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Estimation of Group Size, Age and Sex Composition of Evident Prey Species in the Segur Plateau, Nilgiri Biosphere Reserve

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Abstract

Segur Plateau is part of Mudumalai Tiger Reserve; the reserve extends over an area of 321 km^2 and forms a part of the Nilgiri Biosphere Reserve. The sanctuary is located in the Western Ghats, which is one of the 34 Biodiversity hotspots of the world. This study was conducted to determine the population structure and evaluate the population density of different potential prey species in the segur plateau. In order to know the population structure and density, the line-transect sampling method were used. The overall individual density (number/km^2) were chital (68), sambar (7.7), gaur (8.6), black napped hare (5.31), elephant (1.7) and wild pig (3.0). The chital being predominant compared to other herbivores. The mean group size of black napped hare 1.16, elephant 4.08, gaur 6.58, sambar 3.50, chital 4.08, wild pig 3.00 were calculated respectively. Age composition was also calculated, black napped hare group size range between 1 to 4 were recorded and elephant 1 to 30, gaur 1 to 80, sambar from 1 to 12, chital 1 to 150, wild pig 1 to 9. The sex ratio for elephant (1:0.5), gaur (1:3.25), sambar (1:10.6), chital (1:1.37) was estimated and it was indeterminate for wild pigs and black napped hares due to fast movement of the animals and their nocturnal behaviour.

Keywords: Prey species; Group size; Composition; Sex ratio

Introduction

Animals in groups are thought to have lower risks of predation than solitary individuals [1]. Most mammalian species often live in groups, the size of which constitute the simplest and most basic elements of their social organization. Group size varies widely within and between species [1]. This variation needs to be explained if it is to be considered as a part of the species adaptation to its environment [1] or just a survival strategy. Ungulates group sizes are determined by food quality, abundance and dispersion of cover density and the carrying capacity of the particular ecosystem. Individual fitness varies with group size and the group vigilance level thus increases with increase in group size. Sex ratio is generally an indicator of the reproduction potential of a species. A high percentage of young as compared to adults generally indicates a fast growing or thriving population in contrast to a relatively small percentage of young usually indicating a listless rate of population increase [2,3]. A population with more females than males generally has a higher reproductive potential than the one that is predominantly composed of males. This information regarding group size and sex ratio are required to formulate proper management and apply conservation strategies that will effectively sustain the species. The present paper provides data on group size, sex ratio and group composition of herbivores that are found in the segur plateau of the Nilgiri Biosphere Reserve. Estimating the group size, age and sex composition of evident prey species will help in knowing the carrying capacity of the system and its stable balanced relationship.

Materials and Methods

Study area

Segur Plateau is part of Mudumalai Tiger Reserve buffer area and is located in the Nilgiri District of Tamil Nadu (11º 32´ and 11º 42´ N and 76º 20´ and 76º 45´ E). It extends over an area of 321 km^2 and forms a part of the Nilgiri Biosphere Reserve (5520 km^2). The sanctuary is located in the Western Ghats, which is one of the 34 Biodiversity hotspots of the world. Altitude in the study area varies from 485 to 1226 m above MSL with a general elevation of about 900 to 1000 m. The annual rainfall varies from 1001 mm to 1648 mm. The study area receives rain from both Southwest (May to August) and Northeast (September to December) monsoons.

The study area has three major forest types' namely tropical moist deciduous forest (MDF), dry deciduous forest (DDF) and tropical thorn forest (TF) [4]. The prey species that were encountered during the study included elephants (*Elephus maximus*), three species of cervids:chital (*Axis axis*), sambar deer (*Rusa unicolor*) black napped hare (*Lepus nigricollis*) and wild pigs (*Sus scrofa*).

Methods

The grouping tendency, mean group size, and age-sex composition was calculated from transects count supplemented with counts from road-side, foot trails and waterholes. The sampling area was stratified based on the vegetation and human disturbance. The physical characteristics described for all prey species (Chital, Sambar, Gaur, Elephant and Black buck) in the literature [5-7] and observation made in captive animals to establish the age-sex categories for classification were taken as key features.

In this study, the age of female spotted deer was categorized as follows; full grown >30 kg as adults while <30 kg as sub-adults. The male spotted deer were classified into; adult (>2 feet antlers) and sub-adult (spike and <1 feet antlers). Fawns were considered if the size was equal to the height of the mother's belly. Barking deer were classified into males (adults with antlers having a short brow line, protruded upper canines (whenever possible) >15 kg and sub-adults of approximately 5 - 15 kg), females (adults which were antlerless, >15 kg and sub-adult which were antlerless of approximately 5 - 10 kg) and fawns (sometimes with spotted coat and approximately <5 kg). Gaurs were classified into; adult males (shiny black coat with heavy horns sweeping sideways and upwards), sub-adult males (dark brown coat with a conspicuous dorsal ridge and small dewlap hanging below the chin, large drapes between the fore legs), yearlings (10-20 months old), adult females (smaller than adult males, pelage is dark brown with more upright horns corrugated inwards than in adult males), sub-adult females (50 - 75% size of adult female lacking a conspicuous white stocking), female yearlings (light brown coat which were 25 to 50 percent size of sub-adult females), small calves (light brown coloured coat, approximately <3 months old of <30 kg), medium calves (light brown coloured coat of approximately 30 to 100 kg) and large calves (dark brown coloured coat which were half the size of yearling females). Male wild pigs were classified into adult males (well developed tushes and genital organs), sub-adult males (not well developed tushes and half the size of adult males), male yearlings (tushes not visible, genital organ and half the size of sub-adult males) and adult females (tushes not seen), sub adult females (tushes not seen and half the size of adult females), female yearlings (half the size of sub-adult females). Piglets have brown coloured coat with black stripes on the dorsal region from nape to rump and are classified into small (half the size of large piglet and approximately <3 kg) and large (approximately 3-5 kg). Percentage of male and young ratio to 100 females was calculated from the group composition. Elephants were classified into various age-sex categories based on relative height and morphological characteristics. Young elephants (<15 years) were compared to the oldest adult female in the group [5] based on the height while the older elephants were classified based on their morphological characteristics like degree of ear fold, depression of the buccal cavity and forehead and using field experience. Elephants were placed in broad age-classes; calves (<1 year old), juveniles (1-5 years old), sub-adults (5-15 years) and adults (>15 years). Males were identified by the presence of tusks while females were tuskless [8,9] along with activity pattern also observed.

Results

Prey grouping tendencies

The grouping tendencies of the potential prey species for the carnivores in the segur plateau showed that the chital is a highly-social animal and prefers living in groups, where 85% of our observations were groups of varying size. The largest group had 150 individuals in chital. The sambar is also basically a group-living animal 40% of the observations were groups of varying size. More than 75 percent of sambar groups were observed with the group size ranging from 1 to 12 individuals. The largest of a 12 individual's group size was observed and a large percentage (40%) of singles was sighted, most of them were males.

The elephant were sighted 26.3% mostly singles (loaners). More than 31.6% observed ranged from 2 to 3 and 10.5% observed ranged from 11 to 30. The gaur individual group ranged from 1 to 80. More than 26.3% sighted were singles, range from 2 to 3 sighted were 19.5%, range from 4 to 10 were 17.1%, range more than 30 were 2.4%, black napped hare and wild pig individual group was observed very low percentages, the black napped hare sighted 1 to 4 range group, and wild pig observed ranges from 1 to 9, more than 75% was sighted as a singles, 25% was sighted as range from 4 to 10. The black napped hare was mostly sighted as a singles 92%, 4 % was sighted as a range from 2 to 3, 4% was sighted as a range from 4 to 10 (Table 1).

Species	Range	N	% group in each group size class				
			1	2-3	4-10	11-30	30+
Black napped hare	1-4	25	92	4	4	0.0	0.0
Elephant	1-12	38	26.3	31.6	31.6	10.5	0.0
Gaur	1-80	41	46.3	19.5	17.1	7.3	2.4
Sambar	1-12	40	40.0	25.0	27.5	7.5	0.0
Chital	1-150	69	17.4	14.5	18.8	37.7	11.6
Wild pig	1-9	4	75.0	0.0	25.0	0.0	0.0
N = total number of groups observed							

Table 1: Grouping tendencies of different prey species in the Segur plateau.

Group size, composition and sex ratio of prey species

Black napped hare

As black napped hare sex could not be classified with certainty, only group size classification was carried out. The overall mean group size was 1.16 (Table 2). The black napped hare range between 1 to 4 was recorded (Table 1).

Species	Mean group size	Sd
Black napped hare	1.16	1.08
Elephant	4.08	2.02
Gaur	6.58	2.56
Sambar	3.50	1.87
Chital	18.27	4.27
Wild pig	3.00	1.73

Table 2: Herbivore mean group size.

Elephant

A maximum of 38 elephant individuals were recorded in the period of November to January, Mean group size 4.08 (Table 2), more than 80 percent of the group size ranged from individuals 1 to 12. The overall male:female 1:0.5, sub adult male:sub adult female 1:0.06, juvenile male:juvenile female 1:3.5, adult female:calves 1:0.5 (Table 3). The average age structure of elephant is as follows:Male (Adult – 3.8%, sub-adult – 3.0% and juvenile – 15.9%), Female, 13% (Adult – 7.6 %, sub-

adult – 45.5% and juvenile – 4.5%), calves 13.6% and unclassified 3.8%. the large group size was observed in congress mattam area (Table 4).

Ratio	Black napped hare	Elephant	Gaur	Sambar	Chital	Wild pig
Adult Male	0.0	3.8	18.8	24.8	15.8	0.0
Adult Female	0.0	7.6	5.8	2.3	11.5	0.0
Sub Adult Male	0.0	3.0	0.5	1.6	2.8	0.0
Sub Adult Female	0.0	45.5	22.7	48.8	30.3	0.0
Juvenile male	0.0	15.9	9.2	17.1	10.2	0.0
Juvenile female	0.0	4.5	1.4	4.7	2.9	0.0
Calf/Fawn	0.0	13.6	3.4	3.1	3.0	0.0
Unclassified	100.0	3.8	38.6	2.3	17.7	100.0

Table 3: Age Sex Composition.

Gaur

Group size of gaur ranged from 1 to 80 individuals along with a mean group size of 6.58 (Table 2). More than 70% of gaur groups were observed between the group sizes ranging from 1-10 individuals. The average male:female:fawn in gaur was 1:3.25, sub adult male :sub adult female1:0.02, juvenile male :juvenile female 1:6.3, adult female :fawn 1:7 (Table 3). The average age composition of gaur is as follows:Male 35.2% (Adult –18.8 %, sub-adult – 0.5% and juvenile – 15.9%), female, 29.9% (Adult –5.8 %, sub-adult – 22.7% and juvenile – 1.4%), calves 3.4% and unclassified 38.6%. The largest 80 group individual was observed in the study area. the group male is sighted more (Table 4).

Ratio	Elephant	Gaur	Sambar	Chital	Wild pig
AMXAF	0.5	3.25	10.6	1.37	0.00
SAM XSAF	0.06	0.02	0.03	0.091	0.00
JMXJF	3.5	6.3	3.6	3.55	0.00
AFXCALF/FAWN	0.5	1.7	0.75	3.81	0.00

Table 4: Age-sex, female x juvenile/calf ratio of herbivores.

Sambar

Sambar varied from 1 to 12 individuals with a mean group size of 3.50 (Table 2). More than 75 percent of sambar groups were observed with the group size ranging from 1 to 12 individuals. The largest 12 individual's group size was observed in congress mattam. The average male:female ratio in sambar was 1:10.6, sub adult male:sub adult female1:0.03, juvenile male :juvenile female 1:3.55 ,adult female :fawn 1:0.7 (Table 3). Female were sighted more in the group. Sambar average age structure is as follow:Male 43.5% (Adult –24.8%, sub-adult – 1.6% and juvenile – 17.1%), female male, 55.8% (Adult –2.3%, sub-adult – 48.8% and juvenile – 4.7%), fawn 2.3% and unclassified 4.7% (Table 4).

Chital

A maximum of 69 chital individuals were recorded in the November to January periods. Mean group size also calculated for chital the range 4.08 and did not vary considerably (Table 2). The percent of the group size ranged from 1 to 150 individuals. The overall male:female sex ratio was 1:1.37 (n = 69 group individuals) (Table 3). The average age structure of chital is as follows:Male 23.8% (Adult – 11.8%, sub-adult – 2.8% and juvenile – 10.2%), female male, 44.7% (Adult – 11.5 %, sub-adult – 30.3% and juvenile – 2.9%), fawn 3.0% and unclassified 17.7% (Table 4).

Wild pig

The wild pig 4 individuals group was observed in the period of November to January. The overall mean group size of wild pig was observed to be 3.00 (Table 2). The male and female ratio was not identified due to sudden fast movement unclassified 100%, only group size classification was carried out (Table 3 and Figures 1 and 2). The wild pig range between 1 to 9 was recorded. 75% only single wild pig was observed (Table 1).

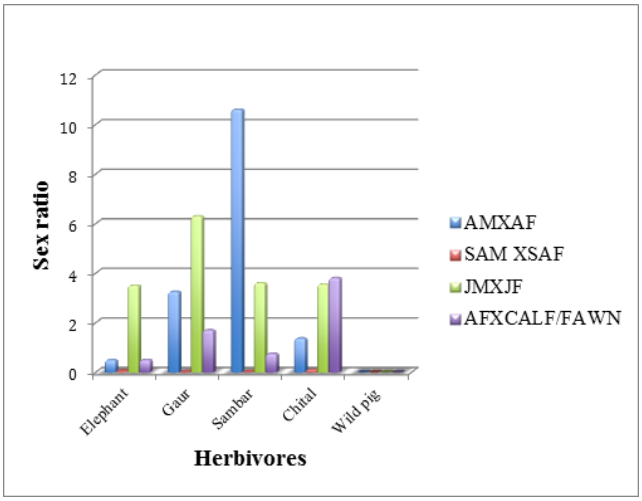

Figure 1: Age sex classification – Sex ratio. Where, AM - Adult Male, AF - Adult Female, SAM - Subadult Male, SAF - Subadult Female, JM - Juvenile Male, JF - Juvenile Female.

Discussion

Prey animals that live solitary or in small groups are more vulnerable to predation [10], because they do not have a communal alarming system and they cannot successfully distract the predator's attention from a particular individual as a target. Hence, it is important to know prey grouping tendencies, which are related to the carnivores hunting success.

The mega herbivore elephant lives in matriarchal groups of five to 20 individuals that interact with other family units in the area [11]. Group size of elephant ranged from 1 to 12 individuals with mean group size of 4.08 in segur plateau. Majority of group size (7.3) was recorded between 11 and 30 category. The elephant group size typically ranged from five to 20 animals and may vary with season [11]. In other studies, the mean group size recorded was 6 to 12.5 in Bandipur [12], 3.59 in Nagarahole [11] which is comparable to segur plateau. The

overall female:calve ratio for elephant in segur plateu was 1:0.5 which is similar to 1:0.19 in Rajaji, lower than Uttar Pradesh (0.58:1 – 0.78:1), Gaioya (0.40:1) [8], Lahugala (0.42:1), Yala (0.31:1) [8].

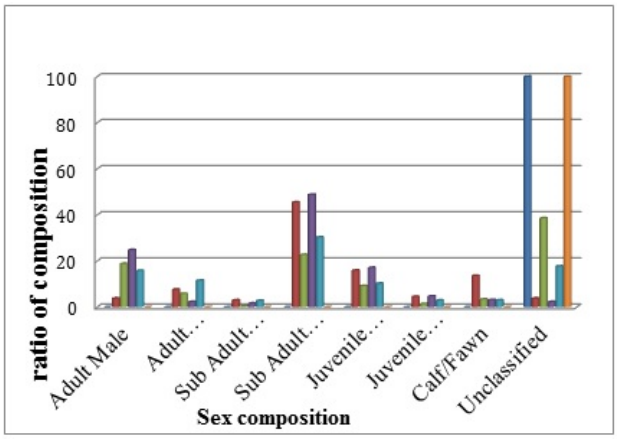

Figure 2: Age Sex Composition. Where, AM - Adult Male, AF - Adult Female, SAM - Subadult Male, SAF - Subadult Female, JM - Juvenile Male, JF - Juvenile Female.

The typical group in gaur consists of cows and few calves, one to two adult bulls and sub adults. The group size ranged from 1 to 43 in Mudumalai, 2 to 19 in Pench, 2 to 40 in Kanha [7]. The result also likely to be higher 1-80. The estimated mean group size of gaur in segur plateau was 6.58 which is similar to Kanha (8.8 ± 0.74) [7], Nagarahole (3.9 to 7.47). The largest group of gaur comprising individuals was recorded in segur plateau 80. More than 50 gaur individulas were observed in Bandipur [12]. The gaur higher groups were observed in grass land areas. The overall gaur male:female ratio was 1:3.25 in segur which is reported higher than as from Kanha (0.38:1) [7], Parambikulam (0.45:1) (Vairavel) and Pench (0.6:1). The female:calf ratio was 1:1.7 in segur which is lower than as Pench (1:24), higher than Kanha (1:0.46) [7] Parambikulam (1:0.16) [13,14] has never seen two or more mature bulls in a gaur herd in south India.

In sambar, group size was small, numbering fewer than 6 individuals [7,15]. The characteristic social unit is one hind and one fawn or one hind, one yearling and one fawn [7]. In segur plateau large aggregations were seen near river area, swampy grasslands. Johnsingh [12] also recorded large association of sambar near water holes and feeding sites in Bandipur. During the present study, the mean group size of 3.50 was recorded for sambar which was much similar to 4.0 ± 2.3 in Sariska [2] and higher than 3.1 ± 0.2 in Pench [16] and 1.7 in Nagarahole [15]. In Segur plateau, the observed sambar male:female ratio was 1:10.6 and female:fawn ratio was 1:0.75. The observed sambar low male ratio might be due to selective predation by tiger on male sambars as reported in other studies [7,12,17].

Tamang [18] reported an average group size of the chital at 5.4 in the Bangladesh Sundarbans. The average group size is very close to his estimate, but the proportions of different group sizes were quite different. According to Tamang [18], the proportions of the chital in group sizes of 1, 2-3, 4-10, 11-30 and 30+ are 6, 36, 46, 11 and 1%, respectively. Mishra [6] reported a higher percentage of chital group size between 5 to 10 individuals with a mean group size of 7.5 in Royal Chitawan National Park. Acharya [16] reported a mean group size of 22.6 ± 2.2 in Pench Tiger Reserve. Chital group size in Karnali - Bardia [19] varied from 1 to 91 individuals with a mean group size of 10.7, while in Sariska, chital group the ratios are similar to my findings are 17.9, 14.5, 18.8, 37.7, and 11.6%. Chital male:female sex ratio was 0.77:1 in Hawaii [20]; 0.69:1 in Corbett and 0.70:1 in Kanha [20], 0.72:1.0 in Nagarahole [17]. The average male:female:fawn ratio was 0.57:1:0.53 in Royal-Karnali Bardia [15], 0.66:1:0.49 in Bandipur [12], 0.47:1:0.22 in Sariska [2] and 0.50:1:0.27 in Pench [16]. The observed average male:female:fawn ratio in chital was 1.37:0.09:3.81 in segur plateau. The segur Plateau also more than that chital mean group size is 18.27. Reza et al. [21] mentioned a range of group sizes from 2 to 137, i.e. chital were sighted, but Tamang [18] and the estimated proportions of group size range of 1 to 150. The male and female ratio chital was 1:1.37, sub adult male and sub adult female ratio 1:0.091, adult female and fawn ratio 1:3.87 its indicate that female ratio chital was very high and mostly observed in the grass land areas.

A maximum of 9 wild pig individuals were observed in a group in segur plateau during study period and this is lesser as reported, Bandipur (32 individuals) [12] and other areas [2]. The mean group size of wild pig 3.00 in segur plateau was lower than Pench (4.23) and higher than Nagarhole (2.23) [17]. The mean group size of the wild pig was estimated by Reza et al. [21] as 2 (range = 1-15), which is again higher than result. Wild pig peak oestrous activity has been recorded during the wetter months i.e. November and December in Sri Lanka. The reproductive activity in pigs tends to be seasonal and positively correlated with the relative availability of food or climatic factors. The fast movement of wild pig and environmental condition of wild pig sex ratio was not observed, however their field sigs were proven guides [22]. Further the wild pig pigs have been adapted to nocturnal activity. Wild pigs have moved to buffer zones and forest fringes interfering with agriculture, showing high occurrences of conflict [23]. Ultimately it was recorded that wild pig population was sparse in the core regions but dense in the fringes.

Conclusion

The distribution and the density of herbivores give a bright scenario of the situation that a habitat is governed. However, the individual animal counts should be carried out to not overlap the field signs that are caused by the same animal. Further, importance to individual species with the specifics including the day to day meteorological, physiological concerns may be pivotal in arriving rigid conclusions on the sex ratio pertaining to the group behavior and complex hierarchy structure in these herbivores studied.

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