

Hunting of endemic and threatened forest-dwelling chelonians in the Western Ghats, India

Arun Kanagavel^{a,*} and Rajeev Raghavan^a

^aConservation Research Group (CRG), St. Albert's College, Kochi, 682 018, Kerala, India.

(Accepted November 25, 2013)

ABSTRACT

This study investigates the hunting of two endemic and threatened terrestrial chelonians, the Cochin forest cane turtle (*Vijayachelys silvatica*) and Travancore tortoise (*Indotestudo travancorica*) in the Western Ghats region of India. Informal interviews were conducted with indigenous and non-indigenous communities and Forest Department officials to understand the dynamics of chelonian hunting and the existent rationale and beliefs that supported it. Chelonian consumption was existent among both indigenous and non-indigenous communities, but was higher among the former. *Indotestudo travancorica* was exploited to a larger extent than *Vijayachelys silvatica*. Both the species were used as a cure for piles and asthma, to increase body strength and were largely captured during collection of non-timber forest produce and fire management activities. These chelonians were also sold to local hotels and served to customers known on a personal basis with minimal transfer to urban areas. Conservation action needs to be prioritised towards *I. travancorica*, by upgrading its IUCN Red List status, and also through increased interaction between the Forest Department and local communities to improve chelonian conservation in the landscape.

Key words: *Indotestudo travancorica*, Kerala, *Vijayachelys silvatica*; Wild meat

INTRODUCTION

Hunting is a primary threat to biodiversity worldwide that leads to major demographic changes in targeted and non-targeted species causing local and global extinctions, as well as ecological changes that disturb ecosystem services and livelihoods (Milner-Gulland & Bennett, 2003; Brashares *et al.*, 2011). Hunting as an activity supports a multitude of rationales ranging between non-income subsistence needs to a multi-billion international industry concerning protein needs, traditional medicines and cultural necessities, and to supplying urban markets of animal trophies, cosmetics, clothing and regular/unique cuisines (East *et al.*, 2005; Fletcher, 2005; Lindsey *et al.*, 2007; Dzoma *et al.*, 2008; Aiyadurai *et al.*, 2010). Despite this wide range of utilization, conservation action is focused largely on the international bushmeat and wildlife trade, which however represents only a small proportion of the global consumption (Brashares *et al.*, 2011). Local utilisation of wildlife by communities existing close to, or within forest areas could be as large a threat as being traded internationally (Peres, 2011). Although there is an increased understanding of localised wildlife hunting, their use and control measures in Africa and South America, such studies are lacking in several Asian regions including mega-diversity countries like India (Corlett, 2007; Velho *et al.*, 2012).

Wildlife hunting in India is illegal and punishable vide the Wildlife Protection Act (WPA) 1972, which includes most of the susceptible species (Kaul *et al.*, 2004). However, hunting continues to be widespread in several regions of India even though it is disregarded or refuted (Madhusudan & Karanth, 2002; Kaul and Ghose, 2005; Velho *et al.*, 2012). The high human population density of several biodiversity-rich regions in India, such as the Western Ghats (Cincotta *et al.*, 2000), which

comprises numerous forest-dwelling communities, potentially means that wild species are being used at a large scale. This existing use warrants for detailed studies, as past research (Madhusudan and Karanth, 2002; Aiyadurai *et al.*, 2010) does not ascertain their viability with wild populations.

Chelonians comprise one of the world's most endangered vertebrate groups and are next only to primates in terms of the impending risk of extinction they face (Turtle Conservation Coalition, 2011). Turtle populations are incessantly declining, due to their use on a massive anthropological scale as food, traditional medicines and pets, seldom accounting for their sustainability (Turtle Conservation Coalition, 2011). The two cryptic forest-dwelling chelonians endemic to the Western Ghats in focus here are the Cochin forest cane turtle (*Vijayachelys silvatica*) and Travancore tortoise (*Indotestudo travancorica*). *Vijayachelys silvatica* is a rare, evolutionarily distinct, endangered, habitat-specialist aligned with evergreen and semi-evergreen forests (Asian Turtle Trade Working Group, 2000a; Vasudevan *et al.*, 2010). *Indotestudo travancorica* is more common, larger in size and occupies diverse habitats, and is listed as Vulnerable (Asian Turtle Trade Working Group, 2000b; Deepak & Vasudevan, 2009).

These chelonians face a wide variety of threats ranging from habitat destruction, forest fires to being consumed by large carnivores and humans (Kanagavel and Raghavan, 2012; Kanagavel *et al.*, 2013a). Chelonian use for meat consumption by the indigenous people has been known since the last two decades (Vijaya, 1984; Appukuttan, 1991), but neither have any mitigation measures been initiated, nor any detailed research been undertaken. Furthermore, previous studies only provide scant details of collection and use, which do not allow for suitable mitigation measures to be formulated.

*Corresponding Author's E-mail: arun.kanagavel@gmail.com

This study therefore aims to determine the dynamics and perceptions behind chelonian use that lead to their collection, supply and consumption, to devise appropriate conservation measures.

MATERIALS AND METHODS

STUDY AREA

Our study was carried out in two adjoining Forest Divisions of the Western Ghats in the south Indian state of Kerala - Vazhachal and Chalakudy (Figure 1). These Forest Divisions were the source for the first *V. silvatica* individuals known to science in 1912 (Deepak & Vasudevan, 2009). Details on the study area and local communities are detailed in a recently published paper (Kanagavel & Raghavan, 2012).

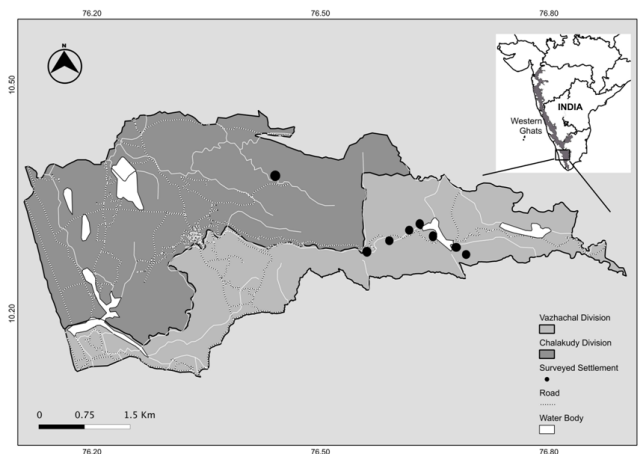


Figure 1. Map of study area and its location in the Western Ghats. The extent of the two Forest Divisions surveyed, road and water body network are shown along with the human settlements where questionnaire surveys were conducted in parallel.

INTERVIEW SURVEY

Interviews were conducted during March to June 2011 around indigenous, non-indigenous settlements and local Forest Department stations to gain an in-depth understanding of chelonian use across the two Forest Divisions (Figure 1). This was undertaken after the questionnaire survey (Kanagavel and Raghavan, 2012) in parallel to the field survey (Kanagavel *et al.*, 2013a). The questionnaire surveys provided information that indicated the extent of chelonian consumption in the region (Kanagavel & Raghavan, 2012) but it did not allow for discussing issues in detail; disrupting and formalising conversation that is known to lead to data inaccuracy or inhibition among respondents (Newing, 2010).

Hence informal interviews were undertaken with individuals from the local settlements and Forest Departments during casual interactions, as it would often lead to discussions on chelonians. A maximum of two individuals undertook the interviews and were accompanied by a local informant, so as to provide a sense of familiarity to the respondents and thereby reduce bias in the case of sensitive information. The respondents were opportunistically selected and composed of individuals that the survey team had already met. During such interactions, a conversation was pursued to understand whether they

had eaten either of the species, the number of chelonians of each type they had collected and use they put it to in the last year and species preference for consumption. Subsequently, details of who, how, when and where in the forests were the chelonians collected was pursued. The reasons for chelonian consumption, the parts and sizes that were consumed were also determined. Lastly, the beliefs of the respondent to chelonians and the existent law enforcement mechanisms were discussed. In case of Forest Department officials, a discussion about the people involved in chelonian consumption and the existent law enforcement was discussed.

All the relevant details of the conversation including the stakeholder type were noted down once the respondent left. The data was coded in accordance to the issues detailed above, analysed qualitatively and summarised with respect to the varying information. The numerical data on the frequency of respondents and the identity of the stakeholders who collected/consumed the chelonians and consumption rates were analysed quantitatively using SPSS 11.5.0. Basic descriptive statistics were computed and whether there were any differences in chelonian consumption rates among the three stakeholders was determined using the non-parametric Kruskal-Wallis test (Kanagavel *et al.*, 2013b).

RESULTS

A total of 104 informal interviews were conducted (71 respondents from indigenous communities, 22 from non-indigenous communities and 11 Forest Department officials).

CHELONIAN COLLECTION, CONSUMPTION AND SUPPLY

While 75% of the respondents had consumed *I. travancorica* in their lifetime, only 22% had consumed *V. silvatica*. Significant differences were found between the different stakeholders towards their consumption of *I. travancorica* (Kruskal-Wallis test $H = 32.2$, $df = 2$, $p < 0.0001$) and *V. silvatica* (Kruskal-Wallis test $H = 13.6$, $df = 2$, $p = 0.001$). *Indotestudo travancorica* was consumed by 90.1% of indigenous and 54.6% of the non-indigenous respondents, while *V. silvatica* were consumed by 32.4% of the indigenous respondents, and non-indigenous respondents did not consume the species. While there was a higher restriction on non-indigenous locals from entering forest areas, this was largely not applicable to indigenous people. The non-indigenous community gained access to forest areas legally when they were employed in 'cutting' fire-lines or other development activities undertaken by the Forest Department. Seven respondents (5 = indigenous, 2 = non-indigenous) stated that they visited forest areas and captured chelonians in the absence of a paid-job or as a leisure activity. 'Expert' non-indigenous and indigenous individuals well versed with the area and chelonian ecology were also known to be involved in collections. Chelonian consumption was prevalent among both indigenous and non-indigenous communities but was perceived to be higher among the former. Forest Department officials and non-indigenous respondents cited the lifestyle of indigenous communities as a reason for high chelonian consumption among them, which they

perceived was difficult to stop.

The respondents collected a total of 76 chelonians (65 *I. travancorica* and 11 *V. silvatica*) within the last year (2009-2010), a majority of which were consumed (Figures 2a, b). Around 31.7% of the respondents had collected *I. travancorica* at a rate of 1.1 ± 0.1 individuals/year; while 6.7% had collected *V. silvatica* at a rate of 0.69 ± 0.1 individuals/year.

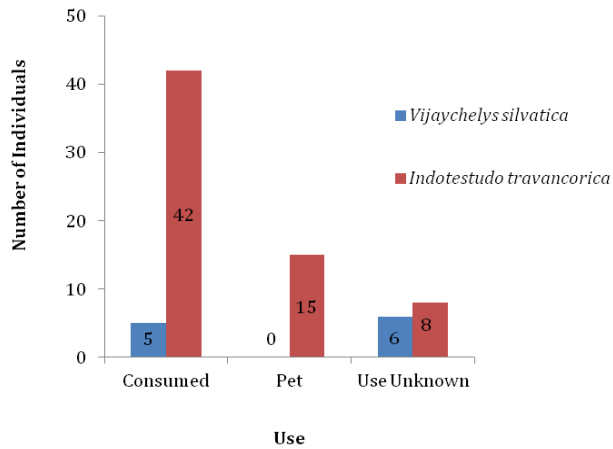


Figure 2a. Frequency of *Vijayachelys silvatica* and *Indotestudo travancorica* collected for different purposes.

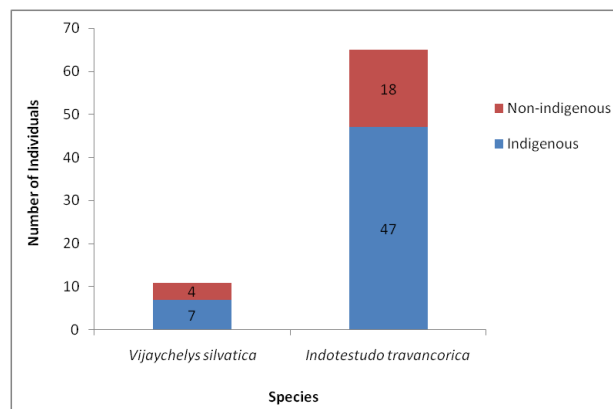


Figure 2b. Frequency of *Vijayachelys silvatica* and *Indotestudo travancorica* collected by indigenous and non-indigenous people.

Chelonians were also supplied at prices varying from INR 100–250 (\$2.0-5.1) to local hotels and toddy (local alcohol) shops across the state highway that cuts across the Vazhachal Forest Division. The cooked meat of chelonians was also reported to be sold to customers known personally. Cooked meat or live chelonians were sometimes shared with the other neighbouring households (especially when available in large quantities), relatives, friends or guests.

There was no apparent preference for any chelonian species, and meat was sold or consumed irrespective of the species concerned. However, as *I. travancorica* grew to larger sizes, it made them more desirable for consumption over *V. silvatica*, which only resulted in 100-120gm of meat. Eight indigenous respondents also stated that *V. silvatica* were avoided as they carried an offensive odour and defecated when picked up.

Large-sized chelonians were readily consumed while smaller ones were reared at houses (Figure 3a, Figure 4). A hole was made in the posterior portion of the carapace on the caudal or marginal plates of small-sized chelonians (Figure 3b) and fed on leftovers that mainly comprised of



Figure 3a. Captive Travancore tortoise *Indotestudo travancorica* at the surveyed indigenous settlements in Kerala.



Figure 3b. Holes made in the carapace of captive Travancore tortoises *Indotestudo travancorica*.

rice until they reached a size desirable for consumption. The meat was considered to taste like pork and immature eggs within a chelonian were considered more delicious than other body parts. Chelonian eggs were also consumed when found while the carapace and plastron were mostly discarded.

These chelonians were usually collected while “cutting” fire-lines during the annual fire-management initiatives undertaken by the Forest Department, and during the collection of non-timber forest produce (NTFPs). Respondents stated that they filled ‘sack loads’ of chelonians especially while clearing bamboo stretches. Forest fires set by locals during the dry season to facilitate growth/collection of NTFPs subsequently yielded chelonians. Respondents stated that they often encountered the two chelonians close to forest streams in the evening or when they aggregated around ‘mootal’ and ‘ponna’ (*Dillenia pentagyna*) trees during the fruiting season. They could also find chelonians by following their tracks, which were easier if over grass, cane leaves or close to streams. Both *I. travancorica* and *V. silvatica* were known to hide under leaf-litter, grass/shrub, logs and rock cavities. During the dry season they could be found in cooler areas amidst moist soil while during the rainy season they were highly active and were known to move across the landscape. *Vijayachelys silvatica* were more associated with thick evergreen forests where little light penetrated through the canopy. *Indotestudo travancorica* were found more often than *V. silvatica* as the former’s size and appearance made their detection easier and

were found across the entire landscape unlike *V. silvatica*, which were perceived to be found only in a few habitats.



Figure 4. A Cochin Forest Cane Turtle *Vijayachelys silvatica* being reared at an indigenous settlement in Kerala

The chelonians were primarily collected directly while a few respondents collected them from pit-fall traps. The success of detecting chelonians was perceived to be higher when dogs were taken along. This was often the case as they doubled up as watchdogs sounding an alarm, useful especially if problematic species like elephants (*Elephas maximus*) were in close proximity. The indigenous communities in the region trained these dogs to detect chelonians through prior acclimatization. Non-indigenous individuals were known to either buy such dogs or allow the indigenous communities to train their dogs.

REASONS FOR CHELONIAN USE

Only 7% of the respondents associated *I. travancorica*'s meat with medicinal properties that could cure piles, one of them explaining in detail the ability of a chelonian to withdraw its neck into its shell at rapid speeds as being able to retract the piles-affected tracts on consumption. Fewer respondents (3.8%) associated *I. travancorica* consumption to curing asthma, gaining physical strength, as an aphrodisiac and as a growth-promoting agent in children. One respondent even stated that he had used *I. travancorica* meat as bait to catch large-sized fish from the Chalakudy River. Only 1% of the respondents associated *V. silvatica* meat with the ability to cure piles.

BELIEFS TOWARDS CHELONIANS

Two respondents perceived *V. silvatica* as precursors of bad luck as encountering it indicated that NTFPs would not be found on that day in the locality. They would then kill the turtle and move away from the locality. A respondent who belonged to the state of Tamil Nadu stated that he had had three chelonians at his house as pets but had to release them due to conflicts with other family members as they considered them as a bad omen. Contrastingly, a respondent who enquired about the price that we were willing to pay for a chelonian said that non-local individuals often approached him for chelonians, which they considered as a sign of good luck.

LAW ENFORCEMENTS

All the respondents knew that consumption of the two chelonians was illegal. Four respondents had multiple

wildlife-related charges against them but continued to consume chelonians in the region. Forest Department officials stated that they could only press charges against individuals who were found possessing chelonians or in the act of consuming its meat and that only a small proportion of users were imminently caught. Three respondents also stated that they could get away with paying bribes to avoid law enforcement.

DISCUSSION

Chelonian use at the study location was widely prevalent mainly for consumptive purposes and largely within the human establishments immediate to the areas of their occurrence, their transfer to urban areas being minimal. Utilization of all the life stages of the focal species raises concern as numerous chelonian species face high juvenile and egg mortality in the wild, and depend upon adult survivorship to maintain populations (Schlaepfer *et al.*, 2005; but see Pike *et al.*, 2008). If not already, this use has the potential to cause local extinctions around existing settlements as reported for the spur-thighed tortoises *Testudo graeca graeca* in Spain (Perez *et al.*, 2004). Detrimental demographic disturbances at remote forest locations such as those covered in the present study cannot also be ruled out as such sites are visited on a seasonal/yearly basis by locals to undertake forest-fire management initiatives and collect NTFPs. Law enforcement has also been largely ineffective in controlling the non-commercial chelonian utilisation and may not stop previous offenders from further collection.

Limitations with our study methods and unavailability of data do not allow for extrapolation of chelonian use to a larger area, as well as discuss the viability of chelonian use, or demographic changes. Nevertheless, it provides baseline information of the dynamics of chelonian utilization on the basis of which conservation measures could be designed and implemented.

CONSERVATION MEASURES

Indotestudo travancorica, currently considered the lesser threatened of the two species, is consumed at rates six folds to that of *V. silvatica*. *Indotestudo travancorica* is placed in Schedule IV of the WPA while *V. silvatica* is in Schedule I-Part II (Deepak & Vasudevan, 2009). By being placed in these schedules, the WPA clearly prohibits their hunting irrespective of social status. Though chelonian use is widely known as being against the forest-related laws, enforcement does not defer further consumption like in other similar scenarios (Schneider *et al.*, 2011). Chelonian supply, use and sale in the study area is largely controlled by personal and community relationships, and seldom openly sold in markets like in other parts of India and the world (Rajagopalan & Dan, 1983; Shi *et al.*, 2007; Schneider *et al.*, 2011), resulting in the fact that stronger law enforcement as suggested by Ramesh (2008) if invoked may still fail to check chelonian use. However, an upgradation of both the species in the WPA Schedule and an uplisting of *I. travancorica* from Vulnerable to Endangered status in the IUCN Redlist would lead to much-needed conservation attention for these threatened and endemic species.

Our results reiterate that local communities possess

substantial ecological knowledge of the two target species that enable them to target chelonians if necessary. Consumption of the two species was higher among indigenous respondents than the other two stakeholders. The continued perception among forest department respondents in this study that the indigenous ways are but 'primitive' and hence chelonian consumption might need to be overlooked gives the indigenous communities a derogatory outlook and only further marginalizes them. If the local forest stations accept cultural norms and permit chelonian consumption among indigenous communities, appropriate policy amendments may need to be introduced to recognise it. Among irrefutable criticisms of the preservationist protected area management and inappropriateness of sustainable use based interventions in the Indian context, it has been argued that a direct protection would be necessary until other suitable measures are devised to conserve species (Gadgil, 1992; Madhusudan and Karanth, 2002). The dependency of the Forest Department on local communities for monitoring forested areas and their inter-personal relationships could also be forcing such lapses. Discussions will need to be held between these key stakeholders to recognise chelonian use and negotiate the way forward for chelonian conservation if enforcement of WPA is to be more efficient.

Illegitimate chelonian use was facilitated by legalized inadequately planned NTFP collection (Shahabuddin & Prasad, 2004; Gubbi & MacMillan, 2008). While concern for the inter-relationship between chelonian collection, forest fires and NTFP collection has been stated before (Appukuttan, 1991) no mitigation strategies seem to have been initiated. NTFP collection and fire-line 'cutting' can be supervised on the ground by Forest Department staff to restrict collection of chelonians. Regular checks on local restaurants for sale of chelonian meat could reduce collection for commercial purposes.

While the proposal of complete eradication of dogs from protected areas (Deepak & Vasudevan, 2009) could substantially reduce chelonian collection, the security that dogs provide would be thoroughly compromised, leading to a possible backlash from local communities and increase in human-wildlife conflicts. Instead, a restriction on the number of dogs that each settlement can possess could reduce overall chelonian collection and other species, as reported in other parts of the world (Fiorello *et al.*, 2006).

Contrasting community-specific beliefs exist, some which embody chelonians as sources of bad luck. Local beliefs also promote consumption of chelonian meat as a means to cure body ailments like in other parts of India (Krishnakumar *et al.*, 2009; Mohanraj, 2011) and the world (Schneider *et al.*, 2011). However, the major reason for consumption could be from chelonians being a free protein source, and not because of their medicinal properties. The Kerala State Forest Department had undertaken poster campaigns for a set of species that included the Indian Star Tortoise (*Geochelone elegans*) against local beliefs that imperilled them. Threatened chelonians in general and the species that are the focus of this study would benefit immensely from a similar campaign, especially one that is targeted at individuals from local communities with a mid-level economy and without a formal education (Kanagavel *et al.*, 2013b).

CONCLUSION

This study illustrates that local utilization of wildlife over-rides, and in this case is more disastrous than commercial trade. The primary step to conserve the threatened chelonians in the landscape would be to undertake discussions with the local communities, recognise their chelonian use and negotiate the most suitable measures to initiate chelonian conservation. Although there is no silver bullet for conserving these chelonians, a combination of several measures, and collaborations between the three key stakeholders – Forest Department, local communities and conservation researchers would be necessary to effectively reduce chelonian use in the area (Kanagavel *et al.*, 2013c).

ACKNOWLEDGEMENTS

The authors thank the Forest Department officials at the Kerala State Forest Headquarters, Trivandrum; Forest Stations at Anakayam, Athirapilly, Pokayilapara, Vazhachal and Vellikulangara, local guides and their families, and hotel owners for their assistance in designing field logistics and for introducing us to the local establishments; Fabin Baby, K.S. Amitha Bachan and Anvar Ali for species-relevant discussions, Helen Meredith, Jonathan Baillie, Peter Bennett and Susanna Paisley for helping out in the project formulation stage, Jane Loveless for her support and Nikhil Whitaker for his suggestions on the draft manuscript. This research was permitted by the Department of Wildlife and Forests, Kerala (WL 12-7326/2010) and financially supported by the ZSL Erasmus Darwin Barlow Expedition grant 2010.

REFERENCES

- Aiyadurai, A., Singh, N. J. and Milner-Gulland, E. J. 2010. Wildlife hunting by indigenous tribes: A case study from Arunachal Pradesh, North-East India. *Oryx* 44: 564-572.
- Appukuttan, K. S. 1991. Cane turtle & travancore turtle - a survey report. Peechi, KFRI.
- Asian Turtle Trade Working Group 2000a. *Vijayachelys silvatica*. In IUCN Red List of Threatened Species. Version 2011.1. <http://www.iucnredlist.org> Cited 13 March 2012.
- Asian Turtle Trade Working Group 2000b. *Indotestudo travancorica*. In: IUCN Red List of Threatened Species. Version 2011.1. <http://www.iucnredlist.org> Cited 13 March 2012.
- Brashares, J. S., Golden, C. D., Weinbaum, K. Z., Barrett, C. B. and Okello, G. V. 2011. Biodiversity conservation and poverty traps special feature: Economic and geographic drivers of wildlife consumption in rural Africa. *Proceedings of the National Academy of Sciences* 108: 13931-13936.
- Cincotta, R. P., Wisniewski, J. and Engelman, R. 2000. Human population in the biodiversity hotspots. *Nature* 404: 990-992.
- Corlett, R. T. 2007. The impact of hunting on the mammalian fauna of tropical Asian forests. *Biotropica* 39: 292-303.
- Deepak, V. and Vasudevan, K. 2009. Endemic turtles of India. Wildlife Institute of India, Dehradun.

- Dzoma, B. M., Sejoie, S. and Segwagwe, B. V. E. 2008. Commercial crocodile farming in Botswana. *Tropical Animal Health and Production* 40:377-381.
- East, T., Kumpel, N. F., Milner-Gulland, E. J. and Rowcliffe, J. M. 2005. Determinants of urban bushmeat consumption in Rio Muni, Equatorial Guinea. *Biological Conservation* 126, 206-215.
- Fiorello, C. V., Noss, A. J. and Deem, S. L. 2006. Demography, hunting ecology, and pathogen exposure of domestic dogs in the Isozo of Bolivia. *Conservation Biology* 20: 762-771.
- Fletcher, N. W. 2005. Conserving musk deer in the wild: A comparison of direct payment and community wildlife management strategies. MSc. Thesis. Simon Fraser University.
- Gadgil, M. (1992). Conserving biodiversity as if people matter - a case-study from India. *Ambio* 21: 266-270.
- Gubbi, S. and Macmillan, D. C. 2008. Can non-timber forest products solve livelihood problems? A case study from Periyar tiger reserve, India. *Oryx* 42: 222-228.
- Kanagavel, A. and Raghavan, R. 2012. Local ecological knowledge of the threatened Cochin Forest Cane Turtle *Vijayachelys silvatica* and Travancore Tortoise *Indotestudo travancorica* from the Anamalai Hills of the Western Ghats, India. *Journal of Threatened Taxa* 4: 3173-3182.
- Kanagavel, A., Rehel, S.M. and Raghavan, R. 2013a. Population, ecology, and threats to two endemic and threatened terrestrial chelonians of the Western Ghats, India. *ISRN Biodiversity*: 10.1007/s13280-013-0434-2.
- Kanagavel, A. Raghavan, R. and Verissimo, D. 2013b. Beyond the "General Public": Implications of audience characteristics for promoting species conservation in the Western Ghats hotspot, India. *AMBIO*. DOI: 10.1007/s13280-013-0434-2.
- Kanagavel, A., Pandya, R., Prithvi, A. and Raghavan R. 2013c. Multi-stakeholder perceptions of efficiency in biodiversity conservation at limited access forests of the southern Western Ghats, India. *Journal of Threatened Taxa* 5(11): 4529-4536.
- Kaul, H. R. and Ghose, D. 2005. Conservation implications of wild animal biomass extractions in northeast India. *Animal Biodiversity and Conservation* 28: 169-179.
- Kaul, R., Hilaluddin, Jandrotia, J. S. and McGowan, P. J. K. 2004. Hunting of large mammals and pheasants in the Indian Western Himalaya. *Oryx* 38: 426-431.
- Krishnakumar, K., Raghavan, R. and Pereira, B. 2009. Protected on paper, hunted in wetlands: Exploitation and trade of freshwater turtles (*Melanochelys trijuga coronata* and *Lissemys punctata punctata*) in Punnamada, Kerala, India. *Tropical Conservation Science* 2: 363-373.
- Lindsey, P. A., Frank, L. G., Alexander, R., Mathieson, A., and Romanach, S. S. 2007. Trophy hunting and conservation in Africa: Problems and one potential solution. *Conservation Biology* 21:880-883.
- Madhusudan, M. D. and Karanth, K. U. 2002. Local hunting and the conservation of large mammals in India. *Ambio* 31: 49-54.
- Milner-Gulland, E. J., and Bennett, E. L. 2003. Wild meat: The bigger picture. *Trends in Ecology & Evolution* 18: 351-357.
- Mohanraj, T. 2011. Observations on the exploitation of sea turtles along the Tuticorin coast, Tamil Nadu, India. *Indian Ocean Turtle Newsletter* 14: 9-11.
- Newing, H. 2010. Conducting research in conservation: Social science methods and practice. Routledge, London.
- Peres, C. A. 2011. Overharvesting. In Sodhi, N. S. And Ehrlich, P. R. (eds) *Conservation biology for all*. Oxford University Press, Oxford, pp. 107-130.
- Perez, I., Gimenez, A., Sanchez-Zapata, J. A., Anadon, J. D., Martinez, M. and Esteve, M. A. 2004. Non-commercial collection of spur-thighed tortoises (*Testudo graeca graeca*): A cultural problem in southeast Spain. *Biological Conservation* 118: 175-181.
- Pike, D. A., Pizzatto, L. G., Pike, B. A. and Shine, R. 2008. Estimating survival rates of uncatchable animals: The myth of high juvenile mortality in reptiles. *Ecology* 89: 607-611.
- Rajagopalan, M. and Dan, S. S. 1983. Conservation of fresh water turtles of India. Central Marine Fisheries Research Institute, Cochin.
- Ramesh, M. 2008. Relative abundance and morphometrics of the Travancore tortoise, *Indotestudo travancorica*, in the Indira Gandhi Wildlife Sanctuary, southern Western Ghats, India. *Chelonian Conservation and Biology* 7: 108-113.
- Schlaepfer, M. A., Hoover, C. and Dodd Jr., C. K. 2005. Challenges in evaluating the impact of the trade in amphibians and reptiles on wild populations. *BioScience* 55: 256-264.
- Schneider, L., Ferrara, C. R., Vogt, R. C. and Burger, J. 2011. History of turtle exploitation and management techniques to conserve turtles in the Rio Negro basin of the Brazilian Amazon. *Chelonian Conservation and Biology* 10: 149-157.
- Shahabuddin, G. and Prasad, S. 2004. Assessing ecological sustainability of non-timber forest product extraction: The Indian scenario. *Conservation and Society* 2: 235-250.
- Shi, H. T., Parham, J. F., Lau, M. and Tien-Hsi, C. 2007. Farming endangered turtles to extinction in China. *Conservation Biology* 21: 5-6.
- Turtle Conservation Coalition. 2011. Turtles in trouble: The world's 25+ most endangered tortoises and freshwater turtles—2011. In Rhodin, A. G. J., Walde, A. D., Horne, B. D., Van Dijk, P. P., Blanck, T. and Hudson, R. (eds.) IUCN/SSC Tortoise and Freshwater Turtle Specialist Group; Turtle Conservation Fund; Turtle Survival Alliance; Turtle Conservancy; Chelonian Research Foundation; Conservation International; Wildlife Conservation Society and San Diego Zoo Global, Lunenburg.
- Vasudevan, K., Pandav, B. and Deepak, V. 2010. Ecology of two endemic turtles in the Western Ghats. Wildlife Institute of India, Dehradun.
- Velho, N., Karanth, K. K. and Laurance, W. F. 2012. Hunting: A serious and understudied threat in India, a globally significant conservation region. *Biological Conservation* 148: 210-215.
- Vijaya, J. 1984. Cane turtle (*Heosemys silvatica*) study project in Kerala. *Hamadryad* 9: 4.