An education programme and establishment of a citizen scientist network to reduce killing of non-venomous snakes in Malappuram district, Kerala, India

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SUMMARY

A public education and citizen science programme was developed to improve data collection on incidences of deliberate killing of snakes and to reduce unfounded killing of snakes in human dominated landscapes of Kerala, southwest India. During 2003-2009, citizen scientists recorded 278 direct human kills and more than 200 kills of snakes by vehicular collision, agricultural practices and attack by pets. Participants managed to prevent killing of 276 non-venomous snakes (of 14 taxa). The non-venomous Travancore wolf snake *Lycodon travancoricus* (a batesian mimic of the deadly venomous Indian krait *Bungarus caeruleus*) was the species that benefited most of the programme. In addition, the conservation education programme (highlighting ecosystem services of reptiles) resulted in positive attitudinal changes among local people towards the conservation of snakes and general biodiversity of the region.

BACKGROUND

Direct human killing has been identified as an important cause of population decline in snakes (Dodd 1987). The majority of, mostly unfounded, kills of snakes occur in rural tropical areas, where human deaths resulting from snake bites may be common (Gutiérrez *et al*. 2006, Kasturiratne *et al*. 2008). In global terms, India is the country with the highest number of human deaths due to snakebite, with nearly 11,000 estimated deaths annually (Kasturiratne *et al*. 2008). In India, the majority of snake-bite deaths are caused by spectacled cobra *Naja naja*, Indian krait *Bungarus caeruleus*, Russell's viper *Daboia russelii* and saw-scaled viper *Echis carinatus*, which are considered the 'big four' venomous snakes in the country (Das 2002). The fear and resentment aroused due to snake-bites results in malicious killing of many non-venomous snakes on sight. However, relatively little attention has been devoted to understand the patterns of snake killing and the impact of such mortality on snake populations (Bonnet *et al*. 1999).

Within India (where over 275 species of snakes occur) large numbers of snakes inhabit densely populated rural lowland areas where most species are killed by people on sight. Only a few well-known harmless species, such as Indian rat snake *Ptyas mucosa*, Brahminy blind snake *Ramphotyphlops braminus* and checkered keelback water snake *Xenochrophis piscator* may escape persecution due to correct identification as non-venomous species by the general public.

In a preliminary study of direct human killing of snakes during 2002-2004, I found large number of kills of the non-venomous Travancore wolf snake *Lycodon travancoricus* (Fig. 1a) in Nilambur, Kerala (southwest India) due to its similarity to the Indian krait (Fig. 1b), the most deadly venomous terrestrial snake in India. The Travancore wolf snake is widespread in the low hills and plains of peninsular India. They are dark purplish-brown or nearly black above, with pale yellow cross-bars that bifurcate on the sides, enclosing triangular spots. The Indian krait, distributed through out the Indian sub-continent (widespread in the plains, in thinly wooded forests, agricultural fields as well as the edges of human habitations) is responsible for a large number of snake-bite fatalities. They are black, bluish black or dark brown above with paired narrow white bands across the body (Smith 1943, Das 2002). Because of the similarity of the aposematic warning colours (black and white bands), wolf snakes are considered as Batesian mimics of kraits (Pough 1988). It is understandably difficult for the general public to distinguish a wolf snake from a krait on sight. So the persecution of snakes mimicking dangerous species is not unreasonable. Thus conservation education is paramount in the conservation of the wolf snake and other non-venomous species.

The goal of the present work was to understand the patterns of snake kills and to reduce the killing of non-venomous snakes, especially Travancore wolf snake, by establishing a public education programme and citizen scientist network in Kerala.

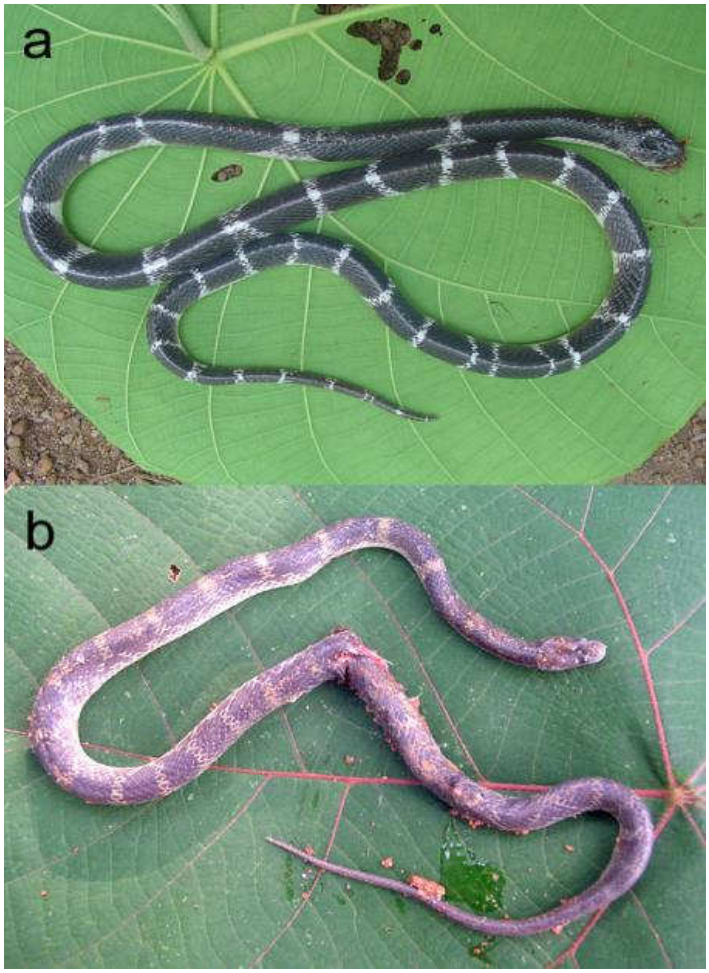

Figure 1. Human killed Indian krait *Bungarus caeruleus* (a) and its Batesian mimic Travancore wolf snake *Lycodon travancoricus* (b).

ACTION

Study area: The study was conducted in Nilambur taluk (11°05' to 11°25' N, 76°10' to 76°25' E), contiguous to the buffer zones of the Silent Valley National Park, in Malappuram district, Kerala. The landscape in this previously forested region is now dominated by a mosaic of human settlements, agricultural land and plantations of rubber *Hevea brasiliensis* and coconut *Cocos nucifera* in the plains, and teak *Tectona grandis* plantations and natural forests in the eastern foothills. A large number of snake-bite fatalities occur, primarily attributable to Indian krait, Russell's viper and spectacled cobra.

Formation of citizen scientist network and snake kill monitoring: Data collection on direct kills of snakes was a difficult task in the initial stage of the study (and remains so) because of the non-random occurrence of kills and lack of personnel at ground level to record kills. Informal interactions with the general public in the study area proved to be useful in data collection during 2002-2004. Thus, one possible solution to improve data collection was to encourage more general public, including school teachers and students (citizen scientists) to help the researcher in collecting field data on snake occurrence and kills.

Further to this several presentations (21 in schools, five in colleges and three in villages; Fig. 2, a presentation in action) and interactions (informal enquiries to assess villager's knowledge about snakes, snake bites and treatments and discussions on the ecosystem functions and conservation of snakes with the aid of education materials) were made under the 'Scientists with Students' and 'Conservation Education for Community' programmes of the Wildlife Research and Conservation Trust (WRCT 2009). The target groups included teachers, students, youth club members, women's groups in villages and the general public. The term 'citizen scientist' in this study refers to a person belonging to any of these groups (usually aged above 12 years of age) who became actively involved. The presentation contents included ecosystem services of reptiles, an overview of the reptile fauna in the region and provision of easy keys for the identification of venomous and non-venomous snake species, with added emphasis on distinguishing Travancore wolf snake from Indian krait. Large number of photographs and video clips of these two species and others occurring in the region were also used as education materials.

Telephone contact is encouraged to provide support to the participants who had doubts regarding species identification or other issues. In most cases of direct kills, data on morphological characters to determine species identification were collected by examining specimens. Citizen scientists were also requested to monitor road kills of snakes in their locality.

Figure 2. Students attending a conservation education programme (photo: S.Prasad).

CONSEQUENCES

To date, more than 400 students, several teachers (c. 50), youth club members (c. 90) and general public (c. 250) have participated in the education programme. After attending the programme many participants became active advocates for the conservation of snakes in the region. Numerous teachers and biology students who learned to identify snakes became the group leaders in schools and community based citizen science networks.

More than 200 citizen scientists from four villages in Nilambur taluk provided valuable information on the snakes of the region. Compilation of data on the occurrence of reptiles collected by different groups in different localities is underway and this may lead to the production of a reptile atlas of the region.

From the initial stage of the study the attendees of the informal talks and discussions, and later the members of the citizen scientist network acted as informers of direct human kills of snakes in their locality. From January 2003 to September 2009, data on 278 direct human kills of snakes were collected based on the information provided by the citizen scientists (Table 1). They also helped to collect data concerning more than 200 kills of snakes due to vehicular collision, agricultural practices (e.g. earth movers, weeders, etc), and attack by pets (e.g. cats *Felis catus* and dogs *Canis familiaris*). This data will be used to understand the patterns of direct and other human associated kills, and the impact of such mortality on local snake populations.

Due to the intervention of the citizen scientists, several individuals of different species were saved from human kills. As of September 2009, there are about 276 reported snakes saved from human persecution (Table 2). This number is minimal as some participants may have not reported their snake-saving efforts. Apart from this, the researcher alone saved 142 snakes by intervening at the time of conflict. These snakes were captured and released in surrounding forest areas, or left where encountered. The most frequently killed species were Travancore wolf snake and spectacled cobra. Kills of non-venomous species decreased (Table 2) indicating that the conservation education programme has been successful in bringing attitudinal changes in the local people towards snake conservation. The low number of direct kills (Table 1) and large number of rescues of Travancore wolf snake (Table 2) during the progress of the study shows that the general public of the region learned to distinguish this non-venomous species from the venomous Indian krait through the education programme. This is an important achievement of this programme because none of the Travancore Wolf Snake appeared in front of human escaped from persecution before the start of this education programme due to its similarity with the Indian krait. The student members of the programme actively prevented the killing of two species (*Ramphotyphlops braminus* and *Xenochrophis piscator*) which now mostly escape from persecution by adults but are still often harassed by children. In addition, many groups and teachers are also involved in environmental awareness-raising among students and general public.

One of the major challenges encountered during this education programme was to prevent killing of venomous species. Because of the fear and resentment aroused due to human mortality due to snake-bites in the region, and lack of expertise among the citizen scientists to handle venomous species, it was often impractical to save venomous snakes from persecution. Thus there is urgent need for local capacity building to sympathetically manage (i.e. to reduce and avoid deliberate killing whenever possible) the venomous species.

Conclusions: Education programmes play an important role in snake conservation because the general public generally dislike and fear them. This present project had some encouraging results. First, the citizen scientists provided valuable data by recording direct human (and also vehicular) kills of snakes. Second, their direct intervention reduced killing of several non-venomous snake species. The species that most benefited is the Travancore wolf snake, often persecuted due to its similarity to the deadly poisonous Indian krait. Moreover, the education programme has undoubtedly helped to draw local attention and interest to preserve snakes (in part due to highlighting their control of pest species that consume crops) and general biodiversity among the general public. The planned extension of this programme beyond its present geographical area would assist in the conservation of snakes and general biodiversity in such human dominated habitats.

Table 1. Summary of data collected on direct human kills of snakes in Nilambur taluk based on the information provided by the citizen scientists during 2003-2009.

	Snake species	Year							Total
		2003	2004	2005	2006	2007	2008	2009	
1	Indian krait *Bungarus caeruleus**	2	2	1	3	5	4	2	19
2	Russell's viper *Daboia russelli* *	2	4	4	4	3	2	1	20
3	Saw-scaled viper *Echis carinatus* *	-	1	-	1	-	-	-	2
4	Spectacled cobra *Naja naja**	3	4	15	7	7	6	4	46
5	Common vine snake *Ahaetulla nasuta***	9	7	3	1	-	1	-	21
6	Buff-striped keelback *Amphiesma stolatum*	-	2	1	-	-	-	-	3
7	Forsten's cat snake *Boiga forsteni*	2	4	1	-	-	-	-	7
8	Common Indian cat snake *Boiga trigonata*	-	1	4	2	-	1	-	8
9	Ornate flying snake *Chrysopelea ornata*	2	3	1	-	-	-	-	6
10	Common bronzeback *Dendrelaphis tristis*	4	4	2	1	1	-	-	12
11	Red sand boa *Eryx johnii*	-	1	2	-	-	-	-	3
12	Travancore wolf snake *Lycodon travancoricus*	12	14	21	7	2	1	1	58
13	Indian rat snake *Ptyas mucosa*	4	6	1	-	1	-	-	12
14	Indian rock python *Python molurus*	1	-	1	-	-	-	-	2
15	Brahminy blind snake *Ramphotyphlops braminus*	3	4	-	-	-	-	-	7
16	Shield-tail *Uropeltis sp.*	2	2	1	-	1	-	-	6
17	Checkered keelback *Xenochrophis piscator*	7	11	9	1	-	-	-	28
18	Unidentified	4	4	2	3	1	2	2	18
	Total	57	74	69	30	21	17	10	278

* highly venomous; **mildly venomous, considered harmless to humans

Table 2. Summary of the non-venomous snakes saved from human kills in Nilambur taluk by the intervention of the citizen scientists during 2004-2009.

	Snake species	Year						Total
		2004	2005	2006	2007	2008	2009	
1	Common vine snake *Ahaetulla nasuta*	1 (3)	2 (3)	7 (4)	3 (1)	5 (2)	5 (1)	23 (14)
2	Buff-striped keelback *Amphiesma stolatum*	- (1)	-	1 (1)	-	2	- (1)	3 (3)
3	Forsten's cat snake *Boiga forsteni*	-	- (2)	1	-	2 (1)	2	5 (3)
4	Common Indian cat snake *Boiga trigonata*		1	- (1)	1	2 (1)	2	6 (2)
5	Ornate flying snake *Chrysopelea ornate*	-	- (1)	1	2	-	- (1)	3 (2)
6	Common bronzeback *Dendrelaphis tristis*	1 (2)	-	1	2 (1)	3	5 (2)	12 (5)
7	Red sand boa *Eryx johnii*	-	-	2	- (1)	-	-	2 (1)
8	Travancore wolf snake *Lycodon travancoricus*	5 (4)	8 (3)	13 (7)	12 (4)	14 (6)	18 (11)	70 (35)
9	Indian rat snake *Ptyas mucosa*	2 (2)	4	4 (3)	9 (3)	7 (2)	6 (3)	32 (13)
10	Indian rock python *Python molurus*	-	-	1	3	1	- (1)	5(1)
11	Brahminy blind snake *Ramphotyphlops braminus*	7 (5)	9 (3)	6 (7)	14 (3)	18 (8)	12 (4)	66 (30)
13	Shield-tail *Uropeltis sp.*	3	2 (3)	3 (1)	8 (1)	6 (1)	4 (1)	26 (7)
14	Checkered keelback *Xenochrophis piscator*	1 (5)	1 (7)	6 (3)	5 (5)	4 (2)	6 (4)	23 (26)
	Total	20 (22)	27 (22)	46 (27)	59 (19)	64 (23)	60 (29)	276 (142)

* Values in parenthesis are the number of snakes saved from human kills by intervention of the author

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