PREY-PREDATOR RELATIONSHIPS WITH SPECIAL REFERENCE TO THE TIGER, PANTHER AND DHOLE COMPETITIONS IN KALAKAD-MUNDANTHURAI TIGER RESERVE (TIRUNELVELI DISTRICT - TAMIL NADU)

S. PAULRAJ*

Introduction

Tigers, positioned at the apex of food chain in the ecosystem, were a common sight five decades ago in the Mundanthurai-Kalakad area (Peploe and Webb, 1942). Presently their distribution is not only restricted to certain areas but also they have become a rare sight. Various reasons have been attributed for the overall decline of the population, and effective conservation measures were suggested to protect the species from further decline and disappearance in the "Project Tiger" areas. One of the conservation programmes is the study on the ecology of the tigers. An understanding of the prey-predator relationship is imperative while undertaking any conservation measures to save this species. Few studies and information are available on the prey species (Ramanathan, 1977; Doraisamy, 1989; Jogindranath, 1989; Maharaja, 1991) and, on the predator species (Ramanathan, 1977; Doraisamy, 1989; Jogindranath, 1989; Anon., 1992) separately in Kalakad and Mundanthurai areas. A preliminary study on the predator-prey relationships at Mundanthurai plateau has been made by Sathyakumar (1988). But no attempts have been made to analyse the prey-predator relationship in this Tiger Reserve as whole. In this present paper an analysis has been done on various factors operating in the prey-predator relationships with reference to Tiger and other predator competition.

Topography and Forests

The Kalakad-Mundanthurai Tiger Reserve is situated in the southern part of the Western Ghats and lies between Latitudes 8°25'N to 8°53'N and Longitude 77° 10'E and 77°35'E. The elevation ranges from 40 m to 1867 m msl. The total area of the reserve is 817 km^2. The major forests of this area include West Coast Tropical Evergreen Forests situated between 920 m and 1610 m msl, Semi-evergreen Forests, Moist Mixed Deciduous Forests and Dry Teak Forests. Apart from this, there are other forests like Riverine Forests and Grasslands, distributed in isolated patches. These forest types provide varied habitats which harbour a variety of wild animals.

Distribution and populations of major prey species

Sambar (*Cervus unicolor*) : This is said to be one of the major prey species for Tigers. This deer is distributed almost all over the

* Forest Utilisation Officer, Madras (Tamil Nadu)

Tiger reserve areas. Their average density varies between 3.5 /km^2 (Paulraj, 1991) and 8.9 /km^2 (Maharaja, 1991) in Mundanthurai area. More numbers were sighted (64-77% of the total sightings) only in shrub land and tall grass areas (Maharaja, 1991). Total population-wise, this animal occupies the first position among deer species. It may be estimated that the total population in the entire habitat of the predators (742 km^2) would be about 2900 to 3000.

Chital (*Axis axis*) : Unlike Sambar, Spotted Deer are distributed in some selected areas of the reserve extending over about 3.5 km^2 (Fig. 1) and seldom seen in other areas. Their density in these areas varied between 24/km^2 (Maharaja, 1991) and 13.5/km^2 (Paulraj, 1991) with an average of 18.7/km^2. Their population is estimated to be about 650 in the area of their distribution. The above density can not be extrapolated to the whole reserve. More than 87% of their sightings were made only in clear felled areas, teak plantations and shrub lands. They are not generally sighted in tall grass areas and dense forests.

Mouse Deer (*Traqulus meminna*) : This is also said to be one of the major prey species in Mundanthurai and their population density was about 13.2/km^2 in the Mundanthurai plateau (Sathyakumar, 1988). No studies on their population in other parts of the reserve are available. Their total population in Mundanthurai plateau may be estimated to be about 780 Nos.

Gaur (*Bos qaurus*) : Although this species is said to be one of the major prey species for the Tiger (Schaller, 1967) its distribution in this Tiger Reserve is very sparse and restricted to upper reaches of the reserve. Their preference is reported in Netterical Valley, Kusunguliar Catchment, Kuluratti Catchment, Kalivar Pulmottai, Chinnapul area, Kanunni and Nadukani (Anon. 1992). In these areas their density is worked out to be 1.4/km^2 (Paulraj, 1992).

Nilgiri Langur (*Presbytis johni*) : This species is one of the prey species for Panthers. Its distribution is restricted to the riverine forests and its population in the reserve is estimated to be about 237 in Mundanthurai and about 73 in Kalakad areas (Paulraj, 1992).

Hare (*Lepus nigricollis*) : This is yet another prey species preferred mostly by the Panthers (Sathyakumar, 1988). They are found throughout the reserve and their average density varies between 2.9 to 7.3/ km^2.

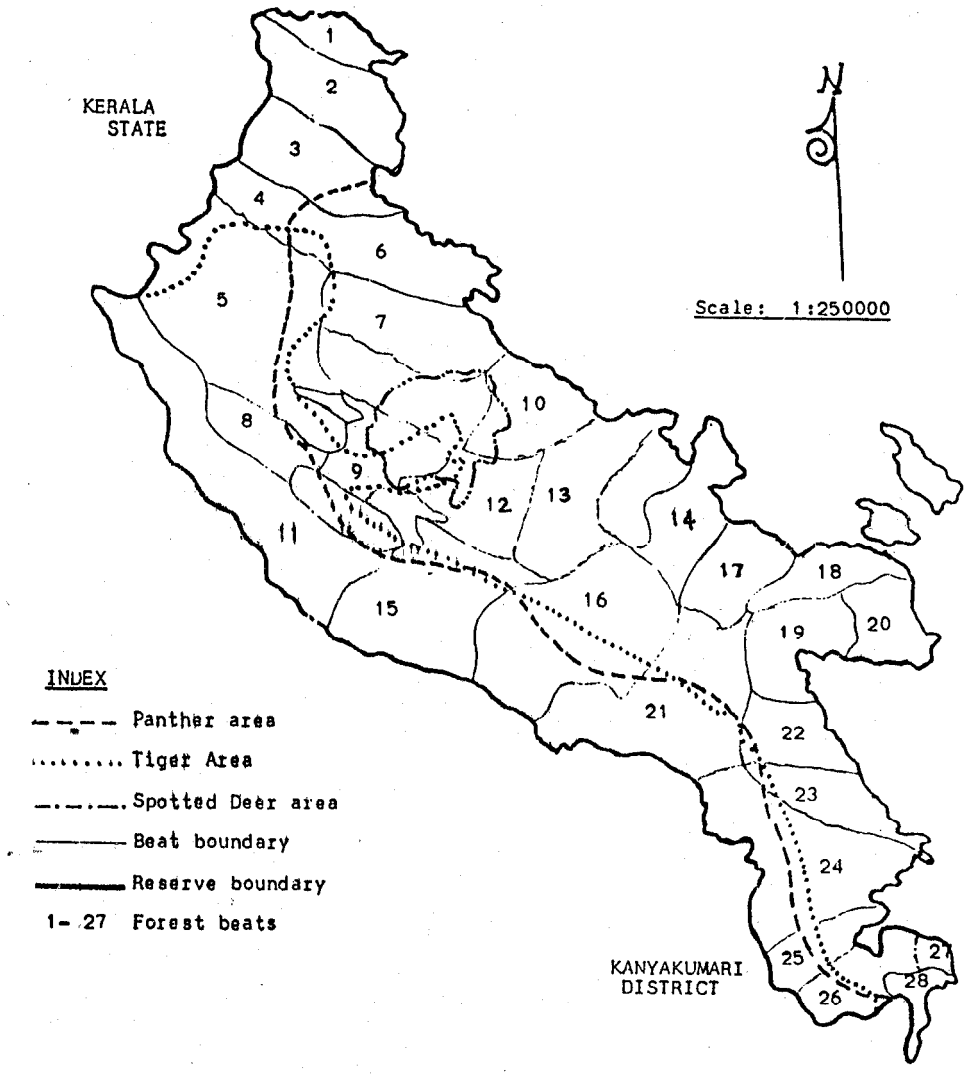
Wild Boar (*Sus scrofa*) : The Wild Boar constitutes about 14% of the total kills made by Panther in Mundanthurai plateau (Sathyakumar, 1988). They are also consumed by the Tigers (Anon., 1992). Wild Boars are more plentiful at Kalakad area (Ramanathan, 1977). As per 1991 census there were about 1500 Wild Boars in the reserve.

Cattle : Domestic cattle grazing inside the reserve play a major role in fulfilling the food requirements of the predator species especially for the Panther. Six cattle kills by the Panther was reported in a three month study in Mundanthurai plateau (Sathyakumar, 1988). It is reported that the Electricity Board Employees inside the Mundanthurai plateau owned about 1000 cattle (Doraisamy, 1989). More than 5000 cow units are allowed to graze inside the reserve (Anon., 1992).

Distribution and populations of major predator species

Tiger (*Panthera tigris*) : Potentially the entire dense forest area serves as a good habitat for Tigers inside this reserve (Fig. 1) They occur in Sivasilam, Kodamalai, Padarmalai, Kannikatti, Sengaltheri, Kalakad and Nambikoil beats.

Fig. 1



Kalakad-Mundanthurai Tiger Reserve

Their Census figures have been reported as 2 in Kalakad area (Ramanathan, 1977); 3 in the same area in 1981 (Jogindranath, 1989); 5 in Mundanthurai Sanctuary in 1984 (Doraisamy, 1989); 12 for the whole reserve in 1991 and 10-15 during 1992.

1. Kadayam
2. Govindaperi
3. Sivasailam
4. Ambur
5. Kodamadi
6. Korayar
7. Koiltheri
8. Karayar
9. Padarmalai
10. Aladiyur
11. Kannikatti
12. Sorimuthaiyanar
13. Singampatti No. 3
14. Singampatti No. 2
15. Mylar
16. Singampatti No.6
17. Singampatti No.1
18. Therku Veeravanallur
19. Vadakarai
20. Padmaneri
21. Sengaltheri
22. Kalakad
23. Malayadiputhur
24. Nambikoil
25. Thirukkurungudy
26. Valliyor
27. Parivarisurian.

Panther (*Panthera pardus*) : This is one of the major predator species in terms of numbers inside this reserve. Their distribution is reported in (Fig.1) (Karayar, Mylar, Padarmalai, Sivasailam, Aladiyur, Singampatti, Vadakkarai, Kalakad and Nambikoil beats (Anon., 1992). Their populations were estimated to be 22 Nos. the year 1981 in Kalakad Sanctuary (Jogindranath, 1989); 33 Nos. in the year 1984 in Mundanthurai Sanctuary (Doraisamy, 1989); 37 in the year 1991 in the whole reserve. However, Paulraj (1992) has given and estimate of 20 for the year 1992 for the whole reserve based on the technically organized census.

Wild Dog or *Dhole* (*Cuom alphinus*) : This is one of the major competitors for the prey inside this reserve. They are said to be distributed all along the lower regions, especially below 30m msl (Anon., 1992). About 107 Wild Dogs were said to be present in Kalakad Sanctuary alone as per 1981 census (Jogindranath, 1989). As per Ramanathan (1987) predation of Wild Dog on Sambar is on the increase. A total number of 171 Wild Dogs was reported in 1991 census for the whole reserve (Average density : 0.2/km^2).

Food requirements by the Predators

Tiger : From the available studies on the food and feeding habits of the Tigers, Kurup (1978) has worked out the food demand and supply for the Tigers. His calculations were based mainly on the studies of Schaller (1967) in Kanha National Park. According to his estimate out of 34.5 units of ungulates required by an adult Tiger, Chital formed 25, Barasingha 4, Sambar 5 and Gaur 5. Thus Chital seems to be hunted more frequently than the other ungulates. But, in the case of Kalakad-Mundanthurai Tiger Reserve, various prey demand by the Tiger would be a different one. Here, in the habitat of Tigers there are no Barasingha and Chital. Therefore, the supply from these species has to be compensated by other prey species, such as Sambar, Gaur, Wild Boar etc. available there. It is revealed from the studies of Sathyakumar (1988) that Samber forms the major prey species in this reserve.

The annual food demand for a Tiger has been expressed in different ways. Total removal of prey animals from the biotic pyramid of one Tiger works out to 150 Nos. (Doaraisamy, 1989). According to Israel and Sinchair (1987) an average-size Tiger hills upto 80 average size prey every year. Whereas, Kurup (1978) estimated that a Tiger would require about 35 ungulate kills in a year. According to Schaller (1967), 93 per cent of Tigers diet is composed of Deer species. In the case Kalakad-Mundanthurai Reserve, Samber is the only major Deer species available as a prey to the Tigers. It is reasonable to assume the Samber may constitute about 85% of the Tiger's food. If we take the total annual biomass requirement of a Tiger as 3200 kg (Kurup, 1978), number of Sambar harvested annually by a Tiger would be as follows :

Annual Biomass requirement - 3200 kg. 85% of Biomass - 2720 kg. Average adult Wt. - 180 kg. Equivalent No. of heads - 15.

If we take the total population of the Tiger in this reserve as 12, the total Sambar harvested by them annually would be 180 Nos.

Panther : A good account of Panther predation is given by Sathyakumar (1988). Based on the scat analyses, it is estimated that Sambar constitutes nearly 45% of the total diet and the Chital contributes only about 14%. If we take the annual requirement of food for a Panther as 2200 kg the required biomass of the prey species would be 3143 kg (assuming only 70% weight of the prey species is consumed). This total biomass as contributed by various prey species (Table 1).

For the estimated population of 20 Panthers, 260 Sambars would be required annually.

Wild Dog : Wild Dogs are the major consumers of many ungulates and thus they compete with Tiger and Panther for the prey. From the studies of Sathyakumar (1988), it is observed that Sambar constitutes

Table 1

Prey species	Per cent of food items	Biomass contribution (kg)	Average weight (kg)	Equivalent No.of heads
Sambar	44.6	1400	112	13
Chital	13.5 (2.3)*	424	56	8
Hare	15.5	487	2	244
Mouse Deer	3.8 (9.1)*	119	15	8
Wild Doar	3.8	119	20	6
Cattle	7.7 (4.6)*	242	350	1
Nilgiri languor	2.0 (14.6)*	63	6	11
Others	9.1	289	-	-
Total	100	3143		291

*Estimate in another area of Mundanthurai.

the major prey species (39.2%) followed by Chital (24%), Hare (22.8%) and Mouse Deer (6.7%). Although there is no clear account on the food consumption by Wild Dogs available, it is said that a group of 4 Dogs could demolish a whole Chital kill within a short period. On an average, a Dhole would require about 730 kg of food annually. This would require about 1040 kg biomass for a Dhole per annum. The contributions of various prey species to this biomass are worked out (Table 2).

From the above statement it could be estimated that all Dholes living inside the reserve (170 Nos.) would harvest about 612 Sambar from the food stock.

Discussion

Competition among the wild animals for space and food is very essential in nature to stabilize their population. Here, the problem of competition among the three major predators, Tiger, Panther and Wild Dog, for space and food in Kalakad-Mundanthurai Tiger Reserve is analysed.

The three major predators of this reserve, although seems to have varied diet composition, they compete for some common prey species such as Sambar and Chital of which the former forms a predominant food species for all of them. However, the Tiger and the Panther reduce such competition through geographic relations where, each of them have their operations in separate geographical ranges with two district eco types adjacent to each other without significant overlap (Parapatry condition, Fig.1). On the other hand, the Tigers and the Wild Dogs co-inhabit a particular geographical area in this reserve sympatry condition.

It is pertinent to analyse the situation in the Kalakad-Mundanthurai reserve with reference to prey demand and supply under different conditions. Under the sympatric condition, the Tiger and the Wild Dog compete for the same prey, the Sambar. The habitat of the Tiger extends over an area of about 300 km^2. As per our estimate a Tiger may require 15 Samber in a year and, if we take the population of the Tiger as 10, their annual requirements would be 150 Sambar. In the same Tiger habitat, the population of the Wild Dogs may be estimated as 60 Nos. (0.2 x 300 km^2). It is already estimated that a Dhole may harvest 3.6 head equivalents of Sambar per year and the 60 Dholes would consume 216 Sambar from the stock. Thus, these two predators exploit 366 Sambar annually from the stock. In the same 300 km^2 area of the Tiger habitat, our estimation of the population of Sambar is 1170 (3.9 x 300 km^2). Kurup (1978) estimated that the annual production potential of Sambar is

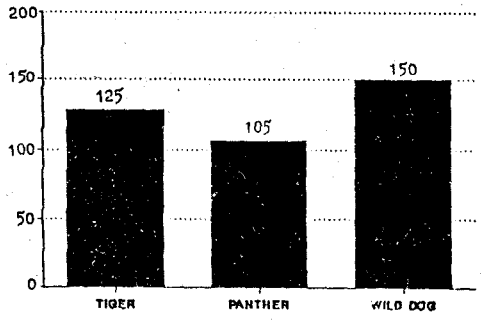
Table 2

Prey species	Per cent of food items	Biomass contribution (kg)	Average weight (kg)	Equivalent No. of heads
Sambar	39.2	408	112	3.6
Chital	24.0	250	56	4.5
Hare	22.8	237	2	118.5
Mouse Deer	6.7	70	15	4.7

1170 (3.9 x 300 km^2) Kurup (1978) estimated that the annual production potential of Sambar as 50%. After detecting fawn mortality and adult mortality he calculated the net increments 12%. For the total population of 1170 Sambar, the net annual increment would be 140. Any exploitation of the Sambar population in the said habitat more than the annual increment of 140 would lead to depleting the capital stock. It is estimated that the 10 Tigers of the reserve would require about 150 numbers which amounts to eating the capital stock. The situation would be still worse if further depletion is done by the Wild Dogs. It is understood from the studies of Sathyakumar (1988) that more than 40% of the food of Wild Dogs consists of Fawn and sub-adult Sambar only. This type of predation not only affects the population increment but also changes the age class structure, which ultimately affects the reproductive capacities of the prey population (Shaw, 1985).

As far as the Panther area is concerned, they occupy about 412 km^2 in the reserve excluding the overlapping area of 64 km^2.

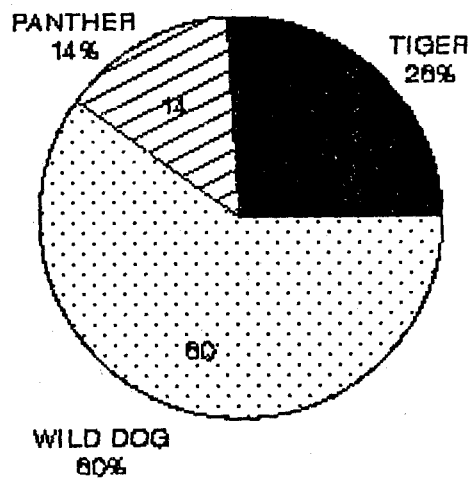
Fig. 2



Annual biomass consumption (per km^2) by the major predators in Kalakad-Mundanthurai Tiger Reserve

Because of variety and small size of their prey, Panthers avoid strong competition. This is evident from the present study. Even complete elimination of their major prey species, Sambar, may not seriously affect their survival. It should be stressed hare that the availability of a variety of prey species of the Panther is helpful to reduce or to limit predation over Sambar. This will in turn be helpful to the Tigers which greatly depend on Sambar as their potential prey. Predation on the cattle by the Panther in Mundanthurai plateau may be considered as a blessing in disguise. This predation behaviour is further helpful to reduce predation pressure on Sambar. It could be reasonably assessed that, one cattle - hill may save upto 3 Sambars from predation by Panthers. It was estimated that in Kanha National Park, about 250 head of cattle and buffalo prey within the Park each year, enough to maintain ten Tigers (Schaller, 1967). Here, the cattle and buffalo were considered as the buffer species for the Tigers.

Fig. 3



Relative predation pressure on Sambar from the major predators in Kalakad-Mundanthurai Tiger Reserve

If we consider the animal biomass consumption by the major predator species in the reserve area as a whole, the Wild Dogs take the major share followed by the Tiger and the Panther (Fig. 2). Thus, any increase in Wild Dog population will have a definite impact on the prey and predator species composition.

As already pointed out, of all the prey species, Sambar faces relatively a heavy predation pressure inside this reserve and the predation pressure by the Wild Dogs is the highest (Fig. 3).

Acknowledgements

The author wishes to express his sincere thanks to Shri M. Harikrishnan, I.F.S., P.C.C.F. for his encouragement; to Shri V.R. Chitrapu, I.F.S., C.C.F. (Wildlife) and Chief Wildlife Warden, Tamil Nadu for providing an opportunity to study this problem; to Shri Bhagwan Singh, I.F.S., Field Director, Kalakad-Mundanthurai Tiger Reserve for providing records and literature connected with this study and to Shri K.S. Neelakandan, I.F.S., C.F., Wildlife Southern Region for critically going through the manuscript and suggestions to improve the paper.

SUMMARY

Prey-predator relationships were analysed with the available data on the population distribution and feeding habits of the major prey and predator species of Kalakad-Mundanthurai Tiger Reserve. Tiger, Panther and Wild Dogs are the major predator animals, while Sambar, Chital, Gaur, Mouse Deer, Langur, Wild Boar and Hare are the major prey species consumed by the above predators. Sambar is one of the major prey species for all the predators. The areas of the Tigers and Panthers are distinct and separate in this reserve (parapatry condition) whereas, the Wild Dogs are found both in Tiger and Panther areas (sympatry condition). Panthers are not major competitors of Tigers for the prey, while Wild Dogs are the potential competitors of the Tigers. Impacts of such competition on prey population and stock for the Panthers is also analysed. Certain aspects which require management considerations are discussed.

कालाकाड-मुण्डनथुरई बाघ संरक्षित क्षेत्र (तिरूनेलवेली जिला, तमिल नाडु) में बाघ तेन्दुआ और ढोल प्रतिस्पर्धा के विशेष संदर्भ में हिंस्र-आखेट संबन्ध

एस० पोलराज

सारांश

कालाकाड-मुण्डनथुरई बाघ संरक्षित क्षेत्र की प्रमुख शिकार करने और शिकार होने वाली जातियों की संख्या के वितरण और भोजन आदतों के उपलब्ध आंकड़ों से हिंस्र-आखेट संबन्धों का विश्लेषण किया गया है । यहाँ बाघ तेन्दुए और जंगली कुत्ते शिकार करने वाले प्रमुख पशु हैं जबकि सांभर, चीतल, गौर, चूहा, हिरन, लंगूर, जंगली सुअर और खरगोश प्रमुख आखेट जातियाँ है जिन्हें उपर्युक्त हिंस्र पशु खाते हैं । सभी हिंस्र पशुओं के लिए सांभर प्रमुख आखेट जाति है । बाघ और तेन्दुओं के शिकार क्षेत्र इस संरक्षित क्षेत्र में अलग-अलग (परक्षेत्रीय अवस्था) हैं जबकि जंगली कुत्ते बाघ और तेन्दुए दोनों के क्षेत्रों में (समक्षेत्रीय अवस्था) पाए जाते हैं । शिकार के लिए बाघों के प्रमुख प्रतिस्पर्धी तेन्दुए नहीं हैं, बल्कि जंगली कुत्ते ही बाघों के संभावी प्रतिस्पर्धी हैं । शिकार की संख्या और तेन्दुओं के लिए स्टाक की ऐसी प्रतिस्पर्धा के प्रभाव का विशलेषण भी किया गया है । कतिपय पक्षों का, जो प्रबन्ध के लिए विचारणीय है, विवेचन किया गया है ।

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