



Solving species quandary: why awareness programs are pivotal in snake conservation

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Snakes are feared but largely misunderstood by the public. In India, a country with ancient cultures and traditions, snakes were historically worshiped and their habitats were protected as sacred. However, over time these values have shifted to non-conservative approaches, even with people killing snakes on encountering them. This attitudinal change is an indication of knowledge erosion. A closed-ended survey was conducted for 300 randomly selected people in Kerala, India in the age range of 21-55 years to discern their skills in identifying common snake species, and evaluate their attitudes and knowledge about the importance of snakes in the environment. The study showed a lack of knowledge among the responders regarding snakes. Common snakes were not familiar, venomous and non-venomous snakes were mis-classified, and a lack of knowledge about post-bite treatment was observed. Therefore, there is an urgent need for planned conservation education and awareness programmes to build a snake-friendly society. A better understanding of snakes will supplement conservation in the future, and can minimise human-snake conflicts.

Keywords: snakes, conservation, identification, awareness

INTRODUCTION

Snakes are generally less liked compared to mammals and birds (Tisdell et al., 2015). They are often regarded as slimy, slithering creatures worthy of fear and disgust (Ohman & Mineka, 2003). Studies have shown snakes to be strongly and widely associated with fear in humans, independently of conscious cognition (Agras et al., 1969; Ohman & Mineka, 2001). A lack of knowledge and misguided perceptions of snakes have threatened their populations worldwide (Pandey et al., 2016). In India, with a long cultural history, traditional literature and mythological stories have depicted snakes as respected and fearful creatures (Mandlik, 1869; Menon, 1901; Sinha, 1979), leading to their worshipping as gods and killing them considered as sin (Allocco, 2009). This concept has led to the protection and conservation of snakes and their habitat in some parts of India, especially in Kerala as sacred groves ("Kaavu" in Malayalam), which are pristine patches of forest protected by a family or community for the conservation of biodiversity. Even though snakes are considered as symbols of power and worthy of worship worldwide (Miller, 1970; Hastings et al., 1922; Sasaki et al., 2010), when encountered in human-inhabited areas, they can be killed out of fear of a potentially life-threatening bite. The killing of snakes by humans has been identified as an important cause of their population decline (Dodd, 1987). India has one of the highest number of human deaths due to snakebites

(Kasturiratne et al., 2008), and people tend to kill snakes when encountered. This is contradictory to the culture and worshipping that was historically practiced. This attitudinal change has drawn the urgent need to educate the public regarding the importance and conservation of snake species.

Along with this change in attitude, human-induced impacts such as urbanisation and habitat loss have challenged the existence of snake species in both urban and rural areas. Rapid urbanisation has resulted in the alteration of most natural habitats, affecting local species (Czech et al., 2000), and is considered as one of the significant factors for current and future species extinctions (McDonald et al., 2008). Encroachment of natural habitat and poor waste management that appeals to rodents and other potential prey species has led to snakes occupying human-dominated and urban landscapes. This has resulted in increased human-snake conflict and casualties for both humans and snakes (Barve et al., 2013). In this context of rapid urbanisation, the study and conservation of urban wildlife is of great importance for minimising the extinction of urban wildlife. In addition to scientific research, public participation and support is mandatory for the conservation of urban wildlife. As the public is responsible for taking effective roles in solving environmental problems, they must be actively included in such actions to generate their interest in supporting long term conservation initiatives (Council of Environmental Quality, 1981).

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Public awareness programmes have shown positive effects on conservation (Zhang & Yin, 2014). Increasing awareness is often considered a precondition that can predict some conservation behaviours (Maibach, 1993; Beedell & Rehman, 2000). Formal education has often been found to be a predictor of an awareness towards nature (Rauwald & Moore, 2002). Peoples' attitudes towards conservation requires a clear understanding of various social, economic and cultural factors (Holmes, 2003). Whilst studies on attitudes and perceptions of charismatic megafauna are given priority (Sekhar, 2003; Shrivastava & Heinen, 2007; Heinen & Shrivastava, 2009), snakes were always given less attention. The aim of the present study is to understand the attitude and knowledge of the public regarding snakes, identification skills and post-bite treatments, from which we could develop an action plan for better education and awareness for promoting the conservation of snakes.

METHODS

A closed-ended questionnaire was distributed to 300 respondents (285 males and 15 females) during a snake awareness workshop conducted during October 2017 as part of a wildlife week celebration in Kannur District of Kerala, India. The interviewees are employees of the Kerala Police Department and the Kerala Armed Force, with ages ranging from 21 to 55 years old. To evaluate the knowledge and snake identification skills of the participants, pictures were shown to them using a slideshow presentation. They were then asked to identify snake species, and to identify correct snake bite treatment protocols. The data were then compiled and analysed to understand the perspectives and knowledge among the audience about snakes.

RESULTS

Among the participants, 80.3 % were afraid of snakes and 19.7 % were not afraid of snakes. When asked about willingness to co-exist with snakes, 68.0 % showed non-willingness while 32.0 % showed a willingness to co-exist with snakes (Fig. 1). The majority of individuals were curious to learn more about snakes (89.0 %), appreciate the ecological benefits of urban snakes (86.7 %), and to support the conservation of snakes (94.7 %). However, the majority (81.0 %) had a false conception that urban snakes should be translocated to nearby forest areas.

Even though 65.7 % of individuals were confident in identifying common snakes, actual results varied when

the responders were asked to identify the species shown in the pictures. When showed pictures of common snakes, the participants were able to identify and name the rat snake (*Ptyas mucosa*, 93.0 %) and the Indian rock python (*Python molurus*, 79.7 %) correctly, whereas the checkered keelback (*Xenochrophis piscator*) and common trinket snake (*Coelognathus helena*) were identified correctly by less responders, 13.0 % and 1.7 % respectively (Fig. 2).

In another question, we asked the responders to identify and name only the venomous snakes species among a total of eight species shown in a picture. The common krait (*Bungarus caeruleus*) and Russell's viper (*Daboia russelii*) were correctly identified as venomous by 74.3 % and 61.6 %, respectively, of the responders. However, the common wolf snake (*Lycodon capucinus*, 68.0 %), common sand boa (*Eryx conicus*, 57.0 %), travancore wolf snake (*Lycodon travancoricus*, 42.0 %), striped keelback (*Amphiesma stolatum*, 25.3 %), checkered keelback (24.6 %) and Indian rock python (8.3 %), which are the other common species in the study area, were all misidentified as venomous by responders (Fig. 3).

Knowledge on post-bite treatment was found to be weak among the responders (Table 1). Correct practices such as washing the bitten area with soap and taking the victim to hospital after immobilising the bitten area were suggested only by 58.0 % and 40.0 % responders, respectively. Incorrect practices such as tight tourniquets (45.3 %), spending time identifying the snake (49.0 %), cutting open the wound to suck out the venom (25.6 %), and applying ice on the bitten area (9.6 %) were also suggested by the responders.

DISCUSSION

Snakes are one of the most misunderstood and feared groups of animals around the world. Predatory snakes have played a central role in shaping the evolution of fear in mammalian and primate brains (Isbell, 2006). They trigger unique stimuli that are deeply grounded in evolutionarily shaped behaviour systems, causing alertness, rapid fear and escape tendencies (Ohman, 2009). It is therefore natural for humans to demonstrate hatred and fear towards snakes.

Translocation has been used as a mitigation measure against problematic animals for decades without any scientific evidence to support it (Athreya, 2006). This happens to be the case for most of the snakes rescued from urban areas, which are then translocated to forest areas. For example, Russell's viper, which is found in

Table 1. Knowledge on post snake bite practices

Post snake bite practices		Percentage of responders
Correct	Wash out the bitten area with soap	58.0
	Take the victim to the hospital at the earliest	40.0
Incorrect	Wrap bandage tightly across the bitten area	45.3
	Identify the bitten snake	49.0
	Cut open the wound and suck out the venom	25.6
	Apply ice	9.6

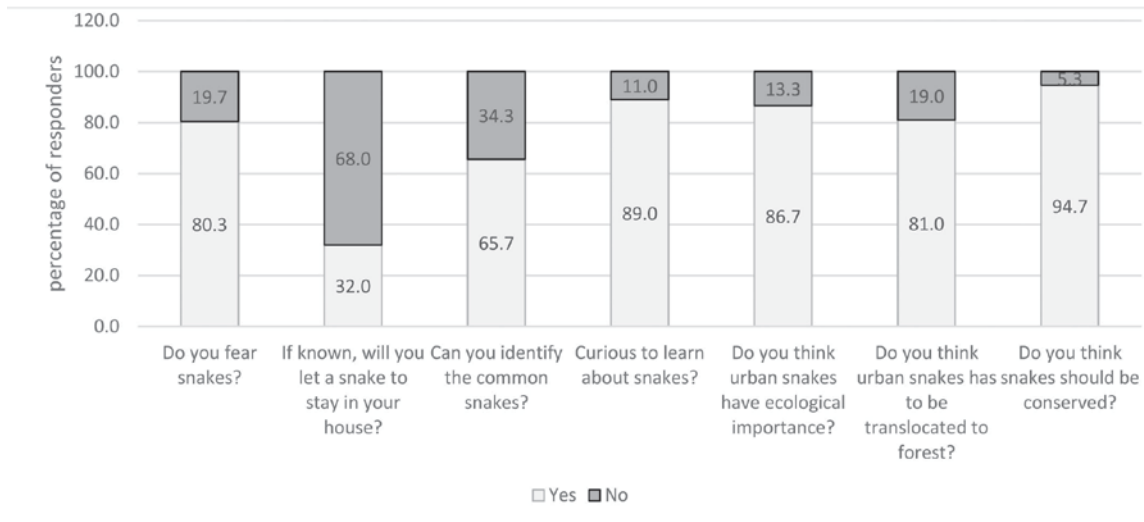


Figure 1. Attitude of the responders towards snakes

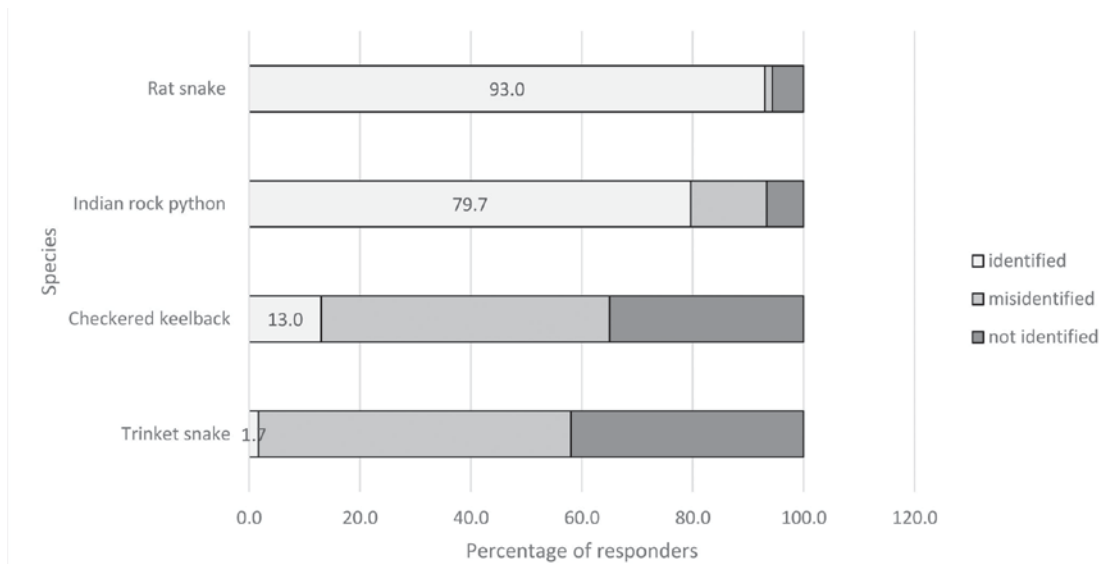


Figure 2. Percentage composition of responders in identifying common snakes

suburban habitats and laterite terrains, are released in the forest when caught. Translocated snakes have shown changes in behaviour such as ceasing reproductive activity and feeding, with deaths occurring due to the unavailability of their familiar prey (Barve et al., 2013). Cases of translocated snakes invading new territories, increasing home ranges, and travelling further distances were also recorded (Nowark et al., 1999; Butler et al., 2005). It was noted that majority of responders believed in the translocation of snakes to forest areas, suggesting the public believes that “snakes live in the forest”. This attitude shows lack of awareness about the ecological role of snakes as a main predator in urban environments, and their economical role in rodent control.

Responders were unable to identify common species such as checkered keelback, trinket snake, common wolf snake, and travancore wolf snake, and the suggestion that species like the checkered keelback and Indian rock python are venomous indicates a lack of understanding amongst the responders about common snakes in Kerala.

This lack of knowledge has implications for conservation, as many non-venomous snakes in human inhabited areas are killed by people, mostly due to their fear of snakes and snake bite deaths (Balakrishnan, 2010). Thus, along with these merciless killings, factors such as habitat loss and urbanisation have led to the decline in distribution and abundance of herpetofauna (Gibbons et al., 2000; Collins & Storfer, 2003; Beebee & Griffiths, 2005)

Good knowledge about potentially venomous snakes in our habitats and post snake bite practices are important lifesaving skills during snake bite emergencies. However, our results also showed lack of awareness in this context. Even though practices like tight tourniquets, spending time identifying the bitten snake, and sucking out venom are not advised (Annon, 2007, Ghosh et al., 2016), responders still follow such practices. A lack of knowledge by the general public on how to react when a bite occurs, and opting for discredited treatments, are major factors in the high rate of snake bite induced mortality in humans (Sivakumar & Jadeja, 2012).

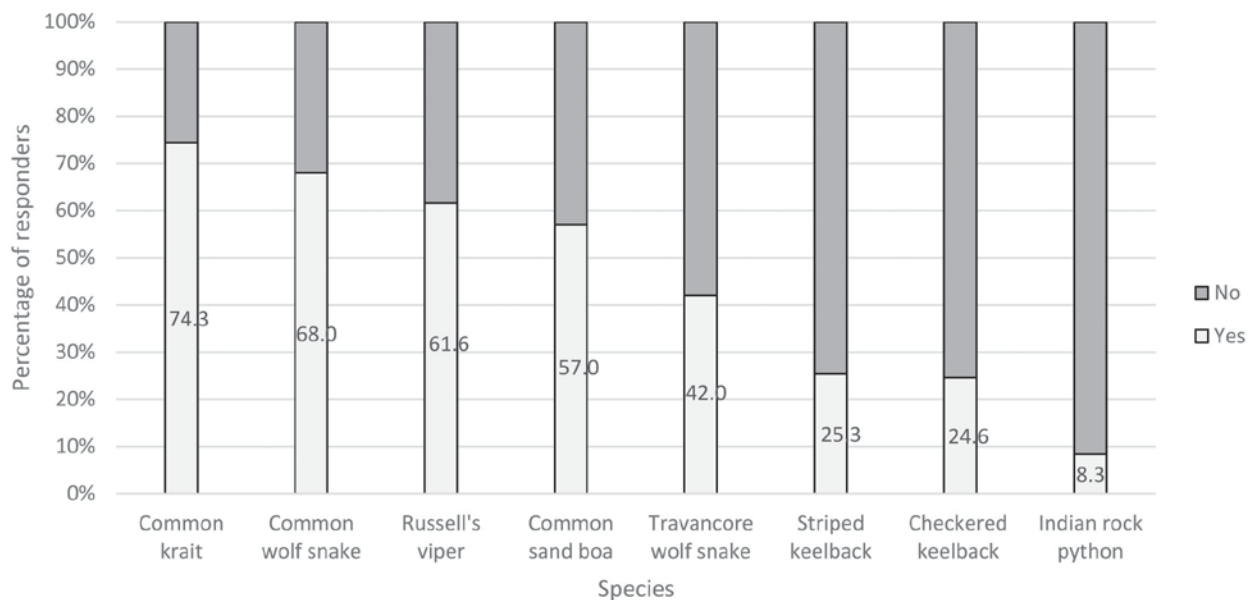


Figure 3. Responder's opinion on snakes; whether venomous or non-venomous

Increasing awareness of urban ecology through information dissemination is one of the best methods to conserve urban environments, leading to effective conservation (Kendle & Forbes, 1997). This was demonstrated during an educational programme on the conservation of non-venomous snakes in Nilambur, Kerala, which led to positive changes in the attitudes of the local public (Balakrishnan, 2010). With the completion of the programme, a considerable decrease in the killing of non-venomous snakes in that area was recorded (Balakrishnan, 2010).

Misconceptions regarding snakes and snakebites have drawn much attention and curiosity by people across a range of cultures and civilizations (Silva, 2013), which was also reflected in our study as many of the responders were curious to learn about snakes. The acceptance of their importance and readiness to co-exist shown by some responders could be a good sign for future conservation programmes. Therefore, more awareness programmes are required, targeting the public to educate them and change their attitudes towards snakes to promote conservation.

Media coverage on environmental issues have also shown potential positive change in the general public (Mikami et al., 1995). Popularising snakes and their importance using visual and print media, as well as developing snake parks and museums, are believed to be helpful in developing snake-friendly attitudes (Pandey et al., 2016). Thus, structured conservation educational programmes have to be prioritised to bring a positive attitude towards the conservation of urban wildlife. Promoting knowledge and awareness among public regarding snakes and snakebites will bring about an attitudinal change in the public, and can minimise casualties and fatalities in human-snake conflicts leading to a snake-friendly society.

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REFERENCES

- Agras, S., Sylvester, D. & Oliveau, D. (1969). The epidemiology of common fears and phobias. *Comprehensive Psychiatry* 10, 151–156.
- Allocco, A. (2009). Snakes, Goddesses, and Anthills: Modern Challenges and Women's Ritual Responses in Contemporary South India. PhD dissertation, Emory University.
- Annon (2007). Indian National Snakebite Protocols. First Aid and Snakebite Prevention Snakebite Treatment Support Concepts, Indian National Snakebite Protocol Consultation Meeting 2nd August, 2007 Delhi. Available from: http://www.files.meetup.com/1166925/Snakebite_Protocol_India_2007.pdf.
- Athreya, V. (2006). Is relocation a viable management option for unwanted animals? – The case of the leopard in India. *Conservation and Society* 4(3), 419-423.
- Balakrishnan, P. (2010). An education programme and establishment of a citizen scientist network to reduce killing of non-venomous snakes in Malappuram district, Kerala, India. *Conservation Evidence* 7(1), 9-15.
- Barve, S., Bhisare, D., Giri, A., Shankar, P.G., Whitaker, R. & Goode, M. (2013). A preliminary study on translocation of "rescued" King Cobras (*Ophiophagus hannah*). *Hamadryad* 36, 80-86.
- Beebee, T. J. & Griffiths, R. A. (2005). The amphibian decline crisis: a watershed for conservation biology? *Biological*

- conservation 125(3), 271-285.
- Beedell, J. & Rehman, T. (2000). Using social-psychology models to understand farmers' conservation behaviour. *Journal of Rural Studies* 16, 117-127.
- Butler, H., Malone, B. & Clemann, N. (2005). The effects of translocation on the spatial ecology of tiger snakes (*Notechis scutatus*) in a suburban landscape. *Wildlife Research* 32(2), 165-171.
- Collins, J.P. & Storer, A. (2003). Global amphibian declines: sorting the hypotheses. *Diversity and Distributions* 9(2), 89-98.
- Council of Environmental Quality (1981). *Global Future: Time to Act*. Washington, D.C.: U.S. Government Printing Office.
- Czech, B., Krausman, P. R. & Devers, P. K. (2000). Economic associations among causes of species endangerment in the United States. *BioScience* 50, 593-601.
- Dodd, C. K. (1987). Status, conservation, and management In: Seigel R.A., Collins J.T. & Novak S.S. (Eds.). *Snakes: Ecology and Evolutionary Biology*. MacMillan, New York, USA.
- Ghosh, S., Mukhopadhyay, P. & Chatterjee, T. (2016). Management of Snake Bite in India. *Journal of the Association of Physicians India* 64, 11-4.
- Gibbons, J.W., Scott, D.E., Ryan, T.J., Buhlmann, K.A., Tuberville, T.D., Metts, B.S., Greene, J.L., Mills, T., Leiden, Y., Poppy, S. & Winne, C.T. (2000). The global decline of reptiles, Déjà Vu Amphibians: reptile species are declining on a global scale. Six significant threats to reptile populations are habitat loss and degradation, introduced invasive species, environmental pollution, disease, unsustainable use, and global climate change. *AIBS Bulletin* 50(8), 653-666.
- Hastings J, Selbie, J. A. & Gray L. H. (1922). *Encyclopaedia of religion and ethics*. New York
- Heinen J. T. & Shrivastava R. J. (2009). An analysis of conservation attitudes and awareness around Kaziranga National Park, Assam, India: implications for conservation and development. *Population and Environment* 30 (6), 261-274.
- Holmes, C. M. (2003). The influence of protected area outreach on conservation attitudes and resource use patterns: a case study from western Tanzania. *Oryx* 37, 305-315.
- Isbell, L. A. (2006). Snakes as agents of evolutionary change in primate brains. *Journal of Human Evolution* 51, 1-35.
- Kasturiratne, A., Wickremasinghe, A. R., de Silva, N., Gunawardena, N. K., Pathmeswaran, A., Premaratna, R., Savioli, L., Lallo, D.G. & de Silva, H.J. (2008). Estimating the global burden of snakebite: a literature analysis and modelling based on regional estimates of envenoming and deaths. *PLoS Medicine* 5, 218.
- Kendle, T. & Forbes, S. (1997). *Urban nature conservation*. E & FN Spon, London.
- Maibach, E. (1993). Social marketing for the environment: using information campaigns to promote environmental awareness and behaviour change. *Health Promotion International* 8, 209-224.
- Mandlik, R. S. V. N. (1869). Serpent Worship in Western India: The Naga-panchami holiday as it is now observed; Serpent Worship, the Nagas and Sarpas. *Journal of the Bombay Branch of the Royal Asiatic Society* 36(9), 169-200.
- McDonald R. I., Kareiva P. & Forman R. T. T. (2008). The implications of current and future urbanization for global protected areas and biodiversity conservation. *Biological Conservation* 141, 1695-703.
- Menon, C. K. (1901). Serpent Worship in Malabar. *Calcutta Review* 113, 19-25.
- Mikami, S., Takeshita, T., Nakada, M. & Kawabata, M. (1995). The media coverage and public awareness of environmental issues in Japan. *Gazette (Leiden, Netherlands)* 54(3), 209-226.
- Miller, H. (1970). The cobra, India's "good snake". *National Geographic Magazine* 138, 393-409.
- Nowak, E.M., Hare, T.R.E.V.O.R. & McNally, J.U.D.E. (2002). Management of "nuisance" vipers: effects of translocation on Western Diamond-backed Rattlesnakes (*Crotalus atrox*). *Biology of the Vipers* 2002, 533-560.
- Ohman, A. & Mineka, S. (2003). The Malicious Serpent: Snakes as a Prototypical Stimulus for an Evolved Module of Fear. *Current Directions in Psychological Science* 12(1), 5-9.
- Ohman, A. (2009). Of snakes and faces: An evolutionary perspective on the psychology of fear. *Scandinavian Journal of Psychology* 50, 543-552.
- Ohman, A. & Mineka, S. (2001). Fear, phobias and preparedness: Toward an evolved module of fear and fear learning. *Psychological Review* 108, 483-522.
- Pandey, D. P., Pandey, G. S., Devkota, K. & Goode, M. (2016). Public perceptions of snakes and snakebite management: implications for conservation and human health in southern Nepal. *Journal of Ethnobiology and Ethnomedicine* 12, 22 <https://doi.org/10.1186/s13002-016-0092-0>.
- Rauwald, K. S. & Moore, C.F. (2002) Environmental attitudes as predictors of policy support across three countries. *Environment and Behaviour* 34, 709-739.
- Sasaki, K., Sasaki, Y. & Fox, S.F. (2010). Endangered traditional beliefs in Japan: influences on snake conservation. *Herpetological Conservation and Biology* 5(3), 474-485.
- Sekhar, N. U. (2003). Local people's attitudes towards conservation and wildlife tourism around Sariska Tiger Reserve, India. *Journal of Environmental Management* 69(4), 339-347
- Shrivastava, R. J. & Heinen, J.T. (2007). A microsite analysis of communities around Kaziranga National Park, India: Implications for conservation and Development. *Journal of Environment and Development* 16, 207-216.
- Silva, A. (2013). Dangerous snakes, deadly snakes and medically important snakes. *Journal of Venomous Animals and Toxins including Tropical Diseases* 19:26 <https://doi.org/10.1186/1678-9199-19-26>
- Sinha, B. C. (1979). *Serpent Worship in Ancient India*. New Delhi: Books Today.
- Sivakumar, S. & Jadeja, S. (2012). Snake survey and awareness programmes at Sonadih and Arasmata Cement Plants, Chhattisgarh, India. *ZOO's PRINT* 27(8), 8-9.
- Tisdell, C., Wilson, C. & Nantha, H.S. (2006). Public choice of species for the 'Ark': phylogenetic similarity and preferred wildlife species for survival. *Journal for Nature Conservation* 14(2), 97-105.
- Zhang, L. & Yin, F. (2014). Wildlife consumption and conservation awareness in China: a long way to go. *Biodiversity Conservation* 23, 2371-2381.

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