Herpetological Journal FULL PAPER

Published by the British Herpetological Society

Feeding habits of Indian rock pythons in Keoladeo National Park, Bharatpur, India

Subramanian Bhupathy[1], Chinnasamy Ramesh[1] & Archana Bahuguna[2]

[1]*Sálim Ali Centre for Ornithology and Natural History Anaikatty (PO), Coimbatore- 641 108, Tamil Nadu, India*

[2]*Zoological Survey of India, Northern Regional Centre Dehra Dun-248195, Uttarakhand, India*

We analysed faecal samples and conducted direct observations to determine the feeding habits of native Indian rock pythons, *Python molurus molurus* in Keoladeo National Park (KNP), Bharatpur, India from October 2007 to September 2009. Pythons fed throughout the year except winter (December–February). Feeding was related to monthly mean minimum temperature (r=0.423, p<0.05), variation in temperature (r=-0.671, p<0.01) and rainfall (r=0.695, p<0.01), but was not associated with prey abundance, monthly mean ambient temperature or humidity. A wide range of prey species belonging to mammals, birds and reptiles was consumed. This study enhances our knowledge of the diet of the Indian rock python in its native habitat and further defines its feeding ecology.

Key words: faecal analysis, Indian rock python, tricotaxonomy, trophic ecology

INTRODUCTION

The food that an animal consumes is a central aspect of its ecology (Slip & Shine, 1988a). Foraging is critical because success or failure in securing food resources has consequences for survival, growth and reproduction (Tuttle & Gregory, 2009). Data on the diet of a species are essential to understand aspects of foraging behaviour, with consequences for habitat use and reproductive strategies (Reinert, 1993; Lind & Welsh, 1994; Shine & Madsen, 1997); knowledge of feeding behaviour is also essential for developing conservation plans for threatened species (Holycross & Mackessy, 2002; Bury, 2006; McCallum & McCallum, 2006). Feeding habits of large snakes are of particular interest, as they show remarkable adaptations for locating, capturing, subduing and ingesting large prey (Slip & Shine, 1988a), but information on species inhabiting the tropics is rare (Shine & Madsen, 1996; Shine et al., 1998, but see Henderson & Powell, 2007).

The Indian rock python *Python molurus* (Family: Pythonidae) is widely distributed in India, Sri Lanka and Southeast Asia (Smith, 1943; Whitaker, 1993; Daniel, 2002; Whitaker & Captain, 2004). Two subspecies, *P. m. molurus* and *P. m. bivittatus* are recognised, and their status as full species is currently debated (Jacobs et al., 2009). *Python m. molurus* is distributed in most parts of India and Sri Lanka. Ecological data on wild Indian rock pythons are rare (Bhupathy & Vijayan, 1989; Bhatt & Choudhury, 1993; Ramesh & Bhupathy, 2010), and information on food habits is largely based on opportunistic observations (Smith, 1943; Bhupathy & Vijayan, 1989; Daniel, 2002; Whitaker & Captain, 2004).

Several methods have been used to study the food habits of reptiles: gut content analysis (Delany & Abercrombie, 1986; Lobo et al., 2005; Dove et al., 2011), stomach flushing (Fitzgerald, 1989; Rivas et al., 1996) and analysis of faecal samples (Sylber, 1988). Non-invasive methods such as the analysis of faecal samples are useful for collecting data without disturbing the study animals. Identification of species based on hairs (trichotaxonomy) is well known for its utility in wildlife forensics (De et al., 1998; Bahuguna & Mukherjee, 2000). However, feathers degrade while passing through the digestive tracts of

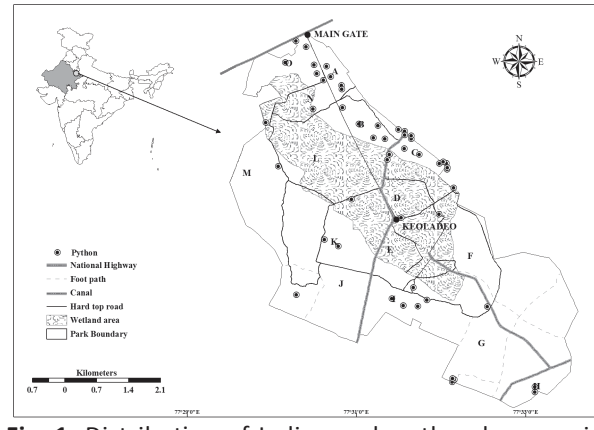

Fig. 1. Distribution of Indian rock python burrows in Keoladeo National Park, Bharatpur, Rajasthan, India during October 2007–September 2009; A–O represent various compartments of the park.

Correspondence: Subramanian Bhupathy (bhupathy.s@gmail.com)

animals, and identification of birds may not be possible in many cases.

Anecdotal data on the diet of the Burmese python *P. m. bivittatus*, an invasive species in Everglades National Park, USA, have been reported by Snow et al., (2007), Reed & Rodda (2009) and Dove et al. (2011, 2012). In order to provide more information on the food habits of native Indian rock pythons, we studied wild snakes in Keoladeo National Park, Bharatpur, India from 2007 to 2009.

Table 1. Frequency of potential prey taxa of Indian rock pythons in Keoladeo National Park, Bharatpur, India based on track plots. Numbers in parentheses are percentages of the total, # represents multiple species, * represents live specimens observed.

Common name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Rhesus macaque *Macaca mulatta*	5	0	2	1	5	1	1	1	1	1	2	3	23(0.3)
Spotted deer *Axis axis*	119	66	43	65	59	74	48	34	49	65	40	118	780(10.7)
Sambar deer *Cervus unicolor*	1	1	1	0	0	0	1	1	0	0	1	1	7(0.1)
Nilgai *Boselaphs tragocamulus*	157	90	61	103	101	132	108	73	92	100	65	159	1241(17.0)
Indian cattle *Bos indicus*	137	74	54	85	84	134	105	89	102	111	66	141	1182(16.2)
Wild boar *Sus scrofa*	17	7	1	6	13	12	4	4	9	11	5	12	101(1.4)
Golden jackal *Canis aureus*	73	62	35	65	46	42	32	21	14	43	28	78	539(7.4)
Domestic dog *Canis domesticus*	2	12	2	3	1	2	1	0	0	3	1	5	32(0.4)
Striped hyena *Hyaena hyaena*	6	4	1	7	2	2	2	2	2	7	6	13	54(0.7)
Jungle cat *Felis chaus*	6	2	1	3	0	0	0	1	0	4	2	7	26(0.4)
Small Indian civet *Viverricula indica*	1	1	0	0	0	0	0	0	0	1	0	1	4(0.1)
Mongoose *Herpestes spp.*	1	0	0	1	3	0	1	1	0	4	0	5	16(0.2)
Black-naped hare *Lepus nigricollis*	47	34	24	21	25	19	8	3	15	50	21	59	326(4.5)
Indian porcupine *Hystrix indica*	102	77	68	117	85	74	89	64	79	94	54	116	1019(14.0)
Five-striped palm squirrel *Funambulus pennantii*	24	10	10	12	5	16	10	1	8	12	5	23	136(1.9)
Field rat# (Species unknown)	109	68	39	59	34	46	31	21	22	49	33	90	601(8.3)
Aves#	139	83	45	88	54	94	70	42	75	88	40	143	961(13.2)
Other snakes*	2	2	0	0	0	3	2	1	5	9	6	0	30(0.4)
Monitor lizard *Varanus bengalensis**	14	3	1	3	3	16	16	12	19	23	10	21	141(1.9)
Garden lizard *Calotes versicolor**	2	5	6	10	6	4	3	2	3	8	0	7	56(0.8)
Skinks *Eutropis* spp.#*	0	0	1	1	0	1	1	0	0	0	0	0	4(0.1)
Geckoes *Hemidactylus* spp.#*	0	0	1	2	1	0	1	0	0	0	0	0	5(0.1)
Indian toad *Bufo melanostictus**	0	0	0	0	0	0	0	0	0	1	0	0	1(0.0)
Total	964	601	396	652	527	672	534	373	495	684	385	1002	7285(100)

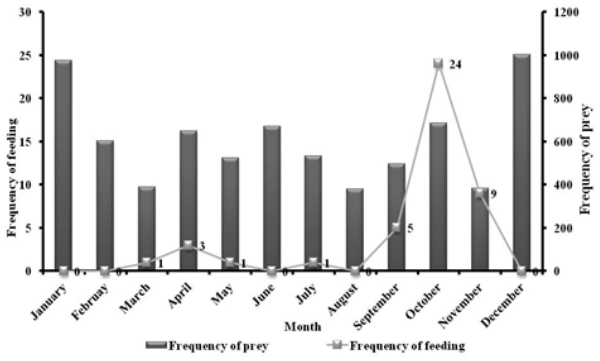

Fig. 2. Frequency of feeding of Indian rock pythons and potential prey species based on signs in Keoladeo National Park, Bharatpur, India (January 2007–December 2009).

MATERIALS AND METHODS

Keoladeo National Park (KNP; 27°7.6' N, 77°33.2'E, Fig. 1), Bharatpur, India, is 29 km^2 in size, of which 8.5 km^2 is comprised of wetlands. The vegetation is dominated by a mixture of xerophytic and semi-xerophytic species (Prasad et al., 1996). The climate is sub-humid to semi-arid and the monthly mean maximum and minimum temperatures range from 30.8–35.1°C and 16.9°–22.4°C, respectively. May and June are the warmest and December and January are the coolest months (Vijayan, 1991). The average monthly relative humidity is 61.23 ±6.26%. The monsoon season extends from late June to September, and the average rainfall of Bharatpur is 655 mm (Ali & Vijayan, 1986).

The Indian rock python is one of the most common snakes found in KNP, and shares ground burrows with the Indian porcupine *Hystrix indica* (Bhupathy & Vijayan, 1989). At KNP, about 50 burrows have been used by Indian rock pythons in recent years (Bhupathy & Ramesh, 2010). During this study, an area encompassing 100 m radius around each of 35 burrows was examined on a bimonthly basis from October 2007 to September 2009. Faeces of this species were distinguished from other snakes on the basis of their size and shape (cylindrical, relatively large size: length 8–30 cm x width 5–8 cm). Once collected, faecal samples were dried in the shade and stored in air-tight plastic bags. In case of direct feeding observations or snakes with distended stomachs, date (month) and size of the snake were recorded.

Data on temperature, relative humidity and rainfall were collected from the meteorological station at Bharatpur. Pearson's correlation was performed to investigate the relationship between frequency of feeding by snakes with monthly mean maximum and minimum temperatures and temperature variation (difference between maximum and minimum temperature), relative humidity, rainfall and prey availability.

Potential prey species found in the area were quantified every two weeks between October 2007 and September 2009, using thirty five 10 x 10 m randomly selected track plots at about 20–30 m intervals, leading to 1680 observations (35 plots and 48 surveys). The dusty nature of the soil facilitated the identification and recording impressions of animal tracks and signs. Prey tracks were recorded as presence (recorded as 1) and absence (recorded as 0) for each species. The tracks found were obliterated to avoid repeat counts. Evidence of mammalian prey species found in the faeces were identified following trichotaxonomy techniques (Bahuguna et al., 2010). The nomenclature of hair medulla type was adopted from Wildman (1954) and the cuticular and cross section types followed Brunner & Corman (1974). Reference micro-slides were prepared from the hair samples of potential prey species known to occur in KNP and compared with hairs found in faeces. The number of dead Indian rock pythons found in the park during this period were also recorded along with their size (total length), and possible reasons for their mortality.

RESULTS

A total of 7285 signs of 23 taxa of vertebrates (16 mammals, five reptiles and one each of birds and amphibians) were observed. Rodents, birds and reptiles could not be identified to the genus or species level. Tracks of Nilgai (*Boselaphus tragocamulus*) were the most common, followed by Indian cattle (*Bos indicus*), Indian porcupine (*Hystrix indica*) and birds (Table 1). The highest number of signs (1002) was observed during December, and the lowest (373) during August (Table 1).

In total, 54 faecal samples were collected. The highest number of feeding events (24) was observed in October, followed by November (9). The post-monsoon season (September–November) covered 38 (86%) feeding records, and no feeding was observed during winter

Table 2. Descriptive statistics and Pearson correlation values of monthly feeding frequency by Indian rock pythons and selected environmental factors in Keoladeo National Park, Bharatpur; SD: Standard Deviation; *n*=24 months.

Environmental Factors	Mean±SD	Pearson Correlation
Mean temperature (°C)	25.71±6.76	r=0.316; p=0.132
Maximum temperature (°C)	32.50±5.99	r=0.159; p=0.457
Minimum temperature (°C)	18.97±7.86	r=0.423; p<0.05
Temperature variation (°C)	13.53±3.54	r=-0.671; p<0.001
Relative humidity (%)	61.23±6.26	r=0.372; p=0.074
Rainfall (mm)	56.42±89.21	r=0.695; p<0.001
Prey availability	303.54±101.79	r=-0.078; p=0.718

(December–February) with few instances of feeding until August. The highest prey activity (based on signs in the track plots) was found during December when snakes did not feed (Fig. 2).

Feeding was significantly correlated with monthly mean minimum temperature (r=0.423, p<0.05), temperature variation (r=-0.671, p<0.01) and rainfall (r=0.695, p<0.01). The relationship between monthly feeding and prey species activity was not significant (Table 2).

Of the 44 direct observations of feeding by Indian rock pythons, prey items were identified visually in seven cases (spotted deer *Axix axis*, comb duck *Sarkidiornis melanotus*, cattle egret *Egretta garzetta*, grey heron *Ardea cinerea*, greater coucal *Centropus sinensis*, grey francolin *Froncolinus pondicerianus*, monitor lizard *Varanus bengalensis*). In 37 other cases, the snakes were located after they had swallowed the prey, and prey species involved was not known. The length of these snakes varied between 1.5 and 4.3 m.

Prey species were identified to various taxonomic levels in 46 of the 49 faecal samples (Table 3); one sample had both feathers (unidentified bird) and hair (spotted deer). Spotted deer was found in 42.59% (n=23) of the faecal samples, followed by birds (16.7%; n=9). Feathers found in the faecal samples could not be identified to genus or species level following trichotaxonomy because of severe digestion. One faecal sample had hair remains of spotted deer and three *Ziziphus jujuba* fruits. In total, 79% of the food items consumed by Indian rock pythons consisted of mammals, followed by birds (17%) and reptiles (4%).

Eighteen Indian rock pythons were found dead during the present study (snout-vent length 0.6–3.9 m). Over one third of the dead snakes had no external injuries and

Table 3. Diversity of prey species of Indian rock pythons based on faecal analysis and direct observations in Keoladeo National Park during October 2007–September 2009; Numbers in parentheses are % frequency, # indicates multiple species.

Taxa	Number of feeding observations
Rhesus macaque *Macaca mulatta*	4 (7.69)
Spotted deer *Axis axis*	23 (44.23)
Sambar deer *Cervus unicolor*	1 (1.92)
Nilgai *Boselaphs tragocamulus*	1 (1.92)
Indian cattle *Bos indicus*	1 (1.92)
Wild boar *Sus scrofa*	1 (1.92)
Striped hyena *Hyaena hyaena*	1 (1.92)
Jungle cat *Felis chaus*	2 (3.85)
Small Indian civet *Viverricula indica*	1 (1.92)
Mongoose *Herpestes spp.*	3 (5.77)
Indian porcupine *Hystrix indica*	1 (1.92)
Field rats#	2 (3.85)
Aves#	9 (17.31)
Monitor lizard *Varanus bengalensis*	2 (3.85)
Total	52 (100)

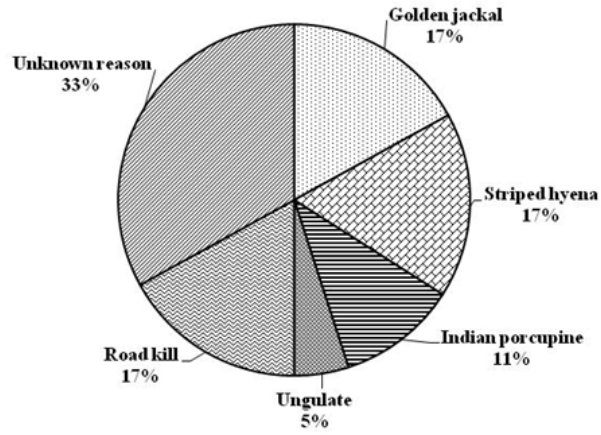

Fig. 3. Reasons for mortality of Indian rock pythons in Keoladeo National Park, Bharatpur (n=18) during October 2007–September 2009.

the reason for their mortality is unknown (Fig. 3). Golden jackals and striped hyenas were observed killing three snakes each (snout-vent length 2.8–3.9 m). Two (11%) dead snakes (2.7 & 3.3m) were found with porcupine quills in their bodies. Other reasons for mortality involved trampling by ungulates (5%), and road kill due to vehicular traffic (17%).

DISCUSSION

Higher feeding incidences (86%) of snakes were observed during September–November, which could be due to warmer climatic conditions during these months. Warmer and drier conditions during April–June might have forced most of the snakes to aestivate, resulting in no feeding during these months. Examination of 29 random plots (100 x 100 m) placed about 1000 m away from burrows during the summer of 2008–09 yielded no sightings of snakes (CR & SB, unpublished data). KNP is a temporary monsoonal wetland, and remains dry during April–July. Colder months (December–February) correspond to the mating season (Bhupathy & Ramesh, 2010), when snakes were found near ground burrows, basking in the daylight (Krishnan et al., 2009).

Prolonged basking by females during the breeding season has been reported to occur in Diamond pythons *Morelia spilota spilota* (Harlow & Grigg, 1984; Slip & Shine, 1988b). The breeding season of *P. molurus* in KNP has been reported as February–August (Ramesh & Bhupathy, 2010). Reproductively active snakes typically stop feeding during the breeding season, as foraging activities are incompatible with reproductive activities such as mate-searching and development of eggs. Cessation of feeding by males during the mating season has been recorded in colubrids (Shine et al., 2003), viperids (Madsen & Shine, 1993; Aldridge & Brown, 1995) and pythonids (Madsen & Shine, 2000). This study showed that the relationship between prey occurrence and feeding of snakes is not significant. Shine (1994) reported that pythons primarily preyed on medium-sized mammals, which is similar to the findings of this study.

All except one faecal sample examined had remains of only one prey species. This could be due to the

retention of faecal contents in the rectum (Shine et al., 1998). The present data showed that the food habits of Indian rock pythons are similar to those of *P. bivittatus*, *P. reticulatus*, *P.* [*sebae*] *natalensis* and *M. s. spilota*, with mammals being the main prey (Pope, 1961; Slip & Shine, 1988a; Dove et al., 2011). Pythons show a shift in the prey size consumed during their ontogeny (Shine et al., 1998). Indian rock pythons consumed a range of prey species similar to invasive *P. bivittatus* in the Everglades National Park, USA (Dove et al., 2011). Fruits of *Ziziphus jujuba* in one faecal sample could be due to herbivorous prey. Similar observations of berries in the gut contents of other pythons have been reported by Wall (1912) and Pope (1961). The incidence of pythons killed by golden jackals, striped hyenas and Indian porcupines are likely due to the use of same burrows (Bhupathy & Ramesh, 2010). Hyena predation on African pythons has previously been reported by Minton & Minton (1973). Further studies are required to understand the dynamics of predator-prey interactions by different size classes of pythons in KNP and elsewhere in its distribution range.

ACKNOWLEDGEMENTS

This paper is an outcome of research project 20-28/2005/WL sponsored by the Ministry of Environment and Forests, Government of India. We record our heartfelt thanks to the Principal Chief Conservator of Forests and Chief Wildlife Warden, Rajasthan and Directors of KNP (Sunayan Sharma, Rajesh Gupta, & Anoop, K R) for their permission and logistic support in the field. Comments and suggestions by Aaron M. Bauer helped us improving the quality of this paper. S. Babu of SACON helped us in preparing the map of the study area and Randhir Singh assisted us in the fieldwork. We also thank the Regional Director, ZSI (Northern Regional Centre), Dehra Dun, and Director and B Nagarajan and A Mayavel at IFGTB, Coimbatore for their support and help with respect to species identification of mammals. We are grateful to the Director, SACON for helping us at various levels. Suggestions and comments by two anonymous reviewers helped to improve the manuscript.

REFERENCES

Aldridge, R.D. & Brown, W.S. (1995). Male reproductive cycle, age at maturity, and cost of reproduction in the timber rattlesnake (*Crotalus horridus*). *Journal of Herpetology* 29, 399–407.

Ali, S. & Vijayan, V.S. (1986). *Keoladeo National Park* Ecological Study Summary

Report 1980–85. Bombay Natural History and Society, Bombay.

Bahuguna, A. & Mukherjee, S.K. (2000). Use of SEM to recognize Tibetan antelope (Chiru) hair and blending in wool products. *Science and Justice* 40, 177–182.

Bahuguna, A., Sahajpal, V., Goyal, S.P., Mukherjee, S.K. & Thakur, V. (2010). *Species identification from Guard Hair of Selected Indian Mammals: A Reference Guide*. Wildlife Institute of India, Dehradun, India.

Bhatt, K. & Choudhury, B.C. (1993). The diel activity pattern of Indian python (*Python molurus molurus* Linn.) at Keoladeo National Park, Bharaptur, Rajasthan. *Journal of the Bombay Natural History Society* 90, 394–403.

Bhupathy, S. & Ramesh, C. (2010). *Ecology of the endangered Indian Rock Python (Python molurus) in Keoladeo National Park, Bharatpur, Rajasthan, India*. Final Technical Report Submitted to Ministry of Environment and Forests, Government of India, New Delhi.

Bhupathy, S. & Vijayan, V.S. (1989). Status, distribution and general ecology of the Indian python (*Python molurus molurus*) in Keoladeo National Park, Bharatpur, Rajasthan. *Journal of the Bombay Natural History Society* 86, 381–387.

Brunner, H. & Corman, B.J. (1974). *The Identification of Mammalian Hair*. Shanghai Printing Press Ltd., Hong Kong.

Bury, R.B. (2006). Natural history, field ecology, conservation biology and wildlife management: Time to connect the dots. *Herpetological Conservation and Biology* 1, 56–61.

Daniel, J.C. (2002). *The Book of Indian Reptiles and Amphibians*. Bombay Natural History Soc. Oxford Univ. Press, Mumbai, India. 238pp.

De, J.K., Chakraborty, S. & Chakraborty, R. (1998). Identification of dorsal guard hairs of five Indian species of Mongoose-*Herpestes illiger* (Mammalia: Carnivora) *Mammalia*. 62, 285–295.

Delany, M.P. & Abercrombie, C.L. (1986). American alligator food habits in Northcentral Florida. *Journal of Wildlife Management* 50, 348–353.

Dove, C.J., Snow, R.W., Rochford, M.R. & Mazzotti, F.J. (2011). Birds consumed by the Invasive Burmese Python (*Python molurus bivittatus*) in Everglades National Park, Florida, USA. *Wilson Journal of Ornithology* 123, 126–131.

Dove, C.J., Reed, R.N. & Snow, R.W. (2012). Consumption of bird eggs by invasive Burmese pythons in Florida. *IRCF Reptiles & Amphibians* 19, 64–66.

Fitzgerald, L.A. (1989). An evaluation of stomach-flushing techniques for crocodilians. *Journal of Herpetology* 23, 170–172.

Harlow, P. & Grigg, G. (1984). Shivering thermogenesis in a brooding diamond python *Python spilotes spilotes*. *Copeia* 1984, 959–965.

Henderson, R.W. & Powell, R. (2007). *The biology of boas and pythons*: a retrospective look to the future. Henderson, R. and Powell, W.R. (Eds). Eagle Mountain, UT: Eagle Mountain Publishing. LC. 436pp.

Holycross, A.T. & Mackessy, S.P. (2002). Variation in the diet of *Sistrurus catenatus* (Massasauga), with emphasis on *S. c. edwardsii* (Desert Massasauga). *Journal of Herpetology* 36, 454–464.

Jacobs, H.J., Auliya, M. & Bohme, W. (2009). Zur taxonomie des dunklen tiger pythons, *Python molurus bivittatus* Kuhl, 1820, speziell der population von Sulawesi. *Sauria* 31, 5–16.

Krishnan, S., Bhupathy, S. & Devi Prasad, K.V. (2009). Monitoring of *Python molurus molurus* in Keoladeo National Park. Bharatpur, Rajasthan. *Hamadryad* 34, 28–33.

Lind, A.J. & Welsh Jr., H.H. (1994). Ontogenetic changes in foraging behaviour and habitat use by the Oregon garter snake, *Thamnophis atratus hydrophilus*. *Animal Behaviour* 48, 1261–1273.

Lobo, A.S., Vasudevan, K. & Pandav, B. (2005). Trophic Ecology of *Lapemis curtus* (Hydrophiinae) along the Western Coast of India. *Copeia* 2005, 636–640.

Madsen, T. & Shine, R. (1993). Costs of reproduction in a

population of European adders. *Oecologia* 94, 488–495.

Madsen, T. & Shine, R. (2000). Energy versus risk: costs of reproduction in free-ranging pythons in tropical Australia. *Austral Ecology* 25, 670–675.

McCallum, M.L. & McCallum, J.L. (2006). Publication trends of natural history and field studies in herpetology. *Herpetological Conservation and Biology* 1, 62–67.

Minton, S.A. & Minton, M.R. (1973). *Giant Reptiles*. Charles Scribner's Sons, New York.

Pope, C.H. (1961). *The Giant Snakes*. Alfred A. Knopf, New York.

Prasad, V.P., Mason, D., Marburger, J.E. & Ajith Kumar, C.R. (1996). *Illustrated Flora of Keoladeo National Park, Bharatpur, Rajasthan*. Bombay Natural History Society, Mumbai.

Ramesh, C. & Bhupathy, S. (2010). Breeding biology of *Python molurus molurus* in Keoladeo National Park, Bharatpur, India. *Herpetological Journal* 20, 157–163.

Reed, R.N. & Rodda, G.H. (2009). *Giant constrictors: biological and management profiles and an establishment risk assessment for nine large species of pythons, anacondas, and the boa constrictor*: Open-File Report 2009–1202. U.S. Geological Survey, USA.

Reinert, H.K. (1993). Habitat selection in snakes. In *Snakes: Ecology and Behavior*. Seigel, R.A. & Collins, J.T. (Eds). McGraw-Hill, New York.

Rivas, J.A., Molina, C.R. & Avila, T.M. (1996). A non-flushing stomach wash technique for large lizards. *Herpetological Review* 27**,** 72–73.

Shine, R. (1994). *The biology and management of the Diamond Python (Morelia spilota spilota) and Carpet Python (M. s. variegata) in NSW*. NSW National Parks and Wildlife Service New South Wales.

Shine, R. & Madsen, T. (1996). Is thermoregulation unimportant for most reptiles? An example using water pythons (*Liascus fuscus*) in tropical Australia. *Physiological and Biochemical Zoology* 69, 252–269.

Shine, R. & Madsen, T. (1997). Prey abundance and predator reproduction: rats and pythons on a tropical Australian floodplain. *Ecology* 78, 1078–1086.

Shine, R., Harlow, H.R., Keogh, J.S. & Boeadi (1998). The influence of sex body size on food habits of a giant tropical snake, *Python reticulatus*. *Functional Ecology* 12**,** 248–258.

Shine, R., Phillips, B., Waye, H. & Mason, R.T. (2003). Behavioral shifts associated with reproduction in garter snakes. *Behavioural Ecology* 14, 251–256.

Slip, D.J. & Shine, R. (1988a). Feeding habits of the diamond python, *Morelia s. spilota* ambush predation by a boid snake. *Journal of Herpetology* 22, 232–330.

Slip, D.J. & Shine, R. (1988b). Reptilian endothermy: a field study of thermoregulation by brooding diamond pythons. *Journal of Zoology, London* 216**,** 367–378.

Smith, M.A. (1943). *The Fauna of British India: Reptilia and Amphibia, including the whole of the Indo-Chinese region. Vol. III. Serpentes*. Taylor and Francis, London. 583pp.

Snow, R.W., Brien, M.L., Cherkiss, M.S., Wilkins, L., & Mazzotti, F.J., (2007). Dietary habits of Burmese Python, *Python molurus bivittatus*, from Everglades National Park, Florida. *Herpetological Bulletin* 101, 5–7.

Sylber, C.K. (1988). Feeding habits of the lizard *Sauromalus varius* and *S. hipidus* in the Gulf of California. *Journal of Herpetology* 22**,** 413–424.

Tuttle, K.N. & Gregory, P.T. (2009). Food habits of the Plains Garter Snake (*Thamnophis radix*) at the northern limit of its range. *Journal of Herpetology* 43, 65–73.

Vijayan, V.S. (1991). *Keoladeo National Park Ecology Study. Final Report (1980–1990)*. Bombay Natural History Society, Bombay. 337pp.

Wall, F. (1912). A popular treatise on the common Indian snakes. *Journal of the Bombay Natural History Society* 21, 447–476.

Whitaker, R. (1993). Population status of the Indian Python (*Python molurus*) on the Indian sub continent. *Herpetological Natural History* 1, 87–89.

Whitaker, R. & Captain, A. (2004). *Snakes of India. The Field Guide*. Draco Books, Chennai, India. 479pp.

Wildman, A.B. (1954). *The microscopy of Animal Textile Fibers*. Wool Industries Research Association, Leeds.

Accepted: 20 September 2013