) [15], which can also be found in IPB and UI campuses [5,6,10]. Snakes, found in urban areas due to their high adaptability, are seen as a problem. The rapid development of urban areas added to the increase of conflicts between humans and snakes [6] with snake bites as one of the conflicts.

World Health Organization (WHO) predicted as many as 5.4 million individuals in a year experience snakebite, with 1.8 to 2.7 million cases being venomous snakebites [16]. Snake bites can cause damage of necrosis on the internal circulatory cells, the loss of muscle function, swelling, damage to the cornea, irritation and swelling in the uvea area and the rupture of red blood cells, kidney failure that leads to permanent disability, and limb amputation [17,18]. Administering the appropriate snake antivenom immediately according to the indication is the right measure. Indonesia has only one type of antivenom, the polyvalent snake antivenom for snake bites from the Javan spitting cobra (*N. sputatrix*), banded krait (*B. fasciatus*), and Malayan ground pit viper (*C. rhodostoma*) [19].

A snake bite case occurred once on the IPB Darmaga Campus in 2021. A student carrying out activities in an experimental field inside the campus ground was bitten by a snake [20]. The student might not know that the area was a habitat of snakes and therefore was not on guard and bitten by the snake. Considering that the IPB campus provides ideal habitats for various snake species, the opportunity to encounter snakes is high, particularly for staff and students engaged in their work or other outdoor academic activities. Such incidents can lead to the formation of negative perceptions toward snakes within society. Indeed, there is a common perception among the community that all snakes are dangerous and must be destroyed.

Such a negative perception could hinder the conservation efforts of snakes since perception may lead to behaviour [21]. Negative perception could affect people's behaviour and their decisions related to animals [22]. Myths and stories spread in the community could also affect how people interact with wildlife [23]. Myths about snakes that spread among the urban communities in Indonesia, such as snakes chasing people [24], snakes are dangerous and scary, all snakes are venomous, and snakes are related to mystical stuff [25] are all negative percepts resulted from people's perception toward snakes, which could decrease support for snake conservation.

There are other factors influencing behaviour. The theory of planned behaviour suggests that intentions are believed to represent the motivational factors influencing behaviour and can predict behaviour, while intentions are influenced by attitudes, subjective norms, and perceived behavioural control [26,27]. In the context of wildlife conservation, studies have shown that knowledge [23] and cultural attachment [28] influences people's attitudes toward wildlife with conflict potential. Therefore, the knowledge of the existence of hazardous wildlife could be used in mitigating wildlife-human conflict. Such knowledge could be obtained through mapping the hazardous crocodile-human conflict points in Kutai [16] or mapping places with high snake encounters in Indonesia University campus [6].

In university settings, students make up the largest number of the academic community. As academicians, they could play the role of conservation educators for the community. Considering that role, identifying their perception becomes imperative. Therefore, this study aimed to investigate IPB students' perceptions of snakes through their knowledge of and attitude toward snakes and analyse the tendency of their conservation intention from the data. Further on, the data could be used as a basis to design appropriate educational programs for the students to improve their capacity to disseminate their knowledge and skills

to the community, and as such, provide an opportunity to change the community's perceptions of snakes.

2. Materials and Methods

2.1. Time and Location

The research was carried out from June to July 2023 on IPB University's Darmaga Campus in Dramaga sub-district, Bogor, West Java (Figure 1). The campus was located between $06^{\circ}32'41''$ - $06^{\circ}33'58''$ S and $106^{\circ}42'47''$ - $106^{\circ}44'07''$ E on 145 – 195 m asl. The average rainfall of the area is 8 mm per day. The area is categorized in monsoonal type of rainfall [29].

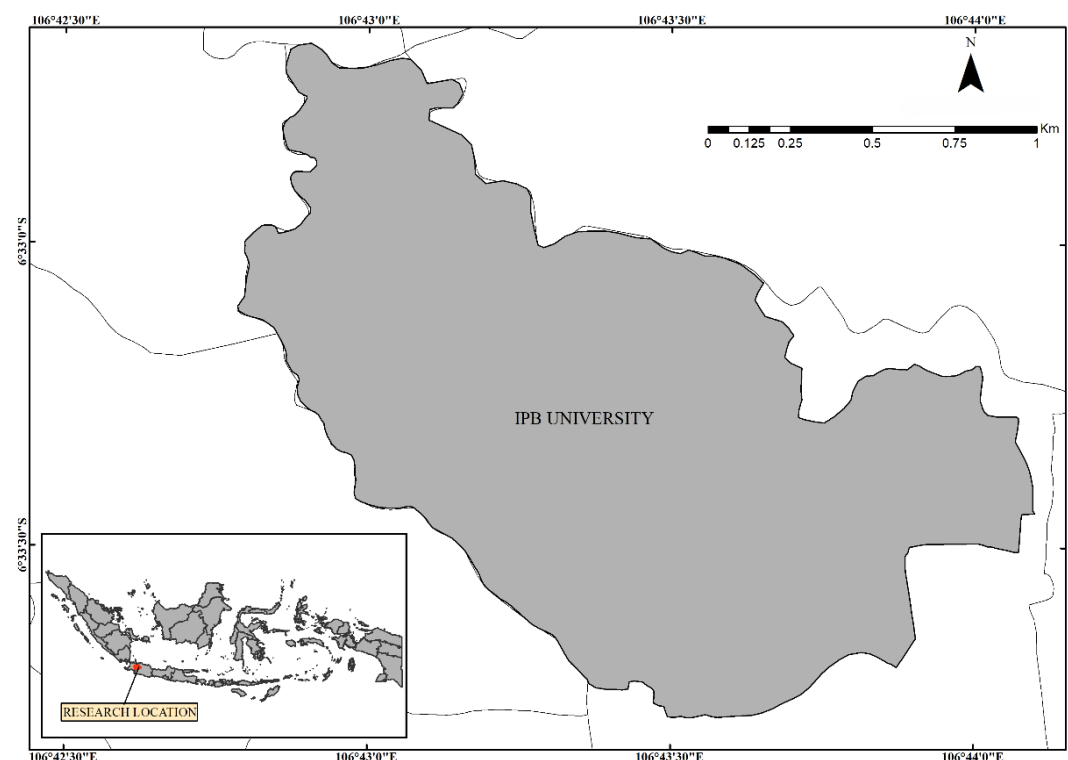


Figure 1. Research Location: IPB Darmaga Campus in Bogor, West Java.

2.2. Materials and methods

This study used a questionnaire to collect data from respondents. A combination of open-ended questions, close-ended questions, photo elicitation, and Likert-scale-type statements were used in the questionnaire administered through Google Forms. Eight questions, which include questions on sex, age, faculty, area of origin, source of information on snakes, and encounter with snakes were asked as part of the characteristic data.

Data on students' perception was elicited through 18 questions on knowledge and 17 statements of attitude. Data on knowledge included knowledge of snake existence on campus, snake species on campus, venomous snakes, and snakes' habitats. Three types of questions were used to identify students' knowledge, i.e., True/False questions, multiple choice, and short form. Photo elicitation, using pictures of 6 venomous and non-venomous snake species commonly found in IPB Dramaga campus, was also used for the specific question eliciting respondents' ability to differentiate between the two snake categories.

Students' attitudes toward snakes were identified using statements constructed in Likert-scale style with five responses, i.e. strongly agree, agree, neutral, disagree, and strongly disagree. Statements was constructed to obtain students' view on snakes, whether snakes are dangerous, interesting, beneficial, chasing human upon encounter, better to be eliminated, can lived side by side with human; students' feelings about snakes: unhappy, fear, disgusted, and disturbed by snakes' existence, as well as; their intention to act: to avoid, to

kill, to inform nature lover's club of snakes encounter, to use protective gear during outdoor activities, and to study snakes' habitat to avoid conflict. Conservation intention was analysed from students' responses to statements on their intention to act.

A total of 374 respondents were conveniently sampled from students who were willing to participate in the study. As the study took place during semester break, it was quite difficult to disseminate the questionnaire directly to students. Therefore, respondents were recruited using posters and the researcher's social media (WhatsApp, Instagram, and Twitter) account, which presented the link to the Google Form. Hence, representation across years, majors or genders could not be ascertained. Roscoe (1982) suggested that 30 to 500 respondents should be sufficient for a study, with 30 respondents for each category when the samples are to be divided into categories. The number of respondents in this study should be sufficient since there was a minimum of 30 respondents from each faculty (Table 1). The significantly higher number of respondents from the Faculty of Forestry and Environment can be explained by at least two reasons. First, the students from the faculty were more familiar with the research topic, and second, followers of the researcher's social media account were from this faculty.

The respondents were divided into two groups. One group consisted of 29 students who actively joined the Herpetofauna Observation Group (KPH), and another group consisted of 345 non-KPH students. The KPH group, which specifically worked on herpetofauna, acted as a comparison group. The students in this group were enrolled in the Department of Forest Resources Conservation and Ecotourism, had undergone trainings on herpetofauna, which include knowledge about snakes and skills to observe snakes, and joined routine monitoring activities of the species on IPB Darmaga Campus. Such activities gave them the knowledge, skills, and experience related to herpetofauna, including snakes. As they specifically worked on Herpetofauna, the group could be the best comparison group than the other students' groups working on a more general wildlife-related field.

Data on snake species, snakes' distribution on campus, and the general condition of the campus were mainly collected through literature study. A field observation was carried out to confirm whether the habitats stated in the literature still existed during the time of the research, considering campus development over the past years.

Table 1. The number of respondents for each faculty in IPB.

No.	Respondents Category (Faculty)	Number of Respondents (individual)
1	Faculty of Agriculture	32
2	Faculty of Veterinary Medicines and Biomedical Sciences	31
3	Faculty of Fisheries and Marine Science	33
4	Faculty of Animal Science	33
5	Faculty of Forestry and Environment	111
6	Faculty of Agricultural Technology	33
7	Faculty of Mathematics and Natural Sciences	39
8	Faculty of Economics and Management	32
9	Faculty of Human Ecology	30
Total		374

Data were then analysed descriptively, using quantitative and qualitative analysis. Microsoft Excel and Statistical Program for Social Science (SPSS) version 26 were used in the quantitative analysis to calculate the frequency and percentage of responses for an item to show respondents' predisposition related to snakes. The qualitative analysis was used to further describe the phenomenon revealed in respondents' responses.

3. Results and Discussion

3.1. Results

3.1.1. Respondents' characteristics

Students from 36 departments of the 9 faculties in IPB were involved in this study. The highest number of students came from the Faculty of Forestry and Environment (Table 1), particularly from the Department of Forest Resources Conservation and Ecotourism. Such results could be expected as the research topic was closely related to students from the department. Female students dominated the respondents (64,2%), while the dominant age fell in the range of 21-24 years old (62,8%; Table 2). As many as 44 respondents admitted that they kept reptiles or lived with housemates who kept reptiles in their abode. Most of the students in this study came from Java and Bali (73.5%), while the lowest number came from Sulawesi (Table 2).

Table 2. Respondent characteristics.

Characteristics	Category	Number of Respondents	Percentage (%)
Sex	Male	134	35.8
	Female	240	64.2
Age	17-20 years old	131	35.0
	21-23 years old	235	62.8
	24-26 years old	8	2.1
Region of origin	Sumatera	62	16.6
	Java & Bali	275	73.5
	Nusa Tenggara	4	1.1
	Kalimantan	11	2.9
	Sulawesi	1	0.3
	Maluku & Papua	21	5.6

3.1.2. Source of information and Encounter with snakes

All students joining the KPH knew about the existence of snakes on campus. Most of non-KPH students (96%) also knew about the existence of snakes on campus, however, only 52.9% (175 students) of them have encountered snakes on campus. Other students knew about snakes on campus from various information sources, such as social media (15.1%), news (5.4), other people (25.4), and interpretive boards (1.2%). The results suggest that word of mouth still plays an important role in spreading information to the students.

Non-KPH students' last encounter with snakes mostly occurred between one to three months ago (23.2%), while the last encounter with snakes of their peers from KPH occurred more recently, between a week to a month ago (41.4%; **Table 3**). Most KPH students encountered snakes more frequently, at least once a month (69%), compared to non-KPH students who encountered snakes once in a semester (33.1%) or only once in the last year (31.4%).

Table 3. Encounters with snakes.

Item of questions		KPH (%) N=29	Non-KPH (%) N=175
Last encounter	< a week	34.5	9.7
	In the past month	41.4	13.1
	1 – 3 months ago	17.2	23.4
	3 – 6 months ago	3.4	21.1
	6 – 12 months ago	3.4	16.6
	>1 year ago	0.0	16.0
Frequency of Encounter	Each day	0.0	0
	Each week	24.1	1.7
	Once in a month	69.0	17.7
	Once in a semester	6.9	33.1
	Once in a year	0.0	16.0
	Once in more than a year	0.0	31.4

Item of questions		KPH (%) N=29	Non-KPH (%) N=175
Time of encounter	Morning	0.0	14.3
	Noon	3.4	22.9
	Afternoon	3.4	21.7
	Night	93.1	41.1
Activities being carried out when encountering a snake	Indoor: In class	6.9	0.6
	Indoor: Other activities *	0.0	6.3
	Outdoor: Practical class	27.6	16.6
	Outdoor: Biodiversity Monitoring	65.5	10.9
	Outdoor: Other activities**	0.0	65.7

Note: * Other indoor activities include cleaning up dormitory rooms, relaxing in the dormitory, and meeting; ** Other outdoor activities include sports, walking, travelling on bike or foot, working on assignments, joining outdoor events, research, and photography activities.

There were 42 locations on campus where students encountered snakes (Figure 2). Snakes were mostly found in the lecturer housing area (35 encounters) followed by the experimental field (33 encounters), campus forest park (28 encounters), male students' dormitory (23 encounters), female students' dormitory (21 encounters), Faculty of Forestry and Environment (19 encounters), the forest behind to the mosque and bamboo arboretum (each 16 encounters), around deer captive breeding facilities and C cage of the Animal Science Faculty (each 12 encounters), nursery (11 encounters), and the oil palm plant (10 encounters). In addition, the students also admitted that they encountered snakes on two experimental fields located on the outskirts of the campus grounds.

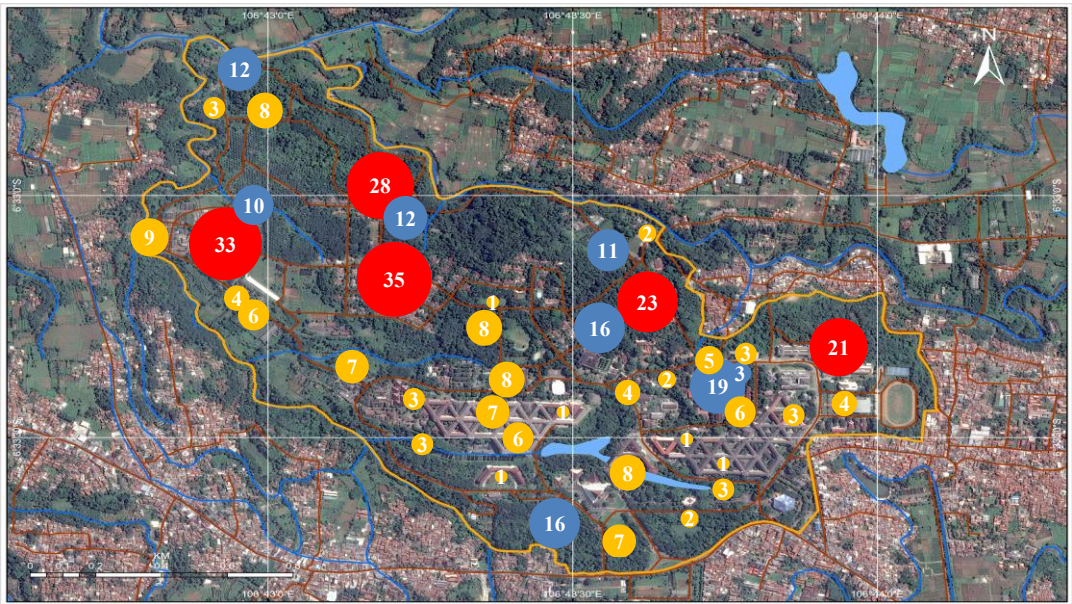


Figure 2. Snake encounter locations (Yellow dots represent frequency of encounter less than 10 times; blue dots represent frequency of encounter 11 – 20; red dots represent frequency of encounter over 20).

Students mostly encountered snakes at night (93.1% KPH students, 41.1% non-KPH students), and some encountered snakes in the afternoon (3.4% KPH students, 21.7% non-KPH students). Only a small number of students encountered snakes in the morning. Most students (65.7%) were doing outdoor activities, such as leisurely strolling on campus, jogging, during travel, and riding motor vehicles. In contrast, KPH students mostly encountered snakes during campus biodiversity monitoring (65.5%). A small number of students found snakes strayed into the classroom (6.9% KPH students, 0.6% non-KPH students) and even inside the dormitory (6.3% non-KPH students). Data on encounters with snakes could reveal respondents’ experiences related to snakes and could be used as educational material about where and when students are likely to encounter snakes on campus.

3.1.3. Students' knowledge of snakes

In general, more KPH students answered all the questions correctly compared to non-KPH students (Table 4). More than half of KPH students (51.7%) and 46.4% of non-KPH students stated that they know snakes can be found at many locations on campus. They select the right habitats from the choices of habitats with a high possibility of encounters with snakes given in the questionnaire. Most students gave correct answers to questions about snake's behaviour upon encounter with humans (100.0% KPH students, 80.6% non-KPH students), whether snakes are beneficial for the environment (100% KPH students, 95.6% non-KPH students), the tendency of population decrease due to snake killing (100% KPH students, 98.3% non-KPH students), snake bite as a form of conflicts (100% KPH students, 99.1% non-KPH students), and the measure to take for the victim of snake bite (96.6% KPH students, 97.4% non-KPH students).

Table 4. Percentage of students giving the correct answer on questions about knowledge of snakes.

Item of questions	KPH (n=29) (%)	Non KPH (n=345) (%)
Snakes can be found at many locations on campus	51.7	46.4
Snakes will avoid humans upon encounter	100.0	80.6
If disturbed, snakes will not attack humans*	48.3	37.7
Snakes are beneficial for the ecosystem	100.0	95.9
Snake's population will keep decreasing if snake killing continues to happen	100.0	98.3
Snakebite is one of the most common occurring conflicts between humans and snakes	100.0	99.1
If bitten by a snake, the victim must be taken to the nearest health centre or clinic	96.6	97.4

Note: * = negative statements, n = number of respondents, % = total percentage

Most KPH students (79.3%) stated that they can differentiate venomous snakes from non-venomous ones, while only 30.4% of non-KPH students suggested they can set the two types of snakes apart. However, only 58.6% of KPH students could describe the characteristics used to tell the two snakes apart, and an even smaller number of non-KPH students (7.2%) could do so. To confirm their ability to distinguish snakes, six pictures of venomous and non-venomous snakes were provided, and the students were asked to identify the venomous snakes. More than half of the non-KPH students (52.4%) could select the correct pictures, and an even higher percentage of KPH students (96.6%) could choose the correct ones. Selecting from pictures was easier than describing the characteristics to identify venomous snakes. Most of the students who stated that snakes are beneficial for the ecosystem could list snakes' role in the ecosystem, such as controlling pests and maintaining the balance of the food chain.

In addition, students were also given questions to explore their knowledge about conflicts and myths surrounding snakes. A higher percentage of KPH students (44.8%) could mention the conflicts that occurred in their respective places of origin compared to non-KPH students (25.8%). The most frequent conflicts mentioned were snake bites and snakes straying into settlements. Other conflicts included people hunting snakes for consumption and killing snakes because they saw snakes as a threat. Similar findings were revealed concerning myth. The percentage of KPH students who knew about the myth surrounding snakes that circulate among the people in their place of origin was higher (51.7%) than that of non-KPH students (20.9%). The myth mentioned included a belief not to let snake bite victims stay under a place with roofs, to use salt to drive away snakes, large snakes are guardians of certain places, snakes found at settlement means disaster would take place, snakes will take revenge on the people who kill its friends, snakes as medium of black magic, coconut water can be used to treat snake bite, and snakes are people's ancestors.

3.1.4. Students' attitude toward snakes

Most KPH students (a total of 75.8%) suggested that snakes are risky, while most non-KPH students thought snakes are not dangerous (71.3% in total; Figure 3). Most KPH students thought snakes are interesting to look at, useful, and will not chase humans upon encounter. They also suggested that they do not mind coming across snakes, do not feel afraid nor

disgusted to see snakes, do not feel bothered by the presence of snakes, and do not mind having snakes around their environment. More than a third of them (41.4%) preferred to avoid snakes when they saw one. They also suggested that they do not think snakes should be exterminated (a total of 96.5%) and will not kill snakes if they chance upon one (a total of 96.5%).

The opposite attitude toward snakes was shown by most non-KPH students on most of the statements, except for statements of 'I do not like coming across snakes', 'I feel afraid coming upon snakes', and 'I do not want to have snakes on my environment' to which more than half of the non-KPH stated their disagreement, and to the statements 'I will avoid snakes when I see one' to which most of them stated their agreement (29.9%) and strong agreement (54.0%). There was a high percentage of non-KPH students who thought snakes are better exterminated (24.9% agree and 56.8% strongly agree) and suggested they will kill snakes upon chance (27.0% agree and 52.5% strongly agree).

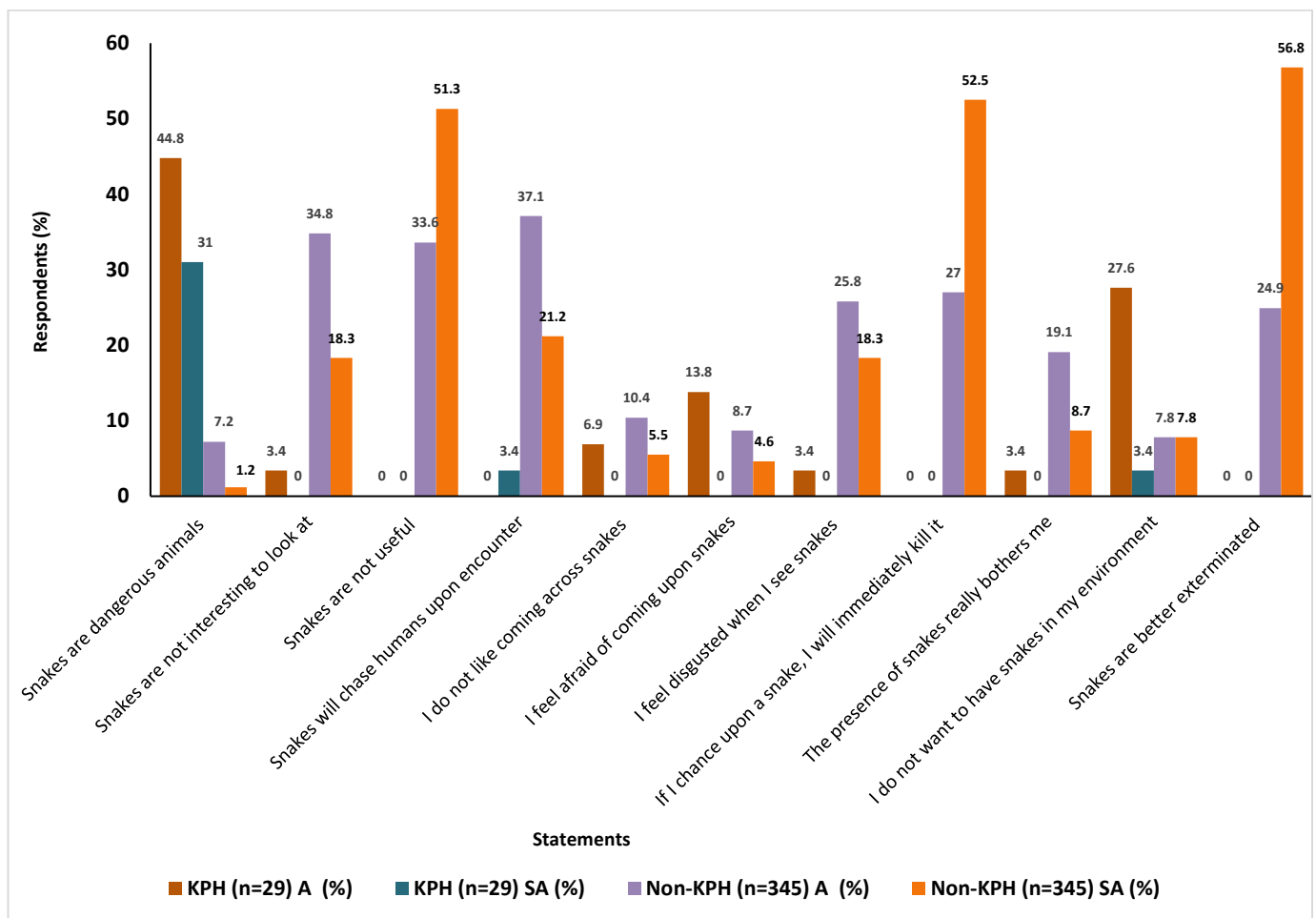


Figure 3. KPH and non-KPH students' agreement (strongly agree and agree) toward the negative statement.

A similar tendency of more KPH students having positive attitudes toward snakes compared to their non-KPH peer students was also shown in positive statements (Figure 4). Even though there was a smaller percentage of KPH students (a total of 41.4%) than non-KPH students (a total of 84.4%) who agreed that they would avoid snakes when they saw one, more KPH students gave their agreement with the rest of the statements. More KPH students stated their strong agreement that humans and snakes can co-exist (34.5%), they will inform nature lover group when they see snakes (37.9%), they believe that knowing how to differentiate venomous from non-venomous snakes could help reduce snake-bite cases (69.0%), they will wear self-protection gear to avoid snake-bite (72.4%), and they will learn about snakes' habitat to avoid conflicts (65.5%).

Although the percentage was lower than that of KPH students, many non-KPH students also had positive attitudes concerning snakes on these positive statements. Many of them thought snakes could co-exist with humans (a total of 44.1%) and that they would inform nature lover groups when they saw a snake (a total of 57.9%). They also suggested that knowing venomous and non-venomous snakes could reduce snake-bite cases (a total of 82.6%) and that to avoid snake bites, they will wear self-protection gear during outdoor activities in places where they are likely to encounter snakes (a total of 80.6%). Many of them also showed their intention to learn about snakes' habitats to avoid conflicts (75.1%).

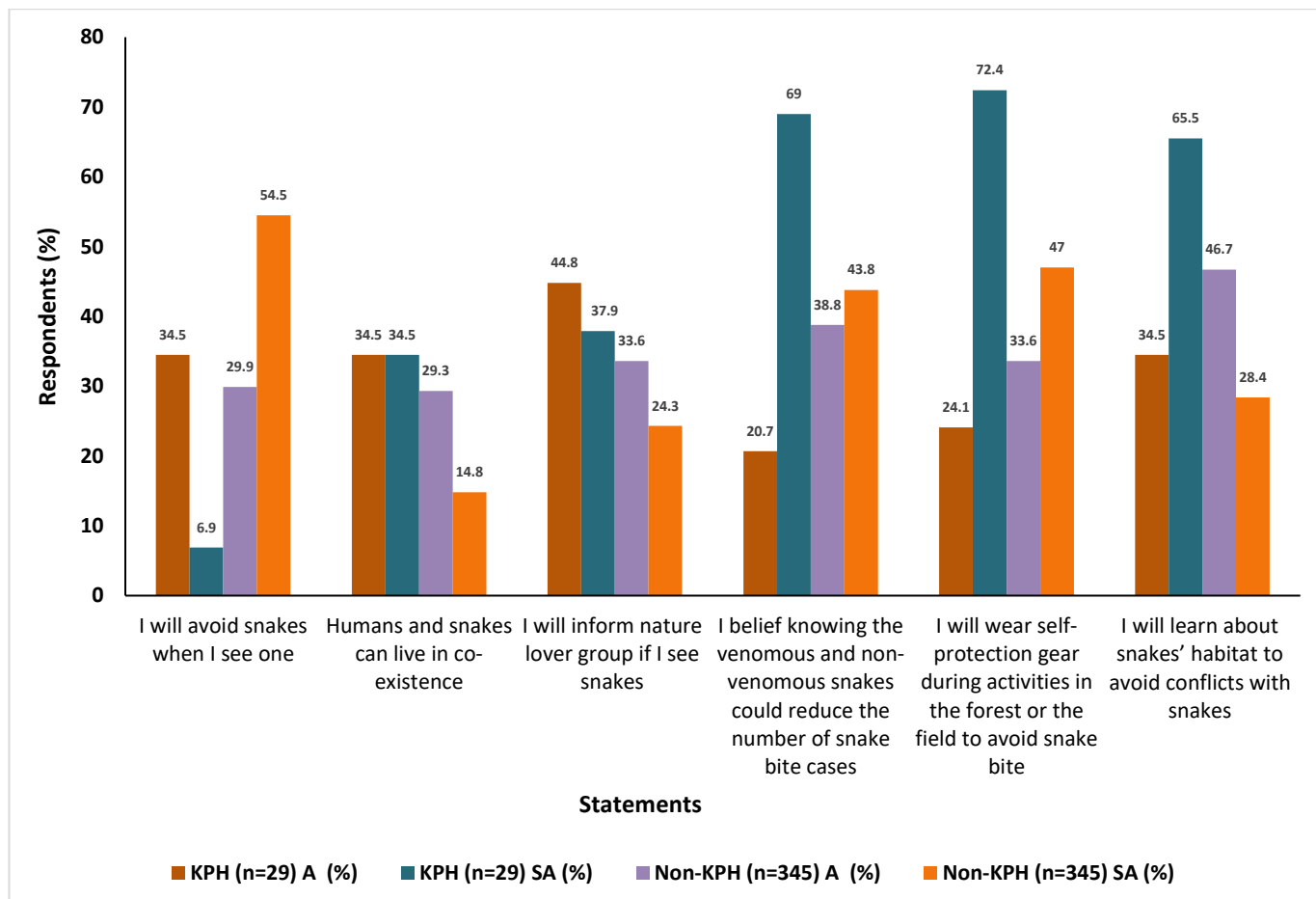


Figure 4. KPH and non-KPH students' agreement (strongly agree and agree) toward the positive statement.

3.2. Discussion

The theory of planned behaviour suggests that intention influences behaviour and that perceived behavioural control (perception of behavioural control), subjective norms, and attitude toward the behaviour influence intention [26,27]. All three factors are related to perception. Perceived behavioural control refers to people's perception of whether it would be easy or difficult to perform a certain behaviour, subjective norms relate to a person's perception of whether social pressure to perform a certain behaviour exist, and attitude toward the behaviour represents a person's evaluation of the behaviour, whether a behaviour is favourable or unfavourable [27]. Among the factors that influence perception are experience [30], prior information [30,31] and/or knowledge [32]. In this study, exposure to and encounters with snakes formed their experiences. Such experiences also influence their knowledge formation and attitude, which eventually influence their intention.

3.2.1. Exposure to and encounter with snakes

IPB University students in Darmaga Campus were exposed to snakes from various information sources, including students' activities. Students were exposed to information on

snakes from social media, such as Twitter (currently named X), Instagram, and WhatsApp. They also obtained information from news on TV or newspapers, other people (Civitas Academica of IPB) and information boards installed in several places on campus ground. Those media had been the sources of information about snakes for the students. However, information boards were the least used source of information for the students. Indeed, the information boards could only be found in limited numbers and provided limited information.

Information boards have the potential to educate students about snakes. However, improvements are needed for the existing board to serve such a purpose, i.e. upgrading the board from an information board to an interpretive board. Such a board conveys meanings of the subject being interpreted to the board user, instead of only presenting information that most users may easily disregard due to lack of meaning and relation to them. Such interpretive boards have been proven useful in improving the conservation awareness of visitors to Penang National Park, Malaysia [33]. Considering there were students, and most probable other academics, who could not differentiate snakes, adding pictures showing snakes' characteristics to the information board would help board users to better understand which snakes are venomous and which are not. Such information, coupled with information on snakes' habitats is expected to improve student's knowledge about snakes and encourage them to be more careful during outdoor activities at places with a high chance of encountering snakes. Adding information on the benefits of snakes for both the environment and humans is expected to improve students' attitudes toward snakes. Information on snakes' benefits for the environment and humans is expected to improve students' knowledge and change their perception of snakes. Information boards should be installed at places with a chance of encountering snakes, which are used for students' practical classes and other activities, such as the nursery, experimental fields, lakes, and arboretum.

Although most students knew that there were snakes on campus, only half of the non-KPH students had direct encounters with snakes on campus. They mostly encountered snakes in outdoor activities. Students from several faculties who had outdoor classes, such as the Faculty of Forestry and Environment, Faculty of Agriculture and Faculty of Fisheries and Marine Sciences had a higher chance of encountering snakes. Many of the locations of their outdoor practical classes are snakes' habitats. Students from other faculties, who mostly had indoor classes, had a lower chance of encountering snakes during their classes but still had a chance of encountering snakes during other activities, such as leisure walking on campus, sports, or extracurricular activities.

Students' activities also influenced their encounter with snakes. KPH students, given that their training in the group was focused on herpetofauna, which included learning about snakes and carrying out observation and monitoring of herpetofauna, had a higher chance of encountering snakes. Therefore, students in this group reported a higher frequency of encounters with snakes. KPH regularly carried out herpetofauna monitoring on campus. On some occasions, they opened the monitoring activities for other students, which provided the opportunity for non-KPH students to get to know herpetofauna. In addition to KPH, other student groups under the Students Association of Forest Resources Conservation and Ecotourism (HIMAKOVA) carried out similar activities on campus. In addition, there was also a students' activity unit called Uni Konservasi Fauna (UKF), which opened to students from any department in IPB, who also had wildlife monitoring activities on campus. Several non-KPH students who admitted that they encountered snakes during wildlife monitoring had probably joined such activities. Non-KPH students had a lower frequency of encounters. At most, they encountered snakes once a semester. Students reported encountering snakes mostly during the night. Although there are snakes that roam and forage during the day (diurnal) and the night (nocturnal) [34], most of the snakes that inhabit the campus ground are nocturnal [35,36], which explains students' time of encounter with snakes.

3.2.2. Students' Knowledge

Most students, both KPH and non-KPH students, knew that snakes could be found in many places on campus. Snakes indeed could be found at various locations on the IPB Darmaga Campus since the campus has habitat diversity [9] suitable for snakes. Snakes inhabit humid areas with loose soil, lowland to highland, plantations, rivers, bushes, and lakes [13]. Most

snake species can live in various habitat conditions [34]. At the Darmaga campus, the lecturer housing, experimental field, campus forest park, male students' dormitory, and female students' dormitory were among the top 5 places with a high frequency of students' encounters with snakes. Those places have suitable habitats for snakes. There were six species frequently found on campus, i.e. *N. sputatrix*, *B. fasciatus*, *B. candidus*, *T. albolabris*, *M. reticulatus*, and *A. prasina*. The first four snakes were highly venomous. The campus manager should pay more attention to places with a high probability of encounters with venomous snakes. Warning boards should be installed in such places to increase students' awareness and alertness of the hazard.

There was a lower number of non-KPH students compared to KPH students who can differentiate venomous from non-venomous snakes. Lack of knowledge and experiences related to snakes could be the cause of this. Most non-KPH students indeed had lack knowledge and experience compare to their peer KPH students. Several students could differentiate between venomous and non-venomous species when they were given pictures of the snakes. However, only a smaller number of students could explain how to differentiate between the two snakes. Snakes' species could be identified based on their colour, body pattern, shape and the number of scales, the shape of teeth and fangs (for venomous snakes), the shape of their heads, the shape of their tail, their habitats and adaptation to the environment [34].

Most students knew that they should leave the snake alone and not disturb it when they see it, because the snakes tend to avoid humans and hide away. Snakes are not the type of animal that will attack humans for no reason, they would only attack when they are provoked or feel threatened [37]. Leaving a snake alone when someone meets one is a good measure. However, there were a few students who chose to move the snakes if they saw one outside their habitat, such as on the road, classroom or other places used for human activities. Translocating snakes should be carried out by an experienced person or one who has expertise in handling snakes to avoid snake bite incidents.

Concerning protected snakes, only a small number of students knew that Indonesia has protected snakes under the Ministry of Environment and Forestry regulation. *Python bivittatus*, *P. condro*, *P. timorensis* and *P. boelani* are protected under the regulation, and they are all endemic to Indonesia. Snakes benefit the ecosystem for their role in the food chain and rodent pest control [38]. A decrease in the snake population will disturb the food chain and increase the population of rodent pests. In the health field, snakes have the potential to contribute to the treatment of human illnesses, such as itchiness or hives on the skin and immune system (snake's blood and oil), skin illnesses (snake's bile), illnesses caused by bacteria, virus and parasite infection (snake's venom) [39–41].

Some students who had experienced or knew about conflicts between humans and snakes said that *N. sputatrix* and *M. reticulatus* were the species that most often conflicted with humans. The same species were also found to be the species that most often caused conflicts in another research [15]. The most frequent conflicts between snakes and humans are snake bites and snakes roaming into settlements, making nests near the settlements, coming into people's houses and eating people's cattle. Such conflicts could occur due to snakes' adaptability and natural disaster. Snakes can adapt and reproduce in almost every type of habitat, including those inhabited by humans. Some snake species can even adapt to land cover changes and the threat of habitat loss [24]. Natural disasters, such as floods, can also cause conflicts. When the flood drowns their habitat, snakes will search for a warmer place, which is usually found around human settlements [42], thus causing conflicts with humans.

In addition to conflicts, some students also knew the myths circulating in the community about snakes, which are mostly negative, such as snakes will chase people, snakes are afraid of salt, snakes are related to mystic or magic, and so on. Such negative myths believed by the community could instil negative attitudes toward snakes [43], which may influence their behaviour. Studies found that environmental knowledge influences people's behaviour toward the environment [44–46].

3.2.3. Students' Attitude

Overall, more KPH students have positive attitudes toward snakes than non-KPH students. This could be attributed to their training in the group, which enabled them to gain more knowledge and skills related to herpetofauna, including snakes. More KPH students suggested that snakes are dangerous, while more non-KPH students thought snakes are not dangerous. Venomous snakes and large snakes can pose a higher risk to humans, while small and non-venomous snakes can be considered harmless. As many people cannot differentiate between the two, it would be safer to consider all snakes as dangerous and to avoid snakes when seeing one.

For most KPH students, snakes are interesting to look at. But not as interesting for many non-KPH students. However, even though non-KPH students thought snakes were not interesting, they did not dislike encountering one. Many non-KPH students are afraid of seeing snakes. The feeling of fear could stem from the lack of knowledge of snakes and lack of experience with snakes. Most of the students who acknowledged being afraid of snakes were male students. This is in contrast with two other studies that found more females are afraid of snakes compared to males [42,43]. Such fear could influence their view and actions concerning snakes.

Almost half of the non-KPH students (44%) felt disgusted by the sight of the snake, and half of them were female students. Although they felt disgusted, they did not think snakes were dangerous and did not feel bothered by the presence of snakes in their environment. Still, they did not agree that snakes can co-exist with humans. The presence of snakes in their environment did not bother them, as long as the snake was present far from the centre of their activities and the probability of encounter was low. Fear and disgust might influence their action toward snakes. Most of the students who suggested they felt afraid of and disgusted by snakes also suggested that snakes are better exterminated and that they will kill snakes upon chance. Indeed, attitude may also influence people's behaviour [44,47].

3.2.4. Students' Conservation Intention

KPH students, who had more experience and knowledge about snakes, appear to have a more positive attitude toward snakes. They disagreed that snakes should be exterminated. They also reported disagreeing on killing snakes. Indeed, a study found that someone who has more knowledge of the benefits, the ecology and habitat of snakes, and the handling of snake bites, will have a positive perception toward snakes [43]. That means, with such knowledge and attitude, KPH students tended to have higher conservation intention, at least to refrain from killing snakes and choosing a more friendly action toward the snake, it is by avoiding the snakes.

Unfortunately, many, if not most, non-KPH students lacked the experience related to snakes, either from encountering snakes or obtaining the correct information about snakes from other sources, thus, they lacked the required knowledge about snakes. This further influences their attitude. Many of the non-KPH students also still have negative attitudes toward snakes, which made them feel the need to kill or exterminate snakes. Such a condition indicates the need to improve student's knowledge and attitude concerning snakes, not only to protect themselves from the risk of conflicts with snakes but also to protect the snakes.

A study on sustainable waste management suggested that both knowledge of waste management and a positive attitude toward waste management contribute positively to the intention to engage in sustainable waste management [48]. Another study confirmed that environmental knowledge influences the intention to act [49] and a positive attitude toward environmental behaviour also influences the intention to engage in the behaviour [50]. Later, intention influences behaviour [49]. Therefore, having sufficient knowledge and positive attitudes is needed for students to develop their intention to conserve snakes.

3.2.5. Improving Students' Capacity Concerning Snakes

Students, particularly those with a higher chance of encountering snakes, need to have the capacity to avoid conflicts with snakes. The knowledge of snakes' habitat on campus, the ability to differentiate between venomous and non-venomous snakes, the awareness of the importance of using self-protection gear during outdoor activities, and the right measures to

take when encountering snakes and handling snake bite victims, including whom to contact, would be beneficial for the students. The importance of snake conservation, their role in the ecosystem, and the awareness that some snakes are protected under Indonesian regulations would also be useful in shaping students' positive attitudes toward snakes.

Such topics could be included in educational programs for students delivered through curricular or non-curricular activities. A study found that over a longer period, formal environmental education could, albeit slightly, increase students' appreciation and intention for environmental behaviour [51]. Educational subjects about snakes could also be provided to students through information and interpretive media, both traditional media such as interpretive signage, brochures, and pamphlets, and more modern media such as university's website, social media, GPS navigated tours, and virtual tours. Both types of media have been proven beneficial for interpreting natural resources [52].

Some topics, such as distinguishing snake species, may not be easy. Some species have a few similar morphological characteristics. For example, *T. albolabris*, which is highly venomous, has the same green colour as *G. oxycephalum*, which is not venomous. An understanding of the specific characteristics that distinguish the two is needed. Students, who do not have the opportunity to do an in-depth study of snakes, may not have the ability to tell apart and spot the differences. Using pictures would help to show the differences between two similar snakes, and such pictures could be included in interpretive media. A study found that the use of visualization is more effective in shaping knowledge, attitudes, and behavioural intentions [53].

The various programs to improve students' capacity would not be possible without the support from the management of IPB University. The management of IPB University should also have an understanding of the importance of snake conservation, potential conflicts, and how to avoid conflicts. An audience by herpetofauna expert of IPB could be an alternative in conveying information to the management.

3.2.6. Limitation and Future Research

This research compares KPH and non-KPH students. However, there are other student clubs with outdoor activities that might increase the members' opportunity to encounter snakes. This study has not identified non-KPH students from such activities. Further research could take into account such extracurricular activities. This research only involves participants from the students of IPB University. An expansion to include participation from a wider audience may provide more thorough insights into people's perceptions of snakes. The use of convenient sampling and reliance on social media to recruit respondents limited the generalizability of this study and the representation of various characteristics of the students, such as major, study year, and gender. Other sampling methods, which ensure the representation of such character, would improve the generalizability of the findings.

4. Conclusions

This study found that KPH students generally had more knowledge concerning snakes than non-KPH students. They also had more positive attitudes toward snakes compared to their non-KPH peers. Their training within KPH and their major might have influenced their knowledge and attitude. Such knowledge and positive attitudes of the KPH students could be translated into a conservation intention, which could be observed from their routine activities in monitoring the herpetofauna population on campus. On the contrary, a lack of knowledge and negative attitude toward the snakes could be interpreted as a lack of conservation intention. Conflicts between humans and snakes have contributed to the formation of negative attitudes toward snakes. Conflicts could occur when people do not have sufficient knowledge, and skills, concerning snakes. While conserving snakes would be beneficial for both the environment and humans, preventing conflicts between humans and snakes needs to be prioritised. Students, particularly those with a higher chance of encounters with snakes, should have the ability to avoid conflicts. An induction program should be mandatory for the students whose curricular activities involve fieldwork. Other educational programs through curricular or noncurricular activities or the use of media could

be an alternative to provide them with the required capacity. Educational media informing people about the risk of snakes should be installed in places with a high frequency of encounters. Of course, to support the realization of such programs, the management of IPB University should also understand the importance of avoiding conflicts with snakes and the conservation of snakes.

Author Contributions

LLL: Conceptualization, Data Collection, Software, Investigation, Writing (Early Draft in Indonesian Language); **MDK:** Supervision, Methodology, Writing – Review & Editing; **RM:** Supervision, Methodology, Writing – Review & Editing, Translation to English and Revision of Final Draft.

Conflicts of interest

There are no conflicts to declare.

Acknowledgements

The authors thank all the participants of this study for their time and effort in filling in the questionnaire.

References

1. Ratnarathorn, N.; Sanunsilp, N.; Laoungbua, P.; Tawan, T.; Sumontha, M.; Kongrit, C.; Thaweepworadej, P. Species Richness, Seasonality, and Mortality of Snakes in Human-Snake Conflicts in Thailand: Insights from Citizen Science Data. *Biol Conserv* 2024, 294, 110603, doi:10.1016/j.biocon.2024.110603.
2. Save The Snakes 2017-2022-Annual-Report Save the Snakes; Sacramento, CA, 2022;
3. Gutiérrez, J.M.; Warrell, D.A.; Williams, D.J.; Jensen, S.; Brown, N.; Calvete, J.J.; Harrison, R.A. The Need for Full Integration of Snakebite Envenoming within a Global Strategy to Combat the Neglected Tropical Diseases: The Way Forward. *PLoS Negl Trop Dis* 2013, 7, e2162, doi:10.1371/journal.pntd.0002162.
4. Rambosius; Setyawati, T.R.; Riyandi Inventarisasi Jenis-jenis Ular (Serpentes) di Kawasan Universitas Tanjungpura Pontianak. *Protobiont* 2019, 8, 35–46.
5. Widodo, S.; Kholis, N.; Lestari, F.; Abinawanto; Bowolaksono, A. Snake Diversity at Universitas Indonesia's Urban Forest. *IOP Conf Ser Mater Sci Eng* 2019, 546, 022035, doi:10.1088/1757-899X/546/2/022035.
6. Patria, M.; Kholis, N.; Amarasinghe, A.T.; Widodo, S.; Sundari, A.M.; Supriatna, J.; Bowolaksono, A. A Citizen Science Survey of Urban Snakes at the Campus of Universitas Indonesia. *Herpetol Conserv Biol* 2022, 17, 433–441.
7. Reza, F.; Tjong, D.H.; Novarino, W. Karakteristik Morfologi Ular Familia Elapidae Di Kampus Universitas Andalas Limau Manih Padang. *Sainstek : Jurnal Sains dan Teknologi* 2017, 8, 135, doi:10.31958/js.v8i2.474.
8. Janani, S.; Ganesh, S.R. Urban College Campuses as Safer Refuge for Wildlife Perceived as Dangerous: A Case Study on Snakes in Madras Christian College, Chennai, India. *Journal of Fauna Biodiversity* 2024, 1, 86–95, doi:10.70206/jfb.v1i2.10635.
9. Mustari, A.H.; Zulkarnain, I.; Rinaldi, D. Keanekaragaman Jenis Dan Penyebaran Mamalia Di Kampus IPB Dramaga Bogor. *Media Konservasi* 2014, 19, 117–125, doi:https://doi.org/10.29244/medkon.19.2.%25p.
10. Mustari, A.H. Biodiversitas Di Kampus IPB University; IPB Press: Bogor, 2020;
11. Mustari, A.H. Biodiversitas Pilar Utama Green Campus IPB University. In *Proceedings of the Seminar Nasional Konservasi untuk Kesejahteraan Masyarakat II*; Universitas Kuningan: Kuningan, 2021; pp. 38–48.
12. Suratama, P. Nasib Ular Di Kampus IPB University: Jangan Usik Kehidupan Kami! Available online: <https://unikonservasifauna.org/nasib-ular-di-kampus-ipb-university-jangan-usik-kehidupan-kami/> (accessed on 5 May 2024).
13. Rusli, N. Panduan Bergambar Ular Jawa; Indonesia Herpetofauna Foundation: Bogor, 2020;
14. Rambosius; Setyawati, T.R.; Riyandi Inventarisasi Jenis-Jenis Ular (Serpentes) Di Kawasan Universitas Tanjungpura Pontianak. *Jurnal Protobiont* 2019, 8, doi:10.26418/protobiont.v8i2.32480.

15. Khoerunisa, I.; Kusriani, M.D.; Mardiasuri, A. Diversity of Snake Rescued from Residential Areas in Greater Jakarta Metropolitan Area, Indonesia. *Media Konservasi* 2022, 26, 231–238, doi:10.29244/medkon.26.3.231-238.
16. World Health Organization Snakebite Envenoming Available online: <https://www.who.int/news-room/fact-sheets/detail/snakebite-envenoming> (accessed on 4 May 2023).
17. Dafa, M.H.; Suyanto, S. Kasus Gigitan Ular Di Indonesia. *Jurnal Pengabdian Masyarakat MIPA dan Pendidikan MIPA* 2021, 5, 47–52, doi:10.21831/jpmmp.v5i1.29343.
18. Puspaningtyas, N.W.; Dewi, R.; Imanadhia, A. Gigitan Ular: Manajemen Terkini. *Journal Of The Indonesian Medical Association* 2022, 72, 97–104, doi:10.47830/jinma-vol.72.2-2022-386.
19. Kusriani, M.; Palesa, S.P.; Masy'ud, B. Snake Pet Ownership in the City: A Case Study in Greater Jakarta, Indonesia. *Biodiversitas* 2021, 22, doi:10.13057/biodiv/d220424.
20. Ikhsan, A.; Ika, A. Mahasiswa IPB Tewas Digigit Ular Di Kebun Kampus, Dosen: Di Mana Ada Taman, Pasti Ada Ular. *Kompas* 2021.
21. Dijksterhuis, A.; van Knippenberg, A. The Relation between Perception and Behavior, or How to Win a Game of Trivial Pursuit. *J Pers Soc Psychol* 1998, 74, 865–877, doi:10.1037/0022-3514.74.4.865.
22. Quesada Acuña, S.G.; Pérez Gómez, G. The Video as a Tool to Change Perceptions and Knowledge about Snakes in Adults with a High Academic Level in Costa Rica. *UNED Research Journal* 2020, 12, e3033, doi:10.22458/urj.v12i2.3033.
23. Mota Pereira, H.; Braga-Pereira, F.; Azeredo, L.M.M.; Lopez, L.C.S.; Romeu Nóbrega Alves, R. Assessing Factors Influencing Students' Perceptions towards Animal Species Conservation. *PeerJ* 2023, 11, e14553, doi:10.7717/peerj.14553.
24. Khoerunisa, I. Keanekaragaman Spesies Ular Temuan Masyarakat Di Area Permukiman Wilayah Jabodetabek. Bachelor Thesis, Bogor Agricultural University: Bogor, 2019.
25. Wamad, S. Mitos Ular Weling Dan Jenis Lainnya: Tabur Garam-Sembuh Digigit Kedua Kali. *detiknews* 2020.
26. Ajzen, I. From Intentions to Actions: A Theory of Planned Behavior. In *Action Control*; Kuhl, J., Beckmann, J., Eds.; Springer, Berlin, Heidelberg: Berlin, Heidelberg, 1985; pp. 11–39 ISBN 978-3-642-69748-7.
27. Ajzen, I. The Theory of Planned Behavior. *Organizational Behavior and Human Decision Process* 1991, 50, 179–211.
28. Sunkar, A.; Kusriani, M.D.; Ramadhani, F.S. Role of Culture in the Emotional Response towards Komodo Dragon in Komodo and Rinca Islands of Komodo National Park. *BIO Web Conf* 2020, 19, 00021, doi:10.1051/bioconf/20201900021.
29. Hidayat, R.; Fariyah, A.W. Identifikasi Perubahan Suhu Udara Dan Curah Hujan Di Bogor. *Jurnal Pengelolaan Sumberdaya Alam dan Lingkungan (Journal of Natural Resources and Environmental Management)* 2020, 10, 616–626, doi:10.29244/jpsl.10.4.616-626.
30. Snyder, J.S.; Schwiedrzik, C.M.; Vitela, A.D.; Melloni, L. How Previous Experience Shapes Perception in Different Sensory Modalities. *Front Hum Neurosci* 2015, 9, doi:10.3389/fnhum.2015.00594.
31. Cutting, J.E. Perception and Information. *Ann. Rev. Psychol* 1987, 38, 61–90.
32. Rock, I. Perception and Knowledge. *Acta Psychol (Amst)* 1985, 59, 3–22, doi:10.1016/0001-6918(85)90039-3.
33. Ismail, M.H. bin The Role of Interpretive Signage in Enhancing Conservation Knowledge, Awareness and Behavior Among Visitors at the Penang National Park, Malaysia, Universiti Putra Malaysia: Serdang, Selangor, 2008.
34. Wicaksono, A.; Madang, K.; Dayat, E. Identifikasi Jenis-Jenis Ular Di Desa Muktiyaya Kecamatan Muara Telang Kabupaten Banyuwangi Dan Sumbangsihnya Pada Pembelajaran Biologi SMA/MA. *Bioilmi: Jurnal Pendidikan* 2020, 6, 1–10, doi:10.19109/bioilmi.v6i1.4498.
35. Nurhayati, A.; Sukiya, S. Keanekaragaman Dan Distribusi Ular Di Taman Hutan Raya Bunder, Gunung Kidul, Yogyakarta. *Kingdom (The Journal of Biological Studies)* 2018, 7, 44–57, doi:10.21831/kingdom.v7i1.11923.
36. Yudha, D.S.; Eprilurahman, R.; Jayanto, H.; Wiryawan, I.F. Keanekaragaman Jenis Kadal Dan Ular (Squamata: Reptilia) Di Sepanjang Sungai Code, Daerah Istimewa Yogyakarta. *Biota : Jurnal Ilmiah Ilmu-Ilmu Hayati* 2016, 1, 31–38, doi:10.24002/biota.v1i1.710.
37. Peters, J.A.; Wallach, V. Snake. *Encyclopedia Britannica* 2023.

38. Asri, A.; Yanuwidi; Bagyo Persepsi Masyarakat Terhadap Ular Sebagai Upaya Konservasi Satwa Liar Pada Masyarakat Dusun Kependukuh, Desa Grogol, Kecamatan Giri, Kabupaten Banyuwangi. *Jurnal Pembangunan dan Alam Lestari* 2015, 6, 42–47.
39. Prastikawati, W.; Husain, F. Pemanfaatan Hewan Sebagai Obat Dalam Pengobatan Tradisional Masyarakat Kalipelus, Kabupaten Banjarnegara. *Solidarity* 2020, 9, 964–977.
40. Syafutra, R.; Fitriana, F.; Heri; Ahka, R.; Febriyani, R.; Mubinan, M.F. Pemanfaatan Satwa Liar Sebagai Obat Tradisional Oleh Masyarakat Desa Pedindang, Kabupaten Bangka Tengah. *Jurnal Biogenesis* 2022, 18, 33–41.
41. Ansori, A. Bisa Ular Untuk Penanggulangan Penyakit Tropis Available online: <https://news.unair.ac.id/2017/02/08/ular-penanggulangan-penyakit-tropis/?lang=id> (accessed on 19 April 2024).
42. Babalola, O.; Jegede, H.O.; Ogunro, B. Perceptions, Attitudes, and Outcomes of Human-Snake Encounters: A Retrospective Study of an Online Discussion Community in Nigeria. *Asian Journal of Ethnobiology* 2020, 3, doi:10.13057/asianjethnobiol/y030101.
43. Pinheiro, L.T.; Rodrigues, J.F.M.; Borges-Nojosa, D.M. Formal Education, Previous Interaction and Perception Influence the Attitudes of People toward the Conservation of Snakes in a Large Urban Center of Northeastern Brazil. *J Ethnobiol Ethnomed* 2016, 12, 25, doi:10.1186/s13002-016-0096-9.
44. Vicente-Molina, M.A.; Fernández-Sáinz, A.; Izagirre-Olaizola, J. Environmental Knowledge and Other Variables Affecting Pro-Environmental Behaviour: Comparison of University Students from Emerging and Advanced Countries. *J Clean Prod* 2013, 61, 130–138, doi:10.1016/j.jclepro.2013.05.015.
45. Latif, S.A.; Omar, M.S.; Bidin, Y.H.; Awang, Z. Role of Environmental Knowledge in Creating Pro-Environmental Residents. *Procedia Soc Behav Sci* 2013, 105, 866–874, doi:10.1016/j.sbspro.2013.11.088.
46. Iman, F.; Miarsyah, M.; Sigit, D. V The Effect of Intention to Act and Knowledge of Environmental Issues on Environmental Behavior. *Jurnal Pendidikan Biologi Indonesia (JPBI)* 2019, 5, 529–536, doi:10.22219/jpbi.v5i3.8842.
47. Kim, M.S.; Kim, J.; Thapa, B. Influence of Environmental Knowledge on Affect, Nature Affiliation and Pro-Environmental Behaviors among Tourists. *Sustainability* 2018, 10, 3109, doi:10.3390/su10093109.
48. Gusti, A. The Relationship of Knowledge, Attitudes, and Behavioral Intentions of Sustainable Waste Management on Primary School Students in City of Padang, Indonesia; 2016; Vol. 11;.
49. Iman, F.; Miarsyah, M.; Sigit, D.V. The Effect of Intention to Act and Knowledge of Environmental Issues on Environmental Behavior. *JPBI (Jurnal Pendidikan Biologi Indonesia)* 2019, 5, 529–536, doi:10.22219/jpbi.v5i3.8842.
50. Fielding, K.S.; McDonald, R.; Louis, W.R. Theory of Planned Behaviour, Identity and Intentions to Engage in Environmental Activism. *J Environ Psychol* 2008, 28, 318–326, doi:10.1016/j.jenvp.2008.03.003.
51. Bergman, B.G. Assessing Impacts of Locally Designed Environmental Education Projects on Students' Environmental Attitudes, Awareness, and Intention to Act. *Environ Educ Res* 2016, 22, 480–503, doi:10.1080/13504622.2014.999225.
52. Wolf, I.D.; Stricker, H.K.; Hagenloh, G. Interpretive Media That Attract Park Visitors and Enhance Their Experiences: A Comparison of Modern and Traditional Tools Using GPS Tracking and GIS Technology. *Tour Manag Perspect* 2013, 7, 59–72, doi:10.1016/j.tmp.2013.04.002.
53. Huang, Z.; Weng, L.; Bao, J. How Do Visitors Respond to Sustainable Tourism Interpretations? A Further Investigation into Content and Media Format. *Tour Manag* 2022, 92, 104535, doi:10.1016/j.tourman.2022.104535.