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**Ecology of the Endangered Indian Rock Python
(*Python molurus*) in Keoladeo National Park, Bharatpur, Rajasthan, India**

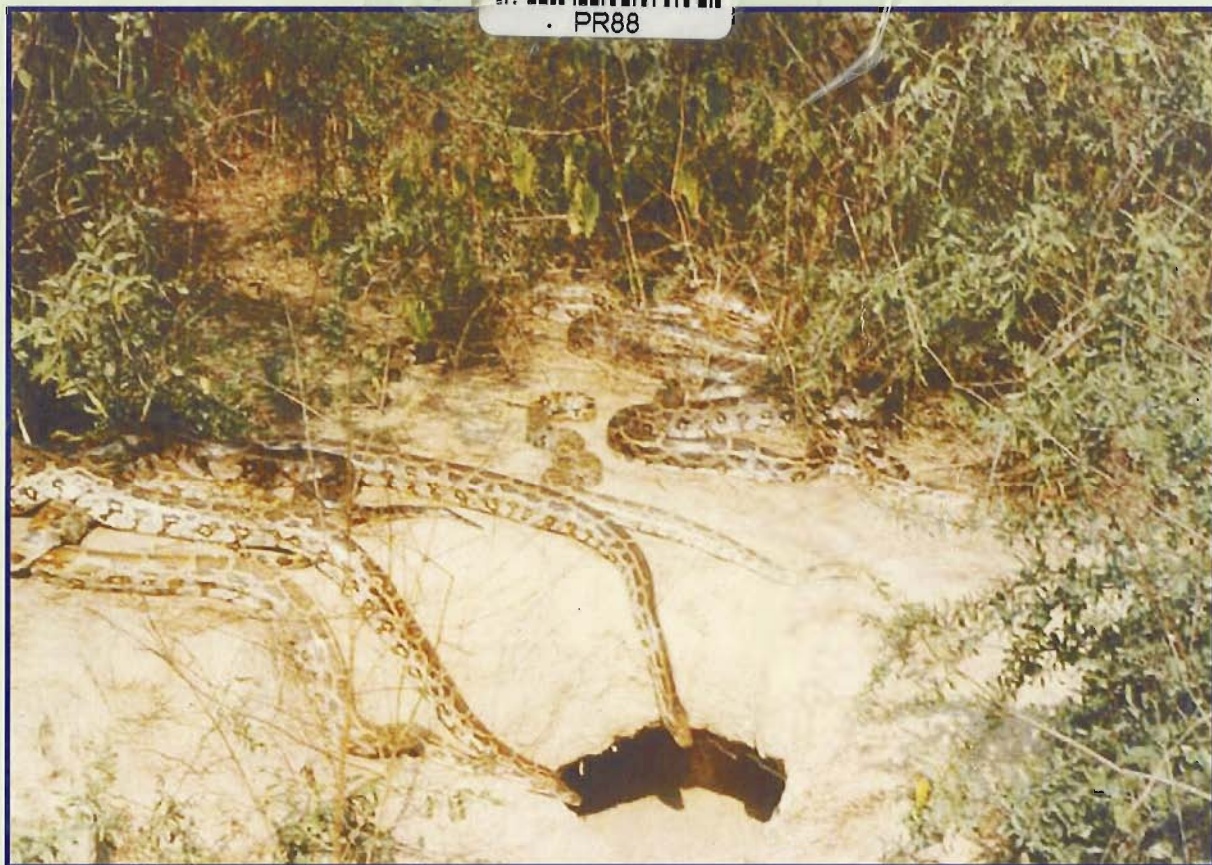
Final Technical Report

Submitted to the Ministry of Environment and Forests, Government of India

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**Dr. S. Bhupathy, Principal Investigator
Mr. C. Ramesh, Senior Research Fellow**



**Sálim Ali Centre for Ornithology and Natural History
Anaikatti (Post), Coimbatore- 641 108**

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PART – II

ABSTRACT

Ecology of the Indian Python (*Python molurus molurus* Linn. 1758) was studied in Keoladeo National Park (KNP), Bharatpur, Rajasthan from October 2007 to April 2010. Major objectives were to (1) Study the population trend in Python in KNP comparing results from earlier studies (2) Gather data on aspects of ecology of Pythons such as basking, burrow fidelity and ranging, food, associate species in the burrow and breeding biology (3) Assess the impact of tourists on the activity of Pythons, and (4) Propose conservation plan for Pythons found in the drier zones, particularly for KNP, Bharatpur.

Distribution of Python burrows: Surveys were done on foot covering the entire Park every year during November to map the distribution of ground burrows. Burrows with signs such as tracks, sloughs and snakes were considered as Python burrows. In all, 50 ground burrows were used by Pythons during 2007-2010. Among them, 19 were used during only one year, 11 during two years and 20 burrows during all the three years studied.

Python Population: In KNP, Pythons thermoregulate during the winter by basking diurnally. Python burrows were visited fortnightly and number of snakes observed at each burrow was recorded. The sum of maximum snakes observed in Python burrows during 2007-2008 to 2009-2010 ranged between 47 and 119. In all, 119 snakes could be identified based on natural markings. A simple Mark-Recapture procedure (Lincoln Index) yielded 116 to 183 snakes. This study highlighted the problems in estimating the population of free ranging snakes. Studies during 1986-1987 and 1999-2000 reported the occurrence of 111 and 119 snakes in KNP.

Mortality: Eighteen snakes were found dead during this investigation. No post-mortem was done to know the reasons for death. Jackals and Hyenas killed three snakes (17%) each and two dead snakes had Porcupine quills injected into the body. Three juvenile Pythons (17%) died due to vehicular traffic on the National Highway (NH 11) near the Park during August 2009.

Size Structure: The smallest Python measured about 60 cm and the largest about 510cm in length (snout to tail tip). Overall, the population of Pythons in this Park showed a bimodal pattern with respect to size, with greater proportion of snakes at <1.5m (33%) and 2.7-3.9 m.

Habitat: Most of the Python burrows were located on slightly elevated areas of the Park with saline soils. In all, 39 species of plants including 13 trees, 14 shrubs and 12 herbs (excluding grass) were observed in 38 (10X10 m) plots examined. Rapid regeneration of *Prosopis juliflora* was observed in the subsequent year of eradication programme initiated by the Rajasthan Forest Department. It appears that continuous removal and monitoring is required to control *P. juliflora*. Thick canopy in the habitat of reptiles such as large bodied snakes would seriously affect their thermal profile.

Burrow Climate: A thermistor probe of a digital thermometer (EUROLAB, 288 ATH, accuracy $\pm 1^{\circ}\text{C}$) was used to record the burrow and ambient temperatures every 15 minutes from 0600 hrs to 1800 hrs every month. The highest (daily) mean ambient temperature (37.4°C) was recorded during May and lowest (19.97°C) during December. In burrows, the highest of 30.5°C and lowest of 17.3°C was recorded during August and January respectively. Burrows had a narrow range of temperature (variation: $0.65\text{-}5.13^{\circ}\text{C}$) compared to the ambient temperature (variation: $8.57\text{-}38.47^{\circ}\text{C}$).

Activity Pattern: Number of Pythons found outside the burrows was considered as a proxy for activity index. Snakes were highly active during January and February and low or no activity was observed during June to October. The highest activity of Pythons was recorded during 1200 – 1400 hrs in winter and spring. During summer, snakes were relatively active during early morning and evening hours (crepuscular). The activity of various size classes of Python was significantly different among seasons ($F= 5.399$, $df = 2, 6$; $p < 0.001$). Activity map of 29 identified snakes showed that only a few snakes were active continuously all through the winter. Most of the Pythons emerged out from burrows around 12.15 hrs and retreated around 13.30 hrs during January, February and March.

Ranging: Sighting and re-sighting locations of individually identified snakes were marked using a Global Position System (GPS), and straight-line distance between two far most locations were considered to know the ranging. Re-sightings of 47 snakes showed that

Pythons moved an average of 770.38 ± 880.73 m (range 0-3727.09 m). Most of the snakes (44.5%, n=47) were using the area within 500 m from the burrows and another 25.5% were ranging between 500 and 1000m.

Food Habits: In all, 1680 track plots (size 100m radius keeping burrow at the centre; 35 plots X 48 surveys) were examined. A total of 7285 tracks and signs belonging to 23 taxa of vertebrates were observed. In all, 91 feeding (47 scats, 44 direct) observations were obtained during this study. Feeding of Pythons was restricted to March - November; the highest (54.5%, n=44) during October followed by November (20.5%) and no feeding was observed during winter (December- February). Twelve species of reptiles, birds and mammals were consumed by Pythons and the Spotted Deer *Axis axis* formed the highest (42.55%, n=47) followed by birds (19.15%). Other food species included Striped Hyena *Hyaena hyaena*, Sambar *Cervus unicolor* and Indian Porcupine *Hystrix indica*.

Breeding Biology: Data on the breeding of Pythons were collected opportunistically. Two nests were monitored from May (egg lay) to August (hatching) during 2008. Irrespective of high variations in diurnal temperatures, a narrow range (31.1 - 33.9°C) of body temperatures was maintained by Pythons throughout the incubation period (72 days). Hatching success of this species was 95% for nests monitored. Mean SVL, TL and mass of 13 hatchlings was 531.53 ± 37.64 mm, 82.3 ± 6.32 mm and 111.15 ± 9.16 g respectively.

Associate Species: During the present study, 33 burrows were monitored fortnightly for recording signs of associate species. In addition, night observations and camera traps were also used. In all, signs and tracks of 16 species were found near the openings of the burrows monitored. The Indian Porcupines were observed in all (33) burrows occupied by Pythons. Other associate species included Jackal, Striped Hyena, Micro-chiropteran Bats and Monitor Lizard.

Impact of Disturbance: Response of snakes to the sudden appearance of human, animals and motor vehicles were recorded. The present study revealed that the disturbed snakes emerged from the burrows more frequently for basking compared to the undisturbed ones. Mean basking duration of the undisturbed and disturbed snakes was 68.48 ± 67.98 minutes and 37.61 ± 34.92 minutes respectively.

Suggestions for Conservation:

We provide the following suggestions for the conservation of Pythons in KNP and elsewhere in the semi arid regions of the country.

- It is suggested that the assessment of Python population could be done every year from 2nd fortnight of January to 2nd fortnight of February in KNP and in other North Indian states as snakes come out from the ground burrows in large numbers for basking. Institutions such as the Salim Ali Centre for Ornithology and Natural History (SACON), Coimbatore and Wildlife Institute of India, Dehra Dun would provide required training to the field personnel of the Forest Department.
- Greater germination, sprouting and growth of *Prosopis juliflora* was observed subsequent to the removal/control of this weed in the Park. *Prosopis* eradication programme should be pursued vigorously during monsoon removing the seedling and uprooting the saplings for many years to yield desired results. However, *Prosopis* control activities should be abandoned between November and April as many snakes emerge out from burrows for basking during these months.
- Sporadic hunting of Porcupine *Hystrix indica* exists in the Park, and increased patrolling in Python areas during monsoon would reduce this problem.
- It is felt that the wetland area has become shallow compared to that of early 1980s. Water holding capacity of the wetlands of KNP needs to be studied.
- Signage along the National Highway 11 nearby the Park with respect to reduction of speed of vehicles and animal crossing the road would help reducing the mortality of Pythons caused by vehicular traffic.
- It was generally thought that incubating female Pythons would stay with eggs till hatching. However, the present study revealed that incubating snakes naturally leave the nest about two weeks prior to hatching. In Zoological gardens (Zoos)/ Captive Breeding Centres (CBC) it is believed that snakes abandon the nest due to reasons such as starvation. It is reported that after abandonment of nests, the officials shift the eggs to incubator. This could be one of the reasons for the poor hatching success of the species in captivity (i.e. <50%). It is suggested that if abandonment of nests are found, the same should be left without disturbing, but care must be given to protect the nest from predators.

- In case of captive breeding programmes of Pythons at Zoos/ CBC, the nest temperature should be maintained at 31.1 - 33.9°C, moderate humidity (40-60%), and good aeration at least the later part of the incubation (i.e. after 55 days).
- A large number of tourists visit the Python areas in KNP. Rotation of burrows for opening up to tourists should also be worked considering the conservation of species and interest of the visitors.

Several aspects of Python ecology need to be investigated. In-depth study on the activity and ranging pattern of Pythons should be studied using temperature sensitive radio-telemetry. Earthen burrows are complex structures and interactions of Pythons with its cohabiting species in the burrows need to be studied. Habitat changes in the Park subsequent to the removal/ control measures of *P. juliflora* need to be monitored.