

Food habits of Tiger *Panthera tigris* and its Co-predator in Sathyamangalam Forest Division, Tamilnadu, Southern India.

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Abstract

The present study on food habits of tiger (*Panthera tigris*) and its co-predator in Sathyamangalam forest division showed that tigers, leopards and dhole were largely preyed upon ungulates in the study area. Chital and Sambar were the high assemblage ungulates and also they were the most preferred prey for all the three carnivores. The present study also showed that tiger, leopard and dhole could co-exist in the same habitat, and there were diet overlap and competition among three predators for the prey preferred species in the Sathyamangalam forest division. Among the two prey species chital was the most preferred preys. Nevertheless the size and weight of the prey play a vital role on the prey preference by the carnivores, which depend on their body size. The tiger kill data also showed that there was more number of sambar killed by tiger followed by gaur and chital. Larger size of sambar and gaur than chital or tiger made easy to locate the carcass, and the predator ate the entire carcass on the same day itself. The present study also clearly shows that there is reasonable number of all the three carnivores found in the forest division.

Key words: co-predator, Food habits, *Panthera tigris*, Sathyamangalam

INTRODUCTION

Carnivores play a vital role in the forest ecosystem to maintain the herbivore population and homeostasis of the ecosystem for its sustainability. The tiger, *Panthera tigris*, is the obligate terrestrial carnivore among all the mammalian assemblages where it occurs (Seidensticker, et al., 1999). Being an umbrella species, its effective conservation enhances survival prospects of other forms of biodiversity (Karanth, 2003). Past studies on tigers (Sunquist, 2000; Karanth et al., 2004) and co-predator, such as the leopard (*Panthera pardus*), dhole (*Cuon alpinus*) and striped hyena (*Hyaena hyaena*) indicate that they play a major role in shaping prey communities (Karanth et al., 2004). The above three predators are specialized killers of large ungulate prey species such as cervids, bovids and suids (Johnsingh, 1992 and Arivazhagan et al, 2007) except striped hyena which is a scavenger. Therefore, scientific data on their food habits and resource partitioning are vital for scientific understanding as well as for setting conservation strategies. A widely used field technique for understanding predator diets is the identification of recognizable parts of prey species that have passed through their digestive system and comparison with reference collections of potential food items (Putman, 1984). Carnivore scats can provide a snapshot of the types of prey consumed and have an advantage over other techniques such as examination of gut content or direct observation of feeding because of the relative ease of obtaining samples and the non-invasive nature of the sampling procedure. Further, advanced analytical

methods (Trites and Joy, 2005) can also be applied to such scat data to obtain accurate prey profiles.

Till 1990s there were no direct or indirect evidence on the presence of tigers in the Sathyamangalam forest division. In the recent days, sightings of tigers as well as encountering them and such indirect evidences have considerably increased across the division. Recently, Tamilvanan (2009) reported a maximum of nine different individuals persist in the Sathyamangalam wildlife sanctuary and reserve forest areas based on pug mark variable analysis. Ramakrishnan and Kumaraguru (2010) found that 69 positive scats of fifteen individual tigers based on DNA finger printing in Sathyamangalam Wildlife Sanctuary and territorial forest division, out of 103 scats collected. Arivazhagan (1997) studied the presence of co-predator in the part of the Sathyamangalam forest division, and reported the food habits of carnivores such as leopard (*Panthera pardus*), Asiatic Wild Dog (*Cuon alpinus*) and Striped Hyaena (*Hyaena hyaena*). Evolving strategies for conservation, maintenance and sustenance of tiger and co-predators and keeping up these measures in the Sathyamangalam forest division and Wildlife Sanctuary assumes greater significance and to suggest management recommendations to conserve the large carnivores.

MATERIALS AND METHODS

Study Area

Sathyamangalam forest division encompasses large contiguous reserve forests extending over 1455 sq km with diversity of vegetation types from tropical dry thorn forest to semi evergreen and also a riparian forest along the Moyar River. The southern portion of the division

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covering an area of 524.34 sq m has been declared as Sathyamangalam Wildlife Sanctuary (SWS), southern India, vide G.O MS No.122 dated 3.11.08 under sec 26 A of the Wildlife (Protection) Act, 1972. SWS is located between the latitudes 11° 29' 15" to 11° 48' 41" and longitude 76° 50' to 77° 27' 22". The topography is undulating with chain of hillocks and the altitude ranges from 350m to 1469 m above mean sea level.

Field sampling of carnivores scats

The diet of large carnivores were studied using scat analysis. Tigers, leopards and dholes prefer to use forest roads as travel routes along which they deposit scats as a social communication mechanism (Smith *et al.*, 1989). Training was given to the author and one assistant for the identification of scats of predator species, while walking in teams of two persons, and to sample a network of forest roads to collect predator scats according to the following sampling scheme.

Identification of predator species from scats

Scats of tigers and leopards are much larger and deposited on the grassy strips at the center or edges of the forest roads. On the other hand, the group-living dholes deposit their smaller scats in clusters on the bare soil along the wheel track, making them easily distinguishable from felid scats (Fig. 1) following the methods described by Arivazhagan *et al.* (2007). Tiger and leopard scats were distinguished from each other using supplementary evidences such as the differences in quantity, typical diameter ranges, presence of ancillary signs like tracks and by avoiding collection of scats of indeterminate origin as described in earlier surveys (Johnsingh, 1992; Karanth and Sunquist, 1995). On the other hand Hyenas are scavenger in nature, and they mostly eat the carcass left over by other carnivores. They also hunt at times when carcass is not available, and generally they go for small prey like chital, fawn and black napped hare. Since they mostly eat left over bone, the scat will be white in colour and ball shape, and easily differentiated from other predator scats.

Collection and treatment of scats

After identification, a portion of the scat containing adequate amount of prey remains such as hair and other undigested body parts were stored in an airtight plastic bag. These scats were subsequently washed in flowing water through a fine (<1mm) nylon sieve (Cunningham *et al.*, 1999). The sieved prey remains, grass and soil are sun dried in thin paper bags for 3 days to avoid fungal growth. The dried scat samples were labeled and stored in airtight bags.

Identification of prey species from scats

The hair of prey species, which passes out undigested through the gut of predators, was the primary source of

information for identifying the prey consumed (Karanth and Sunquist, 1995). Prey species were identified based on macroscopic and microscopic features of the hair in comparison with reference collections at the Care Earth Field station Bhavanisagar. The identification was based on the general appearance of the hair, colour, relative length, relative width, texture, basal configuration, cortex pigmentation, medullary width and patterns as described by earlier workers (Putman, 1984; Karanth and Sunquist, 1995 and Arivazhagan *et al.* 2007).

Mapping of large carnivores distributions

Distribution of large carnivores was recorded using GPS (Global Position System) during the survey. Whenever encounter the scats and signs of large carnivores the geo-coordinates were recorded. Using these geo-coordinates large carnivores' distribution map was prepared by GIS Computer Software Map Info Professional 10.0.

Prey Kill

Prey kill was identified by inspecting the carcasses using clues such as decomposition status, odour, prey alarm calls and predator signs. The predators were not often seen at kills, and their identity was established from indirect evidences of predator track, scat, etc. The prey killed by predator was identified using the key characters described by Karanth and Sunquist (2000) and Johnsingh, (1983).

RESULTS

Prey preference by tiger and co-predators

Totally 220 scat samples were analysed of which 46 scats from tiger, 121 scats from leopard and 43 scats from dhole. Prey remains were identified from all the scats, the ungulates were the preferred species of all the three carnivores in the study area. Among the ungulates, the chital was the most common or preferred prey of tiger, leopard and dhole, which represented 41.3%, 57% and 63.3% respectively across the study area. Among the large carnivores leopards preferred varieties of prey (n=10) followed by tiger (n=7) and dhole (n=5). Sambar constituted second major prey of tiger leopard and dhole, which represented 28.3%, 23.1% and 17% respectively. The prey preference of large carnivores is given in table 1 to 3 and shown in figure.4-6.

Scat Density

Density of scat of all the three predators was calculated across the forest range (the Number of scat encountered was divided by total number of kilometer walked). Among the scats encountered tiger scat was more in the Bhawanisagar forest range (0.033/km) followed by Sathyamangalam and Hassanur ranges. Other two ranges such as Thalavadi and T.N.Palayam showed comparatively less number of tiger scats. Leopard scat

was encountered more in T.N. Palayam (0.036/km) forest range than Thalavadi (0.028/km), Hassanur (0.026/km), Bhawanisagar (0.033/km) and Sathyamangalam (0.024/km). Dhole scat was encountered more in T.N. Palayam (0.027/km) than other ranges, wherein they were uniformly distributed (Table.4).

Encounter rate of prey species

Prey abundance was estimated from the encounter rate of prey during the trail walk in all the forest habitats. There were about 9 species of prey encountered of which chital (2.4/km) was more than sambar (0.79/km), gaur (1.36/km), blackbuck (0.34/km), barking deer (0.23/km), mouse deer (0.11/km), wild boar (1.93/km) and bonnet macaque (1.47/km). The relative density of prey is shown in the figure.7

Examinations of Kill

There were about 24 fresh kills identified by careful examination of the drag-mark, blood trail, pug mark and disturbed vegetation. Among the 24 kills, kills by tiger, leopard and dhole were n=9, n=11 and n=4 respectively. Tiger killed sambar (25%) more than gaur (8.3%) and chital (4.2%). In the case of leopard, chital (16.7%) kill was more than sambar (.3%), gaur (8.3%), porcupine (4.2%), mouse deer (4.2%) and blacknaped hare (4.2%). In the case of dhole, chital (12.5%) was killed more than sambar (4.2%) (Fig.8 and 9).

Distribution of large carnivores

Distribution of large carnivores was mapped using indirect evidence of predator sign like pug mark and scats. The distribution of tiger showed that among the five ranges Bhawanisagar range had high distribution followed by Sathyamangalam, T.N. Palayam, Hassanur and Thalavadi forest ranges. In the case of leopards, it was uniformly distributed across the forest ranges. Interestingly, though dhole was distributed across the forest ranges in the division, it showed less presence in Bhawanisagar range which could be due to high presence of tiger in the particular forest range (Figure 2 and 3).

DISCUSSION

The major prey species of tiger in the study area was chital (41.3%) followed by Sambar (28.3%) and this might perhaps be due to higher assemblages of chital population in the study area. In the present study it was found that the number of chital encounter was more during the survey followed by other prey species recorded in the study area. There was relatively high number of tiger scats collected from the Bhawanisagar forest range that is characterized by vast area of plains where large assemblages of chital was found and that could be one of the reasons for the tigers preyed upon

more chital than sambar. Joseph *et al* (2007) found that the chital remains were found more in the tiger scat (30.09%) than Sambar (26.21%) in Parambikulam Wildlife Sanctuary. The results of the present study are also similar to that of Parambikulam study. Tiger, especially the tigress, feeds on cubs more often during the breeding season and hence the easy prey available was the chital, and that could be the reason for the presence of more remains of chital. On the other hand Andheria *et al.* (2007) reported that sambar was the most preferred prey of tiger in Bandipur National Park. But Karanth and Sunquest (1995) suggested that when medium sized prey such as chital or hog deer and porcupine were abundant, the tigers switched over to medium sized prey that resulted in competition between tiger and leopard and the density of leopard declined. The present study also showed that the presence of tiger was more in the lower region where leopard presence was low. Leopard has been distributed more on the hilly area where tiger presence was less. Though tiger and leopard co-existed competition among the carnivores was also noticed. Andheria *et al* (2007) suggested that tigers co-exist with other predatory carnivores such as leopards and dholes. The densities of different predator species with in such guilds appear to be greatly influenced by the relative abundance of different size classes of prey species in the assemblage (Karanth and Sunquist, 1995; Karanth and Sunquist, 2000; Karanth *et al.*, 2004). In the case of leopard major wild prey was chital, which constituted 57% of the diet of leopards in the study area followed by sambar (23.1%). Arivazhagan *et al* (2007) also found that chital (55.9%) was the major prey of leopard in tropical thorn forest. According to the report of Bailey (1993) in Africa, ungulates were the main prey species of leopard. The finding of the present study was also in accordance with this as ungulates constituted a major portion of leopard's diet in the study area. Schaller (1972) found that the prey of leopard was mostly in the 20-70 kg class. Ramakrishnan *et al* (1999) stated that leopards were opportunists and are very flexible in their diet, and could thus survive in a region where the ungulate densities are low. Their ability to feed on both small and large prey, and to climb trees and scavenge (Johnsingh, 1983) could help them survive in highly disturbed habitat where preys are scare. However, Sedinsticker *et al.* (1990) found that 36% of the leopard's prey in Chitwan was less than 25kg. In the present study it was found that arboreal prey comprised of (6%) in the leopard diet. This might perhaps be due to the tree climbing ability of the leopard, as reported by Sankhla (1977). Sathyakumar (1988) also observed Nilgiri langurs and bonnet macaques' remains in the food contents of leopards at the Mundanturai plateau and stated that leopards proved to be efficient in hunting primates for food. On the other hand Seidensticker (1983) stated that when prey base was abundant then the

Table.1. Frequency occurrence of prey remains found in the tiger scat during the study period

S.No	Name of the Prey	No. of Scats	Percent of Occurrence prey
1	Chital	19	41.3
2	Sambar	13	28.3
3	Gaur	6	13.0
4	Blackbuck	1	2.2
5	Wildboar	3	6.5
6	Livestock	1	2.2
7	Unidentified	3	6.5

Table.2. Frequency occurrence of prey remains found in the leopard scat during the study period

S.No	Name of the Prey	No. of Scats	Percent of Occurrence prey
1	Chital	69	57.0
2	Sambar	28	23.1
3	Gaur	1	0.8
4	Blackbuck	1	0.8
5	Barkingdeer	2	1.7
6	Blacknaped Hare	2	1.7
7	Common Langur	7	5.8
8	Wildboar	3	2.5
9	Livestock	3	2.5
10	Unidentified	5	4.1

Table.3. Frequency occurrence of prey remains found in the dholes scat during the study period

S.No	Name of the Prey	No. of Scat	Percent of Occurrence prey
1	Chital	33	62.3
2	Sambar	9	17.0
3	Barking Deer	1	1.9
4	Blacknaped Hare	3	5.7
5	Unidentified	7	13.2

Table 4. Density of scat (all three predators) calculated across the forest ranges of the study area during the study period

Name of the Forest Range	Scat density/km		
	Tiger	Leopard	Dhole
Sathyamangalam	0.007	0.024	0.009
Bhawanisagar	0.033	0.025	0.006
Hassanur	0.006	0.026	0.009
Thalavadi	0.003	0.028	0.009
T.N.Palayam	0.003	0.036	0.027

Figure 1. Scat of Large carnivores (a). Tiger (b) Leopard (c) Dhole



(a)



(b)



(c)

Figure 2. Distribution of tigers in the study area of Sathyamangalam forest division

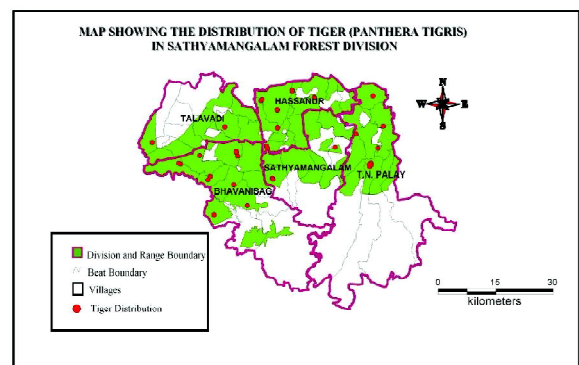


Figure 3. Distribution of Dhole in the study area of Sathyamangalam forest division

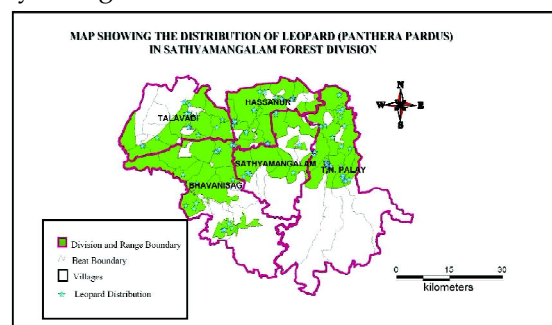


Fig.4. Diet composition of tigers in the study area during the study period

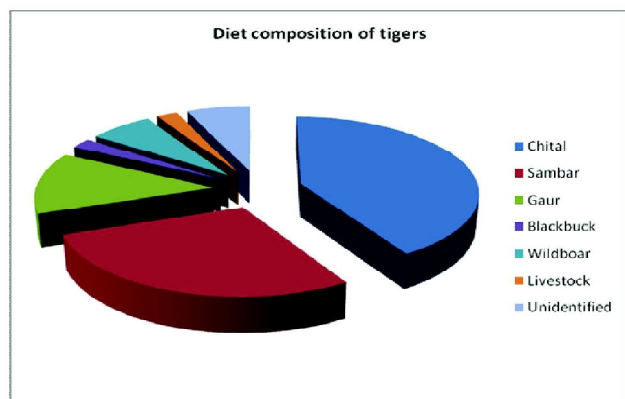


Fig.5. Diet composition of leopards in the study area during the study period

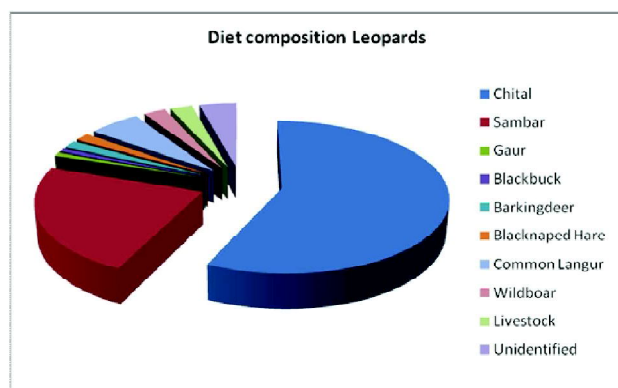
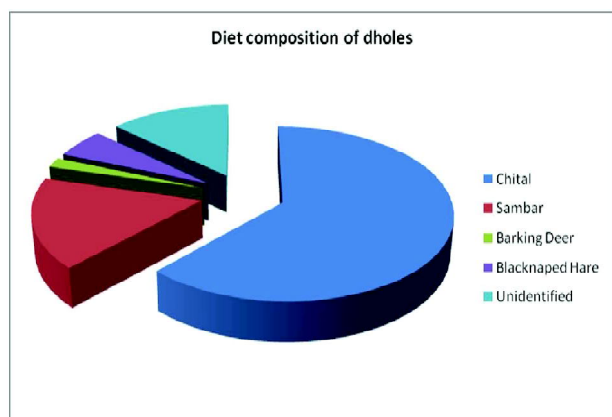


Fig.6. Diet composition of Dholes in the study area during the study period



leopard would take the macaques and langurs occasionally.

Unlike leopard and tiger, dholes were highly social canids such as African hunting dogs, wolves in Africa. The results of the present study also showed that food preference of dhole in the study area was chital (62.3%) followed by sambar (17%). Earlier studies suggest that chital was the most preferred prey for dhole in most part

Fig.7. Density of scat (all three predators) calculated across the forest ranges of the study area during the study period

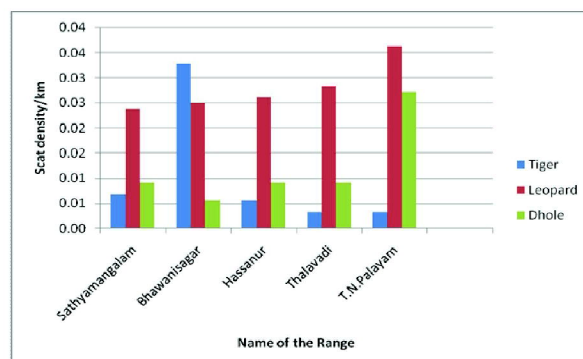


Fig.8. Encounter rate (per km) of prey species observed during the study period in the study area

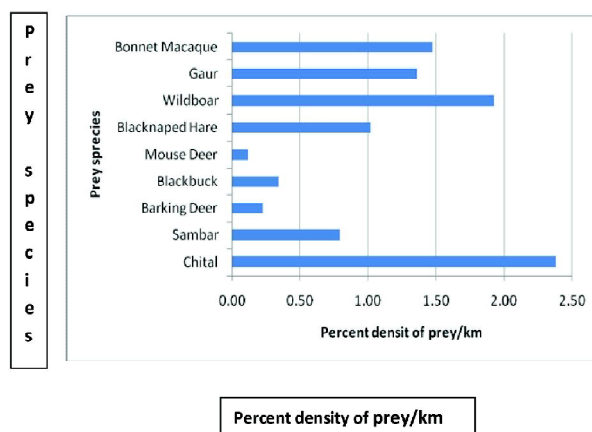
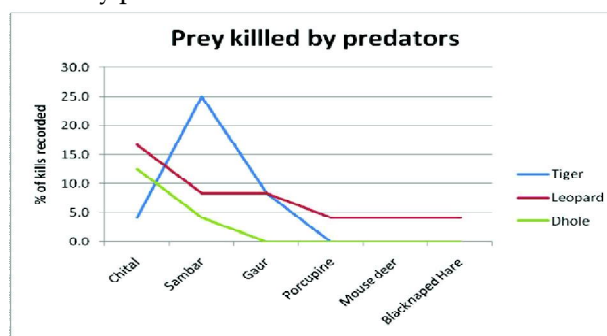


Fig.9. Different prey killed by large carnivores during the study period



of the country. Venkataraman *et al.* (1995) found that chital (70.4% and 41%) was the most common prey species of dhole in the Mudumalai Wildlife Sanctuary. The result of the present study is also in accordance with that finding. Similarly Arivazhagan *et al.* (2007) found that chital (71.4% and 52.6%) was the most preferred prey of dhole in both disturbed and undisturbed habitats. Andheria *et al.* (2007) stated that dholes were dependent on medium sized prey such as

leopard would take the macaques and langurs occasionally.

Unlike leopard and tiger, dholes were highly social canids such as African hunting dogs, wolves in Africa. The results of the present study also showed that food preference of dhole in the study area was chital (62.3%) followed by sambar (17%). Earlier studies suggest that chital was the most preferred prey for dhole in most part of the country. Venkataraman *et al.* (1995) found that chital (70.4% and 41%) was the most common prey species of dhole in the Mudumalai Wildlife Sanctuary. The result of the present study is also in accordance with that finding. Similarly Arivazhagan *et al.* (2007) found that chital (71.4% and 52.6%) was the most preferred prey of dhole in both disturbed and undisturbed habitats. Andheria *et al.* (2007) stated that dholes were dependent on medium sized prey such as chital which constituted the major portion of the diet of dhole in the Bandipur National Park. Studies on the density of scat across the forest ranges showed that the presence of tiger was more in the Bhawanisagar range than other four ranges in the division, but at the same time tigers were also found distributed across the study area. According to WWF (un-published data) data on mark – recapture technique of camera trap results showed that there were about 20 individual of tiger in the Bhawanisagar range. On the other hand leopards were uniformly distributed in all the forest ranges, whereas dhole distributed more in the T.N. Palayam forest range than other four ranges in the division. The result of the scat distribution indicated the presence of tiger and leopard in the all the forest ranges, which could be positively due to prey base assemblage. Karanth and Nichols (1998) also stated that the abundance of tiger and leopard was in relation to prey community structure, and the present study also supports this view. But in the case of dhole less presence observed in the Bhawanisagar forest range which could be due to high presence of tiger in the particular range.

Management Recommendations

Long-term study on prey and predator population in the division is needed. Since the division is dominated with large stretch of human dominated area, long-term study may give better understanding of prey-predator relationship, which would be useful for managing prey-predator population in the landscape.

Anthropogenic pressure such as cattle grazing, fire wood collection, etc., should be restricted for the improvement of habitat. Continued monitoring of large carnivores and their prey is needed for the long term conservation of larger carnivores in the landscape.

Capacity building for the forest department at grass root level in order to identify the pug mark, scat and kill is needed.

Local people should also be educated by biologist and by forest department on the conservation of large carnivores in the landscape.

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REFERENCE

- Ackerman, B.B., Lindzey, F.G. and Hernker, T.P.1984. Cougar food habits in southern Utah. *J. Wildl. Mgmt.*, 48:147-155.
- Arivazhagan, C. 1997. A study on the food habits of leopard *Panthera pardus fusca* in the Sigur Reserve forest Nilgiri District and Thalamalai Reserve Forest Erode District of Tamilnadu, southern India, with special reference to Human- Leopard conflicts. M.Phil thesis submitted to Bharadhidasan University, Trichy.
- Arivazhagan, C., Arumugam, R. and Thiyagesan, K. 2007. Food habits of leopard (*Panthera pardus fusca*), dhole (*Cuon alpinus*) and striped hyena (*Hyaena hyaena*) in a tropical dry thorn forest of southern India.
- Andheria, A.P., Karanth, K.U. and Kumar, N.S. 2007. Diet and prey profiles of three sympatric large carnivores in Bandipur Tiger Reserve, India. *Journal of Zoology*, 273: 169-175.
- Bailey, T.N.1993. The African leopard. Ecology and Behaviour of a solitary felid. Columbia University Press, New York. 429 pp.
- Cunningham, S.C., Gustavson, C. and Ballard, W.B.1999. Diet selection of mountain lions in southeastern Arizona, *J. Range Mgmt.* 53: 202-207.
- Johnsingh, A.J.T.1983. Large mammalian prey-predator in Bandipur. *J. Bombay Nat. Hist. Soc.* 80:1-57.
- Johnsingh, A.J.T.1992. Prey selection in three sympatric carnivores in Bandipur. *Mammalia*, 56:517-526.
- Joseph, S., Thomas, A.P., Satheesh, R. and Sugathan, R. 2007. Foraging ecology and relative abundance of large carnivores in Parambikulam Wildlife Sanctuary, Southern India. *Journal of Zoos Print*, 22(5): 2667-2670.
- Karanth, K.U. and Sunquist, M.E.1995. Prey selection by tiger, leopard and dhole in tropical forest. *J. Anim. Ecol.*, 64(4):439-450.
- Karanth, K.U. and Nichols, J.D.1998. Estimation of Tiger Densities in India Using Photographic Captures and Recaptures. *Ecololgy*, 79 (8): 2852-2862.
- Karanth, K.U. 2003. Tiger ecology and conservation in the Indian subcontinent. *J. Bombay Nat. Hist. Soc.*, 100:169-189.
- Karanth, K.U., Nichols, J.D., Kumar, N.S., Link, W.A. & Hines, J.E. 2004. Tigers and their prey: predicting carnivore densities from prey abundance. *Proc. Nat. Acad. Sci.*, 101: 4854-4858.

- Putman, R.J.1984 . Facts from faeces. *Mammal Rev.*, 14:79-97.
- Sankhala, K. 1977. Tiger, The story of Indian Tiger, Simon and Schuster, New York. 220pp.
- Sathyakumar, S.1992. Food habits of leopard (*Panthera pardus*) on Mundanthurai plateau, Tamil Nadu, India. *Tiger paper*, Vol. XIX: 8-9.
- Seidensticker, J.C.1983. Predation by Pathera cats and measures of human influence in habitats of south Asian monkeys. *Int.J.of Prim.*,14 (3):345-349.
- Seidensticker, J., Christie, S. and Jackson, P. 1999. Overview. In Riding the tiger: tiger conservation in human-dominated landscapes: 1-3. Seidensticker, J., Christie, S. & Jackson, P. (Eds)., Cambridge University Press.
- Seidensticker, J., Sunquist, M. E. and McDougal, C. 1990. Leopards living at the edge of Royal Chitwan National Park, Nepal. Conservation in Developing Countries: Problems and Prospects (Eds. J.C. Daniel and J.S. Serrao), pp. 415-423. Bombay Natural History Society, Bombay.
- Schaller, G.B.1967. The deer and the tiger: a study of wildlife in India. Chicago: University of Chicago Press.
- Smith, J.L.D., McDougal, C. and Miquelle, D. 1989. Communication in free-ranging tigers (*Panthera tigris*). *Anim. Behav.*, 37:1-10.
- Sunquist, M.E. 1981. The social organisation of tigers (*Panthera tigris*) in Royal Chitwan National Park. Smithsonian. *Contrib. Zool.*, 336: 1-98.
- Sujai, R. 2004. Diet profile of three large sympatric carnivores in Central India. M.Sc., thesis. Bharathidasan University, Tamil Nadu, India.
- Trites, A.W. and Joy, R. 2005. Dietary analysis from fecal samples: how many scats are enough?. *J. Mammal.*, 86:704-712.
- Venkataraman, A.B., Arumugam, R. and Sukumar, R. 1995. The foraging ecology of dhole (*Cuon alpinus*) in Mudumalai Sanctuary, southern India. *J. Zool.*, 237:543-561.