

New range extension by Asian Elephant *Elephas maximus* L. - a case study of Oddanchatram Forest Range in Dindigul Forest Division, Tamil Nadu, southern India

Introduction

At present, the population estimate of wild Asian Elephants distributed in 13 countries across southern and southeastern Asia is 45,671–49,028 (Sukumar 2018). The Indian sub-continent harbours 50% of the world's Asian Elephant population, which is estimated to be 27,312. Most of these are currently distributed over an area of about 110,000km² within four regions in India; Tamil Nadu alone has a population of about 2,761 elephants (Synchronized Elephant Population Estimation Report 2017). We witnessed the presence of elephants in the foot hills of Oddanchatram Forest Range, which falls under the Palani Northern Slope Reserved Forests of Dindigul Forest Division, Tamil Nadu, southern India after 200 years

Studies on mapping the distribution of elephants, their habitats and estimating elephant population in the project Elephant Range No. 9, consisting of Anamalais-Nalliyampathi and Palani hills between January 2005 and June 2006, reported elephant distribution in Palani Range of Dindigul Forest Division (Baskaran 2013), which is further west of Oddanchatram Forest Range. Although the foothills of Oddanchatram have a natural forest

suitable for elephants, the area was not reported for elephant until 2006 as per the studies cited above. Thus, it indicates that elephants' movement into Oddanchatram Forest Range is likely be after 2006 from Anaimalai Tiger Reserve and Chinnar Wildlife Sanctuary. The elephants crossed Palani-Kodaikanal road which act as a natural barrier for elephants where the important areas are Thekkanthottam, Annanagar, and Varathamandhi reservoir are located. Hence, the present study is focused on Oddanchatram Forest Range, which is about 35km long foot-hill stretch.

In recent years, range extension or dispersal of elephants into new areas where elephant movements were not reported for the past 2–3 centuries are becoming more common in southern India. For example (i) Hosur and Bannerghatta dispersing into Andhra Pradesh and (ii) elephants from north Canara dispersing into Maharashtra and Goa. Similarly, elephant population in the eastern central Indian range especially from south Odisha, extending their ranges into northern Andhra Pradesh and elephants of old Bihar, i.e. Dhalma Wildlife Sanctuary extending their range up to southern Bengal region. Although, the present event in Dindigul

Forest Division is not a dispersal, which is an indication of much higher severity in their natural habitats. Range extension is also an indication of either resource lack in their traditional natural habitat or growing elephant population. In either case, management must take into account the presence of elephants in newer areas and ways and means to manage them effectively without much conflict with people. In this context, the present study throws more light on the new issues of range extension by elephants in Oddanchatram Forest Range.

The trend of range extension by elephants in Oddanchatram Forest Range is a greater relevance to the management of Asian Elephant population not only for this area, but also adjoining landscape areas like Annamalai Tiger Reserve. Therefore, a new range extension by elephants into Oddanchatram Forest Range could be viewed as a unique case to derive management implications for elephant conservation in this region.

Objectives

1. To monitor elephants in newly extended range of Oddanchatram Forest Range.
2. To understand the age-sex of elephants.
3. To estimate number of elephants in new extended range of Oddanchatram Forest Range.

Materials and Methods

a) Foot survey was carried out all along the foothills and crop fields to monitor the elephants and their movements using scan

sampling method as described by Altmann (1973). The following indirect signs were used for identifying elephants' movements (a) occurrence of dung piles of elephants (b) feeding sign and other indirect evidences such as rubbing sign and mud bath locations of elephants (Sivaganesan et al. 2000).

b) The foot hill habitats between Palani-Kodaikanal road and Parapalar reservoir was intensively surveyed to document elephant movement, number of individuals and its age and sex (Choudhury 1980) to identify different individuals of elephants using their natural identifications like back shapes, tail types according to length and brush (hair) and especially males, tusk types according to their plane, thickness, parallelness, and angle to the ground. Arivazhagan & Sukumar (2005) has described the physical features such as ear cuttings, external growth on the body for individual elephant identification. All elephant sighted locations were geo-tagged with the help of e-trex global positioning system (GPS).

c) Weekly two days were spent in one location which has covered a total of 23 locations falling between Palani-Kodaikanal road and Parapalar reservoir to estimate the number of elephants and their age and sex.

Result

Monitoring elephant population in newly extended foothills in Oddanchatram forests

The present study revealed that the elephants mostly used two different paths for their movement either through the foot hill forests or crop fields. These two trails are crucial to this pocketed herd of elephants in Oddanchatram Forest Range of Dindigul Forest Division. It was pointed out by the local people that the elephants initially moved up to Annanagar till 2005 in Palani range, later they moved into Ponnimalaikaikadu which is located about 1km north of Varathamnadhi Reservoir and goes up to Parapalar Reservoir of Oddanchatram Forest Range.

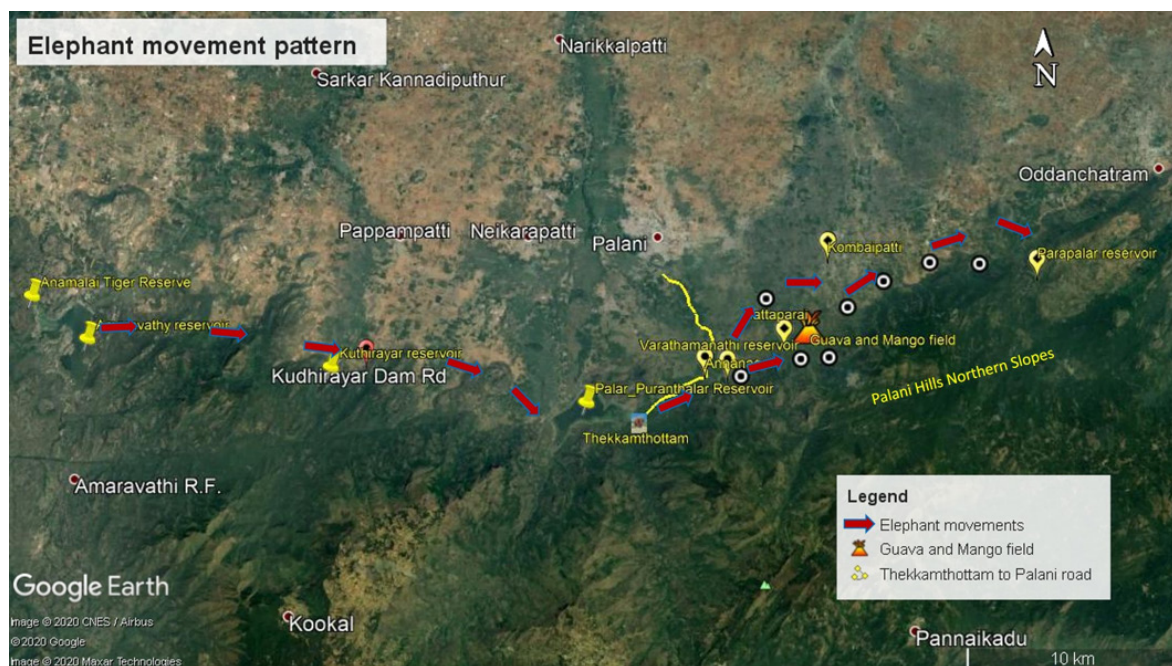
a. Movement of elephants in foothills:

(from Thekkanthottam to Pudukottai via Anna Nagar, Varathapattinam and Sattaparai). Very often, this route was utilized by elephant herds to cross the check post of Palani-Kodaikanal road in Thekkanthottam to reach Pudukottai.

From Pudukottai the herds climb up and reach the Parapalar Reservoir. It has been observed that the herds stay for a week at Parapalar Reservoir and raid the crop fields in the villages of Bethelpuram, Pulikuthikadu, Mettupatti, and Thattakuzhikadu. These herds were not seen to climb beyond Pachalur, instead, they moved up to Siruvattukadu, where the altitude is between 750m and 1000m.

b. Movement trail through crop fields:

(Thekkanthottam to Periya Ayyampalli pond, Vannanthurai, Gurukarai pond, Sattaparai and Karnansalai in Kombapatti RF). The Elephants also moved via Josiyar kulam, Periya Ayyampalli-Kodaikanal road near Punganodai predominantly through crop fields. The final destination of the elephants was the Ponnimali north and south until they reached the Sattaparai and Pudukottai further climbed to Parapalar



Elephant movement pattern from Anamalai Tiger Reserve to Thekkanthottam and Parapalar Reservoir.

Table 1. Family herds and solitary elephants sighted during the study period (n=123 days).

	Name of the villages	Number of days elephants sighted	Number of days family herd sighted	Number of days solitary elephant sighted
1	Kittappansalai	26	26	
2	Pudukottai	14	10	4
3	Karnansalai	13	11	2
4	Varathapattinam	12	11	1
5	Annanagar	11	10	1
6	Chattaparai	7	6	1
7	Puliamarathu shed	7	7	
8	Siruvattukombai	5	2	3
9	Palar	4	3	1
10	Parapalar reservoir	4	4	
11	Ponnimalai	4	2	2
12	Varathanadhi dam	3	1	2
13	Kombapatti	2	2	
14	Thekkanthottam	2	2	
15	Bethelpuram	1	1	
16	Gandhinagar	1	1	
17	Kanakkampatti railway cross	1	1	
18	Karadikuttu	1	1	
19	Madathusalai	1	1	
20	Ponnimalai east	1	1	
21	Puliampatti	1	1	
22	Pulikuthikadu	1	1	
23	Vengalaparai	1	1	

Reservoir site and ended at Bethelpuram-Siruvattukadu agricultural field.

Age-sex composition of elephants:

A total of 23 incidents elephants were sighted during our 123-day field work between February and July, 2016. For around 26 days, elephant herds were seen more near Kittappansalai Village followed by Pudukottai (n=14 days), Karnansalai (n=13 days) and Varathapattinam (n=12 days) villages. On most occasions solitary bulls were recorded in Pudukottai (n=4), followed by Siruvattukombai

(n=3) Karnansalai, Ponnimalai, and Varthamanadhi dam and on one occasion, a solitary male was recorded in Varathapattinam, Annanagar, Chattaparai, and Palar villages (Table 1).

A herd comprising of eight to nine individuals was sighted in more occasions near Kittappansalai (n=20 occasions). The same number of individuals were also been recorded near Pudukottai (n=8 occasions) and Karnansalai (n=7 occasions). It was quite interesting to note that 15 to 18 elephants were also sighted in two

Table 2. Number of occasions elephant family herds and solitary bulls recorded in different locations.

	Name of the village	Number of days solitary elephant sighted	Number of days family herds sighted
1	Kittappansalai		26
2	Pudukottai	4	10
3	Karnansalai	2	11
4	Varathapattinam	1	11
5	Annanagar	1	10
6	Chattaparai	1	6
7	Puliamarathu shed		7
8	Siruvattukombai	3	2
9	Palar	1	3
10	Parapalar		4
11	Ponnimalai	2	2
12	Varatham nadhi dam	2	1
13	Kombapatti		2
14	Thekkanthottam		2
15	Bethelpuram		1
16	Gandhinagar		1
17	Kanakkampatti rail cross		1
18	Karadikuttu		1
19	Madathusalai		1
20	Ponnimalai east		1
21	Puliampatti		1
22	Pulilikuthikadu		1
23	Vengalaparai		1

locations near Kittappansalai and Parapalar reservoirs. Solitary elephants were sighted on four occasions at Pudukottai and on three occasions at Siruvattukombai areas (Table 2).

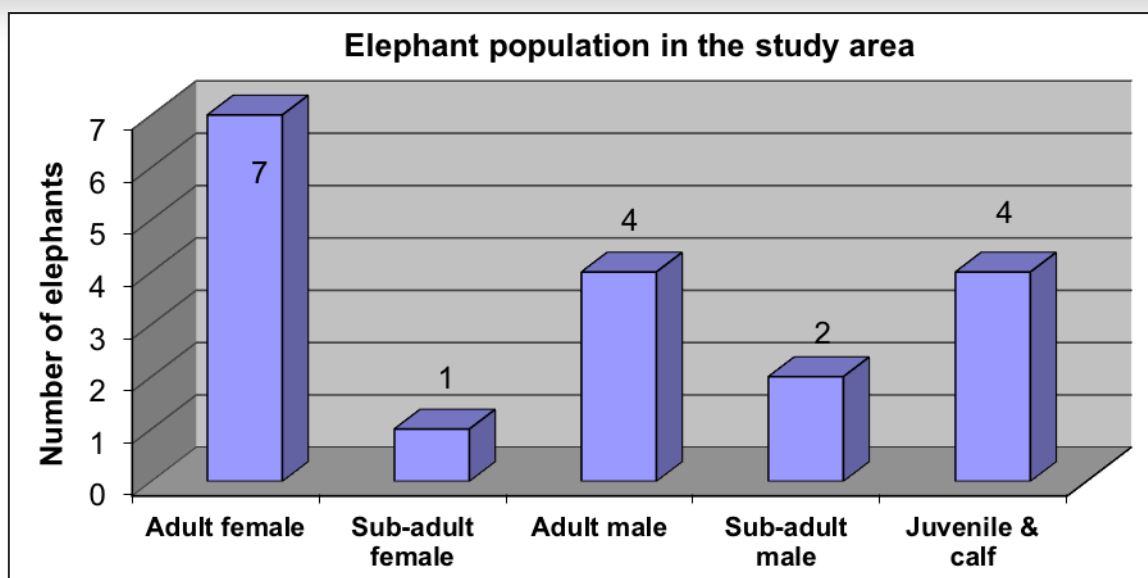
Estimation of elephant population in the new range

The eighteen individuals were seen in different numbers on 12 occasions during our study period. All the repeated elephant sightings were carefully reviewed to remove the duplications according to the individual physical features of elephants. In total, the

elephants sighted in the area consisted of seven adult females, one sub-adult female, four adult males, two sub-adult males, and four juvenile/calves. Overall, the sex ratio between male and female irrespective of age class was 1: 1.3. It was found that an adult male and one group comprising nine individuals were regularly seen in this area.

Discussion

The present study has found a new range extension of elephants for more than 35km into new areas between Thekkanthottam and Parapalar reservoir is a clear sign that



Elephant population and its age and sex in newly extended Oddanchatram Forest Range.

the elephant herds were trying to find new habitats though the elephants have not been sighted here until 2005. The possible reason could be either due to availability of water spread areas in the eastern portion of Palar-Puranthalar reservoir or proximity of agriculture fields with coconut, mango, and silk cotton. In addition, the elephant herds follow the foot hill forests to reach various hamlets such as Annanagar, Gandhinagar, Varathamnadhi's 'O' point, north of Pappampali, and southern part of Ponnimalai, Varathapattinam, Sattaparai, Kombapatti, Karnansalai, Dasaripatti to raid crops and goes to Pudukottai-Theetukkal paarai to enter into Parapalar Reservoir to drink water.

The elephant herds settled down in the foothill tract and sustain with crop fields with a strategy of securing themselves in dense fruit garden closer to the foothill forests. The other option could be to find out new routes to go back into

its traditional range to avoid various anthropogenic pressures. Ramakrishnan (2007) stated that elephants get bounced back due to blockage of corridor. Over a few decades, there has been shrinkage of potential habitats due to various land use changes which forms the major causes for the loss of crucial habitats to Asian Elephant populations (Daniel 1980). The present study has thrown light on the land use changes that has influenced the need to study on various new range extension by these elephants.

This study has brought out various aspects that the elephant's accessible areas have been occupied by the local people in the foothills of Oddanchatram. The occupancy by elephants between Varathapattinam and Pudukottai especially in crop fields showed the significance of attractive food crops for elephants in this tract. Cultivation of elephants' preferable food crops such as guava, mango, paddy,

jackfruit and plantain could trigger the elephants to withstand venturing into new areas. The left over forest patches at the foothill areas are now under serious threat with extensive encroachments. In some areas, elephants are forced to move through human dominated landscapes mainly for water (Sukumar, 1989a). Many studies also suggest that the elephants use microhabitats especially during dry season when deciduous forests become unpalatable (Sukumar 1989b; Sivaganesan 1991; Rameshkumar & Sathyanarayana 1994; Baskaran 1998). The fact that the adjoining areas of Anamalai Tiger Reserve which is dominated by deciduous forests would become unpalatable to elephants in dry season could have triggered the elephants to use these areas for a shorter duration. But from an ecological point

of view, this short period dispersal is inevitable to elephants as its own habitat became unpalatable.

The present study has revealed that the elephants' movement from Thekkanthottam to Parapalar reservoir during the dry spell could also be in search of natural resources like water, food, shade and other ecological requirements that are sparsely distributed in the study area during the onset of north east monsoon. Ishwaran (1981) found that during dry conditions, swampy areas provide grass for elephants. Similarly, in Wilpattu National Park, Sri Lanka, the movement of elephants to large grassy villus during wet season was influenced by the availability of food and dry season movement was influenced by the permanent water source (Eisenberg &



A panoramic view of water spread areas of Paalar-Puranthalar Reservoir at Thekkanthottam where elephants used to cross from Palani-Koddaikanal road towards Oddanchatram foothills and further go up to Parapalar Reservoir.

Lockhart 1972).

Elephants being a wide-ranging species require large areas to forage. Once the habitat is fragmented or reduced in size, elephants become isolated and hemmed in small patches of forests surrounded by vast area of agriculture crops and human habitations. For instance, Annamalai Tiger Reserve and Chinnar Wildlife Sanctuary already have various biological pressures such as fragmentation and conversion of large areas into tea gardens. This scenario has forced elephants to extend their range into new areas or resettle into the neighboring habitat to avoid man-made pressures. Graham et al. (2009) indicated that elephants' movement and use of habitats are based on a risk-minimization strategy with concomitant diurnal differences in habitat use. Elephants could potentially range outside protected areas, survive in reasonable numbers in human-dominated landscapes and get benefit from forest agriculture matrices, despite pressures associated with anthropogenic landscapes (Calabrese et al. 2017; Leimgruber et al. 2003; Madhusudan 2003); however, the space used by elephants is influenced by distribution of resources, vegetation types, changes in land use and presence of human disturbance within their distributional range (Hoare 1995).

Conclusion and recommendations

1) Two-hundred years before, elephants were seen in these areas (evidence from British records), which means these areas were part of the annual seasonal home

range of elephants in those days. Due to some reasons, the elephants were not using their traditional range for about 200 years. Since 2006, the herd comprising 18 individuals dispersed into their traditional part of home range and staying back round the year till now (evidenced from $n=7$ human casualty; $n=2$ elephant electrocution). Therefore, the present study conclude that this can be kind of a geographical distribution range extension by elephants. To establish this in a more scientific manner, at least one or two years of study is warranted.

2) Based on the questionnaire survey, the present study found that from 2006 to 2011, the elephants were extended up to Siruvattukadu and Bechelpuram of Oddanchatram Forest Range. After 2011, they further extended up to Kannivadi Forest Range of Dindigul Forest Division. Last two years, the elephant herd moved up to Betlagundu Forest Range (two forest field staff were injured by one of these tuskiers while they were involved in driving back these individuals into their traditional range during 2019) of the Dindigul Forest Division. This clearly indicates that the elephant herd is extending its range into parts of their ancient home range.

3) A long-term study is urgently needed to thoroughly study the elephant movement pattern in these areas enabling to bring out a strong scientific strategy to manage human-elephant interaction issues.

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