

## Assessment of human-snake interaction and its outcomes in Monduli District, northern Tanzania

HEZRON E. NONGA\* and ALEX HARUNA

Department of Veterinary Medicine and Public Health, Faculty of Veterinary Medicine, Sokoine University of Agriculture, P. O. Box 3021, Morogoro, Tanzania

### Abstract

**Background:** Human-snake interactions has always been associated with different outcomes. This cross-sectional study was conducted to assess the human-snake interaction and its outcomes in Monduli District, northern Tanzania.

**Methods:** Data collection was done through questionnaires, key informants interviews and record review of snake bite cases at Meserani Snake Park Clinic.

**Results:** Most respondents (97%) in the study area had ever encountered snakes mostly in livestock grazing areas (41.5%) especially at noon hours. The common types of snakes were the black ones (44.6%) and most of these (58%) were non-poisonous species. Twelve species of snakes were reported to be found in the area while 22 species dominated by *Psammophis s. subtaeniatus* and *Eryx colubrinus loveridgei* were under zoo environment. Fifty seven people were bitten by snakes in the study area in 2012 and majority of the cases were recorded between February and April. It was further reported that many respondents (92.3%) feel worried whenever they encounter snakes and the reaction is to kill it as a means of control. This was because snakes were regarded as dangerous creatures and were not used in any traditional practices (81.5%).

**Conclusion:** There was a hostile interactions between human and snakes and always humans hated snakes and, killed them whenever were encountered. Basic educations on snake conservation have to be provided to the community to avoid unnecessary killing of snakes.

**Keywords:** human, snakes, bites, venome, Tanzania

### Introduction

Human-wildlife interaction that always leads to conflict is a major concern of most people living next to protected areas or when wild animals come in direct contact with humans. Conflict is here defined as any interaction between humans and wildlife that results in negative impacts on human social, economic or cultural life, and on the conservation of wildlife populations, or on the environment (Anon, 2005). Though humans generally try to avoid interaction with reptiles like snakes, they occasionally bear an importance that extends beyond survival and into the realm of culture. Human - snake interactions has always been associated with different outcomes. Human snake encounters with negative results such as animal death, habitat destruction, injuries to people, injuries to wildlife and the like are common (Magige, 2012). Generally, there are more than 3000 species of snakes in the world and they live in both terrestrial and aquatic ecosystems and are predatory carnivores with wide range of prey species (WHO, 2010; Bijees, 2012). Despite urbanization, villagelization and destruction of their habitats, snakes remain plentiful in most parts of Africa.

Snakes co-exist with humans in homes, gardens and outhouses but their presence usually goes unnoticed. Snakes are beneficial to humans by killing unwanted insects and rodents in food stores and crops. Snake-skins are used as tourism attractions as with cases of snake parks, used to make shoes, handbags, and other articles. The venom is used for producing life-saving

---

\* Correspondence E-mail: [nongahezron@yahoo.co.uk](mailto:nongahezron@yahoo.co.uk); [hezron@suanet.ac.tz](mailto:hezron@suanet.ac.tz); [nongahezrone@gmail.com](mailto:nongahezrone@gmail.com)

antivenin, biomedical research and for other medicinal products. In India, China and Africa, some species of snakes are used as sources of meat (Oi-Fung *et al.*, 2009; WHO, 2010). In Asian countries such as Thailand, Indonesia, and Cambodia, drinking the blood of snakes like cobra is believed to increase sexual virility ([http://en.wikipedia.org/wiki/Snake\\_wine](http://en.wikipedia.org/wiki/Snake_wine)). In the Western world some snakes, especially docile species such as the ball python and corn snake, are kept as pets. Snakes are creatures that are used for reverence and even worship in some areas, and they are exhibited as performing animals by traditional snake charmers (WHO, 2010). All these and many others are uses of snakes to mankind.

Apart from the benefits of snakes, the general society is always scared of snakes especially from bite and their general appearances. Fear of snakes is understandable since they are responsible for a number of bites and numerous deaths as well as cases of permanent physical handicap. However, snakes do not ordinarily prey on humans and most will not attack humans unless they feel threatened, trodden or injured, or provoked. With the exception of large constrictors, non-venomous snakes are not a threat to humans. Of the roughly 725 species of venomous snakes worldwide, only 250 are able to kill a human on bite (Bijees, 2012). In East Africa there are over 200 species of snakes known, and only 41 are dangerous (Spawls *et al.*, 2001). Snake bite incidences are common in some rural areas and is among the cause of morbidity and mortality among farmers, pastoralists, hunters and children (Maregesi *et al.*, 2013). The vast majority of snakebite-induced deaths occur in Asia (estimates ranging from 15,400–57,600 deaths per year) and sub-Saharan Africa (3,500–32,100 deaths per year) (Kasturiratne *et al.*, 2008). For example, Nigeria, has recorded 174 snake bites/100,000 population/year (Nasidi, 2007). In Kenya, per 100 000 population per year, there were 151 bites and seven deaths (about 1% of all deaths) and 36% of survivors had permanent sequelae (Snow *et al.*, 1994). In addition, Zimbabwe has reported 2–5% mortality rate due to snake bite (Muguli *et al.*, 1994; Nhachi and Kasilo, 1994). Most of such cases are reported in the rural poor farmers (Oi-Fung *et al.*, 2009).

In 2009, snake bite was recognized for the first time by the World Health Organization as a neglected tropical disease (WHO, 2010). In tropical countries, it is largely an occupational disease for agricultural workers, and, as a result, can affect food production. Snake bite causes substantial human mortality and disability-physical and psychological-but its recognition as an important international public health issue has been hindered by insufficient epidemiological data. Although snakes have been together with humans for a long time, several studies conducted are based on their biology and ecology. This study was conducted to assess human-snake interactions and the likely outcomes. The whole idea was based on sustainable conservation of snakes and protects their welfare since they are part of the ecosystem.

## Materials and Methods

### Study area

This study was conducted in two villages, Meserani Chini and Meserani Juu in Monduli District of northern Tanzania. Monduli district lies between latitudes 2° and 6° South and longitude 35° to 38° East of Greenwich. Most of the district area is open grassland which is used by Maasai pastoralists as cattle grazing areas and limited agriculture. Livestock production is a type of land use that co-exists with wildlife. The two villages have a human population of 11,301 (URT, 2013). The climate of the area is semi arid with two distinct rainy seasons, short rains in November to December and long rains start in March to May (Rohde & Hilhorst, 2001) with a mean annual rainfall of about 700 mm. The average maximum temperature is 27°C while the average minimum is 16°C. The selection of the study area was due to the presence of favourable conditions to support life of snakes, history of having different types of snakes and presence of Meseran Snake Park in the area.

### **Study design and population**

A cross-sectional research design was conducted where sociological data were collected. All people with the age of 18 years and above living in Meserani Chini and Meserani Juu formed the study population. Randomly selected respondents were administered with structured questionnaire and observational checklist was used to collect information on snakes. Participation in the study was on voluntary bases and depended on willingness to participate in the study and readiness to give the required information.

### **Data collection**

The structured questionnaires used in data collection contained information on demographic characteristics of the respondents, their knowledge on common snakes found in the study villages, availability of poisonous and non poisonous snakes, the way humans interact with snakes, snake effects to humans, incidences of snakes entering houses, snake bites, deaths of humans and livestock due to snake bites, possible effects induced by humans to snakes, uses of snakes and many other information about the snakes.

Interviews with key informants and direct observations were used to complement the questionnaire results. The key informants used in the study were the owner of Meserani Snake Park, Village Leaders, District Natural Resource Officer, Health Officers, elders and clan leaders. Informants were requested to give information on types of snakes found in the area, season of their availability, general problems caused by snakes to the community, usefulness of snakes, diagnosis and treatment of snake bites and how do they control problems of snakes. While conducting the questionnaire and key informants survey, direct observation on likelihood of seeing a snake was done. Whatever snakes seen were identified in accordance to standard procedures. All snakes available at Meserani Snake Park were also identified to species level and whether they are poisonous or non-poisonous snakes.

In addition hospital records of 2012 at Meserani Snake Park Clinic were reviewed on cases of snake bites in Meserani villages. The clinic provides health services to local Maasai in Meserani ward. The types of information collected in the records were sex, age, type of snake involved with the bite, period of the year and the common bite sites. Clinicians diagnosed the snake species likely to have involved with the bite based on the history from the patient, the appearance of one or more puncture on the bite site, local or generalized swelling of the organ, colour change and the general manifestations of the patient.

### **Ethical consideration**

Research permit was provided by the Vice Chancellor Sokoine University of Agriculture and permission letters were obtained from Executive Director, Monduli District Council. Verbal consent was obtained from each participating respondent after explaining the purpose and importance of the study prior to commencement of interviews. Participation in the study was on voluntary basis. All the information collected from the participants was kept under the custody of the researcher as confidential. The management of Meserani Snake Park Clinic accepted to use the 2012 snake bite records at the clinic as data for the study. The retrieved data did not involve any name of the snakebite victims.

## **Results**

### **Demographic characteristics of the respondents**

A total of 65 respondents (35 from Meserani juu and 30 Meserani chini) were involved in the study. It was found that majority of the respondents (37%) were aged between 26 and 45 years. The number of female respondents (55.5%) outweighed that of males. It was also noted that majority of the respondents (41.5%) had a primary school level of education and up to 68% were

married. Most of the respondents (57%) were Christian and all belonged to the Maasai ethnic group. The duration the respondents had been living in the study areas showed that majority (92.3%) lived at Meserani for more than 10 years and almost 61.5% were pastoralists (Table 1).

**Table 1. Demographic characteristics of respondents (n=65)**

Demographic parameter	Category	Number (%) of respondents
Age ranges	18-25	10 (15.4)
	26-45	24 (36.9)
	46-60	22 (33.8)
	Above 60	9 (13.8)
Sex	Male	29 (44.6)
	Female	36 (55.4)
Education level	Non formal	24 (36.9)
	Primary	27 (41.5)
	Secondary	11 (16.9)
	College	3 (4.6)
Marital status	Single	18 (27.7)
	Married	44 (67.7)
	Widow/widower	3 (4.6)
Religion	Christian	37 (56.9)
	Muslim	1 (1.5)
	No religion	27 (41.5)
Duration of stay in the villages (years)	3-6	4 (6.2)
	7-10	1 (1.5)
	Above 10	60 (92.3)
Occupation	Crop farmer	15 (23.1)
	Formal employment	6 (9.2)
	Business	4 (6.2)
	Pastoralist	40 (61.5)
Origin of respondent	Resident	62 (95.4)
	Non resident	3 (4.6)

### **Snake encounter**

Most respondents (97%) have encountered snakes at more than three times (74%) and mostly in grazing areas (41.5%). Many of the respondents reported that the time for snake encounter was mostly during the afternoon hours (52.3%) and this was common during the dry seasons (78.5%). The types of snakes that are mostly found are the black ones (44.6%) of the thickness size like the Maasai walking sticks (46.2%) and a length of up to one meter (55.4%) (Table 2).

**Table 2. Respondents snake encounters**

Variable	Category	No. (%) of respondents
Snake encounter	Yes	63 (96.9)
	No	2 (3.1)
Place of encounter	Grazing areas	27 (41.5)
	Houses	19 (29.2)
	In farms	11 (16.9)
	On the roads	8 (12.3)
	More than three	48 (73.8)
Time of snake encountered	Morning	11 (16.9)
	Afternoon	34 (52.3)
	Evening	15 (23.1)
	Night	5 (7.7)
Period of the year snakes seen mostly	Long rain	11 (16.9)
	Short rains	3 (4.6)
	Dry seasons	51 (78.5)
Colour of the snakes	Black	29 (44.6)
	Brown	24 (37.0)
	Green	6 (9.2)
	Red	6 (9.2)
	Adult man finger	14 (21.5)
Thickness of snakes	Maasai walking stick	30 (46.2)
	Adult man arm	15 (23.1)
	Adult man leg	6 (9.2)
	Adult man arm	24 (36.9)
Snake length	About one meter	36 (55.4)
	Banana tree (~3 meters)	5 (7.7)

### **Snake species**

From the key informants and direct observation results, 12 snake species found in the study area were recorded (Table 3). It was noticed that 50% of the snake were non-venomous.

**Table 3. Checklist of snake species found in the study villages**

Common name	Scientific name	Toxicity category
Black Mamba	<i>Dendroas pispolylepis</i>	Venomous
Boom slang	<i>Dispholidus typus</i>	Venomous
Black-necked spiting cobra	<i>Naja naja nigricollis</i>	Venomous
Egyptian cobra	<i>Naja haje</i>	Venomous
Red spiting cobra	<i>Naja pallida</i>	Venomous
Puff adder	<i>Bitis a. arietans</i>	Venomous
Olive grass snake	<i>Psammophisphillipsii</i>	Non-venomous
Mole snake	<i>Pseudaspis cana</i>	Non-venomous
Green mamba	<i>Dendroaspis angustipes</i>	Non-venomous
Brown house snake	<i>Elapsoidea loveridgei</i>	Non-venomous
African rock python northern	<i>Python sebaesebae</i>	Non-venomous
African rocky python southern	<i>Python sebaenatalensis</i>	Non-venomous

A checklist for snakes at Meserani Snake Park showed that there was 22 species which were at variable numbers (Table 4). The Stripe-bellied sand snake (*Psammophis s. subtaeniatus*) and Kenya Sand Boa (*Eryx colubrinus loveridgei*) constituted the majority in number which were six and five, respectively. It was also noticed that majority of the snake species at the park were venomous (68.2%).

**Table 4. A list of snake species at Meserani Snake Park**

Common names	Scientific name	Number	Toxicity category
African Rocky Python nothern	<i>Python sebaesebae</i>	1	Non-venomous
African Rocky Python southern	<i>Python sebaenatalensis</i>	3	Non-venomous
Black Mamba	<i>Dendroaspis polylepis</i>	2	Venomous
Black-necked Spiting Cobra	<i>Najan.nigricollis</i>	3	Venomous
Boom slang	<i>Dispholidust.typus</i>	1	Venomous
African House Snake	<i>Lamprophis fuliginosus</i>	4	Non –venomous
East African Garter Snake	<i>Elapsoidea loveridgei</i>	1	Venomous
Egyptian Cobra	<i>Naja haje</i>	4	Venomous
Forest Cobra	<i>Naja melanoleuca</i>	2	Venomous
Gaboon Adder	<i>Bitisg.gabonica</i>	1	Venomous
Green Mamba	<i>Dendroaspis angustipes</i>	2	Non-venomous
Kenya Sand Boa	<i>Eryx colubrinus loveridgei</i>	5	Non-venomous
Mole Snake	<i>Pseudaspiscana</i>	3	Non-venomous
Olive Grass Snake	<i>Psammophisphillipsii</i>	2	Non-venomous
Puff Adder	<i>Bitisa arietans</i>	2	Venomous
Red Spiting Cobra	<i>Naja pallida</i>	2	Venomous
Red-Spotted Beaked Snake	<i>Rhamphiophis rubropuncatus</i>	1	Venomous
Rhinoceros Viper	<i>Bitis nasicornis</i>	1	Venomous
Rufous Beaked Snake	<i>Rhamphiophis oxyrhynchus</i>	2	Venomous
Stripe-bellied Sand Snake	<i>Psammophis s. subtaeniatus</i>	6	Venomous
Usambara Bush Vipper	<i>Atheris ceratophorus</i>	1	Venomous
Mozambique Spiting Cobra	<i>Naja mozambica</i>	1	Venomous

#### **Incidences of snake bite**

It was found that 57 people were bitten by snakes in the study area for the year 2012. Majority of the bites were recorded in individuals with age range of 11 - 20 (26.3%) and 21 - 30 (22.8%) and most bites (92.3%) involved the limbs. Both males and females were equally predisposed to snake bites. Most incidences of snake bites were recorded during February (14.04%), March (14.04%), April (12.3%) and June (12.3%). Unknown cyatotoxic snakes (24.6%) and others of unknown nature (21.1%) were the most commonly recorded incidences of snake bites. It was elaborated by the clinician that the unknown category of snakes involved in the bites was because the victims did not see the snake since some cases occurred during the night hours. However, Red spitting cobra and Black-necked spiting cobra also significantly contributed to the number of bite incidences (Table 5).

**Table 5. Incidences of snake bites recorded at Meserani Snake Park Clinic in 2012**

Parameter	Category	Number (%) of bite cases
Sex of snake bite victims	Female	28 (49.1)
	Male	29 (50.9)
Age (years) of snake bite victims	1-10	8 (14.03)
	11-20	15 (26.3)
	21-30	13 (22.8)
	31-40	4 (7.02)
	41-50	9 (15.8)
	51-60	8 (14.04)
Bite sites	Limbs	62 (95.4)
	Others (hands)	3 (4.6)
Types of snakes involved in biting	Black-necked spitting cobra	7 (12.3)
	Burrowing adder	6 (10.5)
	Egyptian cobra	2 (3.5)
	Puff adder	5 (8.8)
	Red spitting cobra	10 (17.5)
	Unknown	27 (47.4)
Period of the year the bites occurred	January	4 (7.02)
	February	8 (14.04)
	March	8 (14.04)
	April	7 (12.3)
	May	3 (5.3)
	June	7 (12.3)
	August	2 (3.5)
	September	3 (5.3)
	October	2 (3.5)
	November	6 (10.5)
	December	7 (12.3)

#### **General impacts caused by snakes to humans**

Many people feel worried (92.3%) whenever they encounter snakes and they normally suffer psychological problems such that some get bad dreams during the night. Majority of the respondents reported to have not encountered snake bites (95.4%) but they have seen (86.2%) snake bite cases in humans. It was reported that snake bite cases were given first aid like application of tourniquet (63.1) and subsequently reported to health facilities especially at Meserani Snake Park Clinic (87.7%). Others reported to manage snake bite cases by making incisions at the bite site and sucking out poisoned blood with special black stones "snake stones". Some reported to apply local herbs while others washed the bitten site with warm water and soap before the victim is taken to hospital. All the people interviewed had ever seen snakes into their houses especially during night hours (67.7%). The season snake enter houses were during long rains and dry seasons.

All the respondents regarded snakes as dangerous creatures since they cause bites to humans, livestock and snake venom can cause deaths. The key informants reported that there have been a number of livestock snake bite cases and deaths every year. However, 63% of the respondents admitted that not all snakes are venomous and dangerous. Seventy four percent of the respondents reported to have participated in killing snakes. It was also reported by the key informants that killing of snakes is almost a daily event in the study villages. The respondents reported to kill snakes because they are venomous (73.8%), are evil (40%), cause misfortune

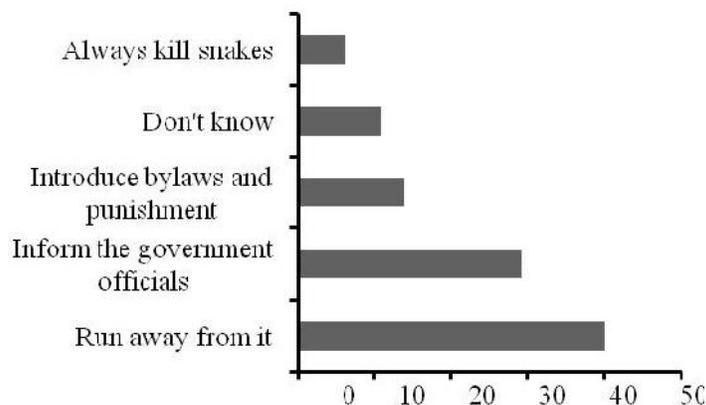
(36.9%), is the means of snake control (30.8%) and others reported just to kill snakes with no reasons (26.2%). Snakes are killed especially when they enter into houses, when are seen in residential areas, when they enter animal houses, when they bite humans or domestic animals, or just whenever are seen in crop farms or grazing areas. All the respondents and the key informants said that there was no any bylaw that prohibit killing of snake in the study area.

**Table 6. The reported impacts of snakes to humans**

Variable	Category	Number (%) of respondents
Feeling when encounter snakes	Normal	5 (7.7)
	Worried	60 (92.3)
Seen any persons bitten by snake	Yes	56 (86.2)
	No	9 (13.8)
Immediate measures taken when a person is bitten by a snake	First aid measures	41 (63.1)
	No action, just taken to hospital or traditional healers	24 (36.9)
Where do cases of snake bite treated?	Taken to hospital	48 (73.8)
	Taken to traditional healers	16 (24.6)
	Locally treated at home	1 (1.5)
Incidences of snake entering in houses	Yes	65 (100.0)
Time at which snake enters in houses	Day time	21 (32.3)
	Night	44 (67.7)
Season of the year snakes enter houses frequently	Long rains	31 (47.7)
	Short rains	3 (4.6)
	Dry seasons	31 (47.7)
What are the dangers of snakes?	Their venom kills	17 (26.2)
	Swallow and bite livestock	5 (7.7)
	They bite humans	43 (66.2)
	Create worries to people	32 (49.2)
Responses when an individual meet a snake	Kill it	42 (64.6)
	Run away	21 (32.3)
	Shout	2 (3.1)
How do you avoid snake bites?	Not grazing in thick grasses	35 (53.9)
	Avoid bushes around houses	18 (27.7)
	To be careful when walking during the night	10 (15.4)
	Good houses	2 (3.1)
	I don't know	32 (49.2)

### **Uses and conservation of snakes**

The findings show that majority of the respondents do not make use of snakes in any traditional practice (81.5%). A few respondents reported to use them for worship (16.9%). Witchcrafts also were reported to use snakes in their different activities. Majority of the respondents (89.2%) and District Natural Resources Officer reported that presence of Meserani Snake Park in Meserani ward attracts many tourists around to whom local people sale different Maasai commodities as souvenir. When respondents were asked as to why there was no by-laws that prohibits people from killing snakes, majority (72.3%) said that they had no idea whereas 27.7% insisted that there are no by-laws that protect snakes because they are human enemies. Furthermore, 90.8% of the respondents said that the government has to provide education to respondents about snakes and their usefulness if any so as to minimize the impact to both snake themselves and humans. More opinions on conservation of snake given by the respondents are summarized in Figure 1.



**Figure 1. Respondents' opinion on conservation of snakes**

### Discussion

Generally it was found that several snake species were endemic in the study areas and were causing variable problems ranging from creating fear to causing bites to humans and livestock. This had created a hostile relationship between human and snake such that humans were beating snakes to death whenever they saw them since were regarded as useless dangerous creatures to humans. To overcome this problem, continuous education on snake conservation have to be provided to the community of Monduli district and Tanzania at large.

The results of the current study show that most people have ever encountered snakes in the study villages at more than three times and most snakes are seen in grazing areas. Snakes are mostly seen in these areas because it is their habitat. Snakes are encountered mostly during the afternoon hours and it is common during the dry seasons because snakes activity is dependent primarily on temperature and relative humidity, and most species become active during dry seasons (WHO, 2010). Snakes are typically more active during the warmer months and hours of the day. During cool periods they aestivate in burrows, under large boulders and in standing dead trees (Spawls *et al.*, 2001).

It was further noted that the impacts of snakes to humans include worries when they are encountered because they fear of being bitten although most of people interviewed had not been bitten by snakes instead had heard number of people that has been bitten by snakes. Being afraid of snakes is a natural human behaviour. People fear snakes for their venom, and the possibility that their lives may be in danger. All the respondents regarded snakes as dangerous creatures since they cause bites to humans, livestock and snake venoms can cause death. However, two thirds of the respondents admitted that not all snakes are venomous and dangerous although they are afraid to any kind of snake. Indeed, snakes are important in aspects of tourism, education and many other uses as was pointed out by some key informants and respondents during this study.

The respondents had different ways of attending the cases of snake bite before were further taken for treatment. Majority reported to give some first aid that included applications of tourniquet just above the bite area if the bite involved appendages like limbs, make incision and suck blood with snake stones, apply local herbs, and wash with warm water and soap. Although some studies challenged the use of tourniquet as a means to reduce the severity of envenoming after snake bite (Amaral *et al.*, 1997), it is a custom to most people to use it as the first aid management of snake bite in most developing countries. Incision of the snake bite area and suck out blood is also challenged since it is a potential means of introduction of infections (Bhat, 1974).

It was further found that majority of the people reported to attend to hospital whenever they are bitten by snakes. This implies that people are knowledgeable on the likely consequences caused by snake venoms and that the reliable treatment of snake bite is found in hospitals. These results are different from what was reported in Kenya where two-thirds of the snake bite cases are treated by traditional healers (Snow *et al.*, 1994). Similarly in Pakistani, a study by Chandio *et al.* (2000) in Sindh rural population found that majority of snake bite cases are attended by local healers. Other studies in Nigeria also reported that majority of the people rely on traditional healers to treat snake bite cases (WHO, 2010). Generally, in most developing countries, up to 80% of individuals bitten by snakes first consult traditional practitioners before visiting a medical facility (WHO, 2010; Gupta & Peshin, 2012). The contradicting results observed during the current study may be due to the availability of Meserani Snake Park clinic that provide a free medical services to community around including that of snake bites. Being in snake endemic areas, the Meserani Snake Park clinic is enriched with antivenoms of different kinds depending on the locally available snake species in the location. This could have sensitized the local people nearby the clinic to immediately report to hospital whenever they encountered cases of snake bites.

Twelve snake species which are commonly found in the study area were recorded during this study. Most of these snakes are non-venomous species although people are still afraid of them. On other hands, poisonous species like puff adder also exist in the area and may be potentially dangerous to the people. As among the snake impact to people, the results showed that slightly over half of people had encountered snake bite during 2012. Majority of the people who were bitten by snakes were aged between 11-30 years and the bites involved limbs. This is due to the fact that at this age many people are engaged in different economic activities including grazing of livestock and crop farming such that are more predisposed to snakebites. However, WHO (2010) reports that the most vulnerable group of snake cases are children who account for 20–40% of cases in most published studies in Africa. Limbs are easily accessible to snake especially when someone accidentally steps on the snake which will defend itself by inflicting a bite.

Indeed, during the current study, it was observed that Red Spitting cobra (*Naja pallida*) and Black-necked spiting cobra significantly contributed to incidences of snake bites. Interestingly, most of the bites were noticed between November and June, which coincided with the period of rain season followed by long grass that gives better hiding places for snakes. Similar observation of incidences of snake bites has been reported by WHO (2010). Seasonal variation in the incidence of snake bite may be attributed to farming activity and grazing of animal in relation to rainfall and possibly the yearly reproductive cycle of the snakes. To overcome the problem of snake bites, community education to reduce the risk of bites is a better approach than is the eradication of snakes by killing them regularly. It should be based on knowledge of the circumstances in which most bites occur, the preferred habitats of dangerous snake species, and their peak periods of activity i.e, time of day, season, and climate. It was further observed that it was common to encounter a snake in houses especially during dry seasons. Snakes enter into houses probably to search for food during dry season. Equally the same when there is a long rainy season snakes enter houses to get warm and dry environment since they cannot tolerate extreme cold and wet conditions (WHO, 2010). In addition, ectothermic is a physiological constraint to behavioral avoidance of disturbance because reptiles are often tied to specific activity periods, habitats or retreat sites (Heatwole, 1977; Pough, 1983).

Killing of snake was a common practice in the study area whenever people encounter them. This was because snakes bite humans, they were regarded as misfortune (bad evil) and some bite and kill livestock. About three quarters of the respondents reported to have ever participated in killing snakes. In this area there are no by-laws that prohibit killing of snakes. However Lim (1982) suggested that means of snake control which includes habitat management, exclusion and uses of repellents. Some local people in the study areas argue that for better

conservation of snakes there is need to introduce by-laws and punishment to people who kill snakes.

Snakes being important in contributing to the national economy through tourism and in ecosystem function, they need special attention and care for their survival. It is clear that, despite the risk of snakebite and other undesirable effects, humans must learn to co-exist peacefully with snakes, respecting their place in nature while minimizing the danger they pose by avoiding them as far as possible. To reduce the impact people to snake, continuous education on snake conservation have to be provided to the community of Meserani juu and Meserani chini villages in Monduli district and Tanzania at large.

### Acknowledgments

The authors are grateful to the Government of United Republic of Tanzania through the Higher Education Students' Loan Board (HESLB) for funding this study. Village Executive Officers of Meserani Chini and Meserani Juu are thanked for their corporation during data collection. The support received from the Park Director at Meserani Snake, Meserani Snake Park Clinic the District Executive Director of Monduli district and the district natural resource officer is appreciated. All the respondents and key informants are thanked for providing data for this study.

### References

- Amaral, C.F.S., Campolina, D., Dias, M.B., Bueno, C.M. & Rezende, N.A. (1998) Tourniquet ineffectiveness to reduce the severity of envenoming after *Crotalus durissus* snake bite in Belo Horizonte, Minas Gerais, Brazil. *Toxicon* 36, 805-808.
- Anonymous (2005) *Human Wildlife Conflict Manual*. Southern African Regional Programme Office (SARPO). Action Set Printers, Harare Zimbabwe, 30pp.
- Bhat, R.N. (1974) Viper snake bite poisoning in Jamma. *Journal of Indian Medical Association* 63-383.
- Bijees, K.B. (2012) A study to evaluate the effectiveness of structured teaching programme on management of snake bite among staff nurses at selected hospitals in Bangalore, Karnataka. MSc. Dissertation, Rajiv Gandhi University of Health Sciences, Bangalore, Karnataka, 189pp.
- Chandio, A.M., Sandelo, P., Rahu, A.A., Ahmed, S.T., Dahri, A.H. & Bhatti, R. (2000) Snake bite: treatment seeking behaviour among Sindh rural population. *JAMC* 12, 3-5.
- Gupta, Y.K. & Peshin, S.S. (2012) Do herbal medicines have potential for managing snake bite envenomation? *Toxicology International* 19, 89-99.
- Heatwole, H. (1977) Habitat selection in reptiles. In: C. Gans & D.W. Tinkle (eds) *Biology of the reptilian*, Vol 7. Academic Press, New York, pp 137-155.
- Kasturiratne, A., Wickremasinghe, A.R., de Silva, N., Gunawardena, N.K., Pathmeswaran, A., Premaratna, R., Savioli, L., Lalloo, D.G., David, G. & de Silva, H.J. (2008) The global burden of snakebite: A literature analysis and modelling based on regional estimates of envenoming and deaths. *PLoS Medicine* 5, 1591-1604.
- Lim, T.W. (1982) Epidemiology of snake-bites in Malaysia. *Snake* 14, 119-124.
- Magige, F.J. (2012) Human-wildlife interaction in Serengeti and Ngorongoro districts of Tanzania: A case study on small mammals. *Tanzania Journal of Science* 38, 95-103.
- Maregesi, S., Kagashe, G. & Masatu, K. (2013) Ethnopharmacological survey of snake bite treatment in Ukerewe Island, Tanzania. *Scholars Academic Journal of Pharmacy* 2, 381-386.
- Muguli, G.I., Marimba, A. & Washaya, C.T. (1994) Snake bites in Zimbabwe: a clinical study with emphasis on the need for antivenom. *Central Africa Journal of Medicine* 40, 83-88.

- Nasidi, A. (2007) Snakebite as a serious public health problem for Nigeria and Africa. Paper presented at the WHO Consultative Meeting on Rabies and Envenomings: A Neglected Public Health Issue, Geneva, Switzerland, 10 January 2007. [http://www.who.int/bloodproducts/animal\\_sera/A.Nasidi.pdf](http://www.who.int/bloodproducts/animal_sera/A.Nasidi.pdf) [accessed 03/10/2014].
- Nhachi, C.F. & Kasilo, O.M. (1994) Snake poisoning in rural Zimbabwe—a prospective study. *Journal of Applied Toxicology* 14, 191-193.
- Oi-Fung, W., Hin-Tat, F., Shing-Kit-Tommy, L., Ka-Keunga, L., Chak-Wah, K. & Simpson, I.D. (2009) A preliminary survey of Hong Kong snake shops and the potential snake bite risks for the healthcare system. *Transactions of the Royal Society of Tropical Medicine and Hygiene* 103, 931-936.
- URT (2013) *Population and Housing Census 2012*. The United Republic of Tanzania; National Bureau of Statistics; Ministry of Finance Dar es Salaam Tanzania and Office of Chief Government Statistician; President's Office, Finance, Economy and Development Planning Zanzibar, 264pp.
- Pough, F.H. (1993) Amphibians and reptiles as low-energy systems. In: Aspey WP, Lustick SI (eds) *Behavioral Energetics: the Cost of Survival in Vertebrates*. Ohio State University Press, Columbus, Ohio, pp 141-188.
- Rohde, R. & Hilhorst T. (2011) A profile of environmental change in the Lake Manyara Basin, Tanzania. Issue Paper 109, Drylands Programme, IIED. [http://www.ntz.info/docs/boo833-dry\\_ip109eng.pdf](http://www.ntz.info/docs/boo833-dry_ip109eng.pdf), 31pp accessed on 29/09/2014.
- Snow, R.W., Bronzan, R., Roques, T., Nyamawi, C., Murphy, S. & Marsh, K. (1994) The prevalence and morbidity of snake bite and treatment-seeking behaviour among a rural Kenyan population. *Annals of Tropical Medicine and Parasitology* 88, 665-671.
- Spawls, S., Howell, K. & Drewes, R.C. (2001) *Field guide to the reptiles of East Africa: All the reptiles of Kenya, Tanzania, Uganda, Rwanda and Burundi*. Princeton University Press, Princeton, New Jersey, 544pp.
- WHO. (2010) *Guidelines for the prevention and clinical management of snakebite in Africa*. World Health Organization Regional Office for Africa, Brazzaville, 145 pp.