

Observation And Analysis Of Sex Ratio Of Herds Affecting Social Behaviour Of Blackbuck In Buxar, Bihar, India

Sourabh Suman

Ph.D. Scholar, Department Of Zoology, T.P.S. College, Patliputra University, Patna, Bihar, India.

Dr. Sananda Sinha

Assistant Professor, Department Of Zoology, T.P.S. College, Patliputra University, Patna, Bihar, India.

Abstract

The research paper aimed to study the impacts of the sex ratio of herds of Blackbuck (*Antilope cervicapra*), a species of antelopes found in India, with a specific focus on district Buxar, Bihar, India. The study provided a comprehensive understanding of the demographic structure and factors influencing the sex ratio of blackbucks within the region. During the study period, the authors conducted extensive field surveys, utilizing systematic sampling techniques to gather data on ecological factors affecting blackbucks' population in Buxar, Bihar. This study also presented the primary documented assessment of the sex ratio of blackbuck in Buxar, Bihar in comparison with the population dynamics of blackbucks in Jodhpur, Rajasthan, where more extensive studies have been conducted. The findings showed significant fluctuation in the sex ratio of blackbuck, with notable effects by environmental factors and anthropogenic pressure. Additionally, the research work also provided data on seasonal variation, distribution and behaviour of blackbuck at different locations. The behaviour and herd size are crucial for the growth and survival of blackbucks, but they have been facing various challenges in unprotected regions of the district. Understanding the sex ratio, referred as the balance between male and female individuals within the population, which played an important role in the conservation and genetic diversity of blackbucks. The result of this research work indicated the need of enhanced conservation efforts to address the sex ratio imbalances of the blackbucks and the underlying causes to support a stable and healthy population of the target animal to maintain the ecological balance of the habitat.

Keywords: *Antilope cervicapra* (Blackbuck), herd size, population, sex ratio, ecological balance

Date of Submission: 21-03-2025

Date of Acceptance: 31-03-2025

I. Introduction

Blackbuck, *A. cervicapra* (Linnaeus 1758), is a species of the Bovidae family. Blackbucks are endemic to the Indian subcontinent, but the present distribution of the species is limited to India, with an isolated population in Nepal (Meena et al., 2017). As of now, the geographical distribution of this species is restricted to a few Indian states. Blackbuck holds significant importance in India's ancient literature, art and ecology (Archunan & Rajagopal, 2013). The International Union for Conservation of Nature (IUCN) categorizes the blackbuck as least concerned animal. In India, blackbucks are legally protected under the Wildlife Protection Act 1972. The blackbuck is listed in Schedule I of the Wildlife Protection Act 1972, which prohibits hunting of the blackbuck.

Ecologically, *A. cervicapra* is a grazer and prefers to live in open grassland. The blackbuck is among the fastest animals and can outpace most predators over long distances. This antelope shows remarkable sexual dimorphism at maturity (Das & Kar, 2015). Based on documented statistics, male blackbucks can weigh anywhere between 35 to 55 kilograms, while females usually weigh between 30 to 40 kilograms. There is also a variation in the colouration on the heads and back regions. The coats of adult males show striking black or dark brown colour on their dorsal side, with a white ventral side. Females and young male blackbucks are yellow-brown on their dorsal and outer limbs (Meena & Saran, 2018). Nearly all animals interact with members of their species to establish characteristic patterns of habitation and behaviour. Blackbuck is a highly social animal, and they prefer to live in herds (Gaisinsky et al., 2023). In India, blackbucks are found in 80-100 isolated areas across plain and semi-natural habitats. Since most of their habitat is outside protected zones, their population is at risk due to the shrinkage of habitat and competition with livestock (Debata, 2017). Blackbuck is mainly found in the non-protected area of Buxar, Bihar. They have adapted to open grasslands and agricultural fields in the region and the species is considered endangered in this region (Prasad & Ahmed, 2021). The expansion of human settlements

into natural habitats has negatively impacted wildlife, leading to habitat loss and fragmentation of isolated areas (Archunan & Rajagopal, 2013). Despite its conservation and ecological significance, the sex ratio of blackbuck in India remains understudied compared to the extensive research conducted on various species (Das & Kar, 2015).

The primary objective of this study is to shed light on the first comprehensive research work on the sex ratio of blackbuck, along with the seasonal variations and their impacts on the herds in the Buxar district. With the researcher's utmost effort to locate blackbucks in every possible habitat within the region and by observing the different environmental factors, availability of resources and human-wildlife conflict, this research work will add valuable knowledge about the species and guidelines for making conservation policies in unprotected regions of Buxar, Bihar, India.

II. Methods

Study area

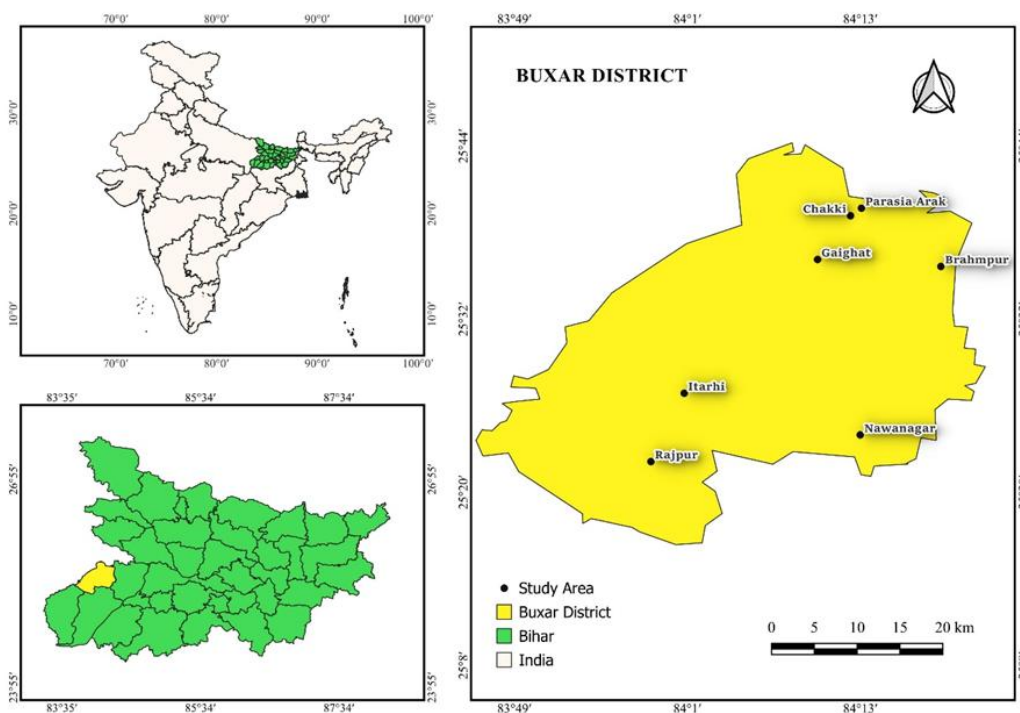


Fig - 1: Location map of the study area in district Buxar, Bihar, India

The present research work is conducted in the Buxar district located in Bihar, India, as shown in Fig - 1. The district Buxar is located in the western part of Bihar, where the river Ganges enters the state. The region is considered to be the best wheat-growing area in the state. Buxar district is restricted on the north by the Ballia district of Uttar Pradesh, on the south by Rohtas district, on the west by Ghazipur district and on the east by Bhojpur district. Geographically, Buxar lies between the latitudes 25.56049°N and the longitudes 83.98054°E. The district Buxar observes temperature variations in different seasons of the year. In May, June and July summer temperature climbs up to 45°C. While in the winter it starts around the middle of October, and by January and February, it can get as chilly as 4°C. The district receives an average rainfall of 1021 mm every year from June to September, with 85% coming from the south-west monsoon (Singh, 2013).

Methods

In this research work, various standard methods and procedures have been followed for the counting of the target animal. During the visits, the surveys and interviews were conducted with local people at different locations and times in the study area. For the counting of target species, sightings were done by the method of direct observation through binoculars from a close range as much as possible. Along with the above, the behavioural patterns of herds of blackbucks were also observed and noted. Relevant and concerned photographs were taken with a high-quality digital camera. The researcher also interacted with the concerned officials of the Bhojpur Forest Division. The present investigation was carried out in the surrounding regions of the Dumraon sub-division of the district Buxar, Bihar, from February 2023 to April 2024.

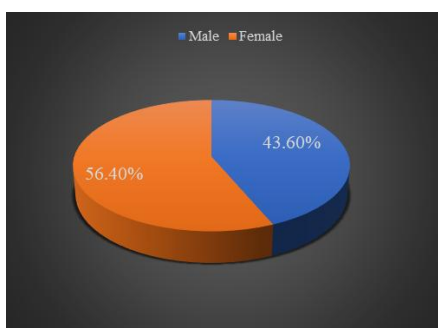
III. Results

During this study, the effort has been made by the researcher to evaluate ecological factors contributing to the imbalance of the sex ratio of blackbuck herds in Buxar. The study was conducted for the analysis of variations in the sex ratio of blackbuck herds at different locations in the study area. The study revealed a notable variation in the sex ratio in different herds of blackbuck at different locations in Buxar, Bihar, India. Previously, the study related to the population status and sex ratio was conducted in Jodhpur, Rajasthan (Meena & Jaipal, 2020). They reported the total population of blackbuck was 133 in the study area, out of which 58 were males and 75 were females which was estimated an overall ratio of males and females was 1:3 shown in the following Table - 1.

Table - 1: Overall population and sex ratio of blackbucks in the study area of Rajasthan and Bihar, India

Study Area	Total (no.)	Male (no.)	Female (no.)	Male (%)	Female (%)	Overall Ratio	Simplest Ratio
Jodhpur, Rajasthan	133	58	75	43.6%	56.4%	1:3	0.77
Buxar, Bihar	256	59	197	23.04%	76.95%	1:3.33	0.29

It was found that the distribution of males and females among the total population was 43.6% and 56.4% respectively in Jodhpur, Rajasthan, depicted in Pie Chart - 1.



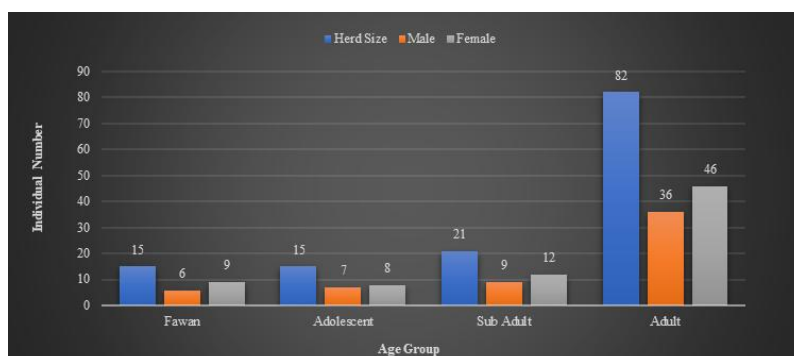
Pie Chart - 1: Percentage distribution of male and female blackbuck in Jodhpur, Rajasthan

Further, they have reported the number and sex ratio of males and females in the herds of blackbucks in Jodhpur, Rajasthan, on the basis of age groups shown in the following Table - 2.

Table - 2: Population and sex ratio of blackbucks on the basis of age group in Jodhpur, Rajasthan

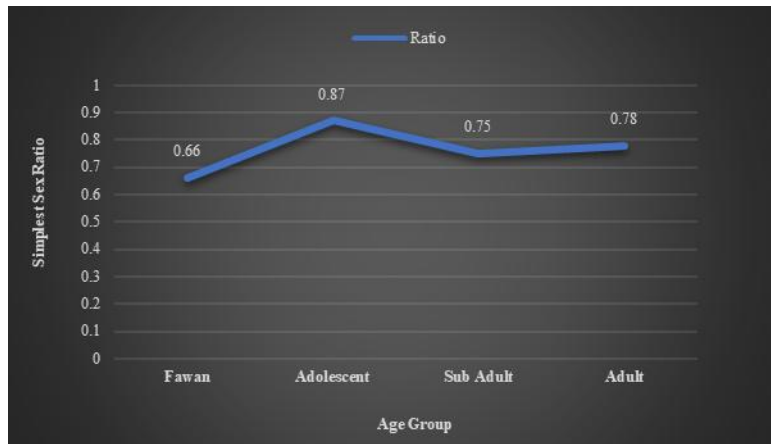
Age Group	Herd Size	Male	Female	Ratio (f/m)	Simplest Ratio
Fawan	15	6	9	1:1.5	0.66
Adolescent	15	7	8	1:1.14	0.87
Sub Adult	21	9	12	1:1.33	0.75
Adult	82	36	46	1:1.27	0.78

They reported total 15 fawns, having age below six months, out of which 6 were males and 9 were females that was estimated the sex ratio of 1:1.5, 15 adolescents, having age between six months to one year, out of which 7 were males and 8 were females that was estimated the sex ratio of 1:1.14, 21 sub-adults having age between one to two years, out of which 9 were males and 12 were females that was estimated sex ratio of 1:1.33, 82 adults having age above two years, out of which 36 were males and 46 were females that was estimated sex ratio of 1:1.27 shown in the following Histogram-1.



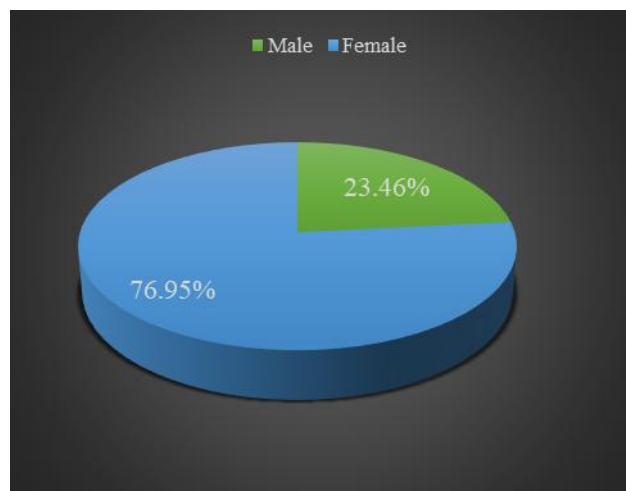
Histogram - 1: Population of Blackbuck of different age groups in Jodhpur, Rajasthan

On the basis of the above data, the sex ratio in the simplest form was estimated in which it was found that the sex ratio of Fawns was 0.66, Adolescents had a sex ratio of 0.87, Sub-adults showed a sex ratio of 0.75 and the sex ratio of adult 0.78, shown in the Graph - 1.



Graph -1: Variation in the sex ratio of blackbuck across different age groups in Jodhpur, Rajasthan

In the present research work, conducted in the study area at different locations of Buxar, Bihar, the researchers observed 256 blackbucks out of which 59 were males and 197 were females. It exhibited the overall sex ratio of blackbucks 1:3 shown in Table – 1 and the overall distribution of male and female blackbucks in the study area was 23.04% and 76.95%, respectively in Buxar, Bihar, as depicted in Pie Chart – 2.



Pie Chart - 2: Percentage distribution of male and female blackbuck in Buxar, Bihar

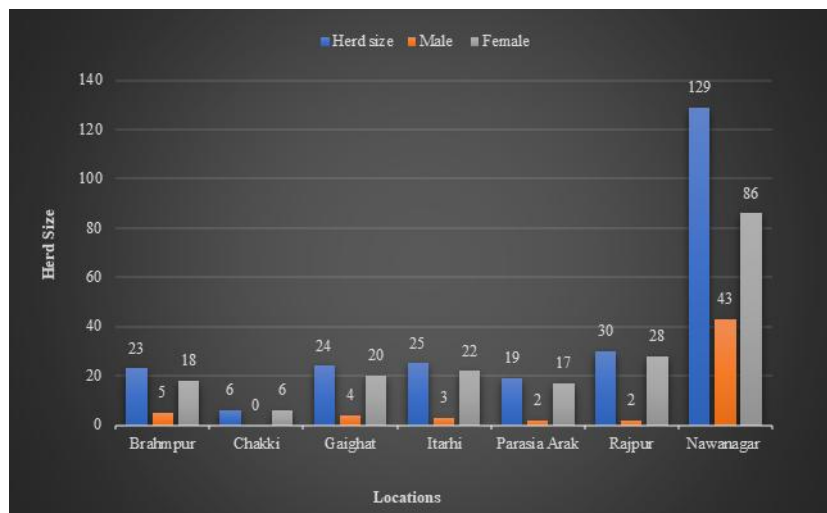
Further, the researchers have observed and analysed the sex ratio of males and females in the herds of blackbuck at different locations such as Brahmpur, Chakki, Gaighat, Itarhi, Parasia Arak, Rajpur, and Nawanagar of the district Buxar, Bihar. Data analysis exhibited variations in the sex ratio at different locations shown in the following Table – 3.

Table - 3: Numbers and sex ratio of blackbuck at different locations in Buxar, Bihar

Location	Herd Size	Male	Female	Ratio (f/m)	Simplest Ratio
Brahmpur	23	5	18	1:3.6	0.28
Chakki	6	0	6	0	0
Gaighat	24	4	20	1:5	0.2
Itarhi	25	3	22	1:7.33	0.14
Parasia Arak	19	2	17	1:8.5	0.11
Rajpur	30	2	28	1:14	0.07
Nawanagar	129	43	86	1:2	0.5

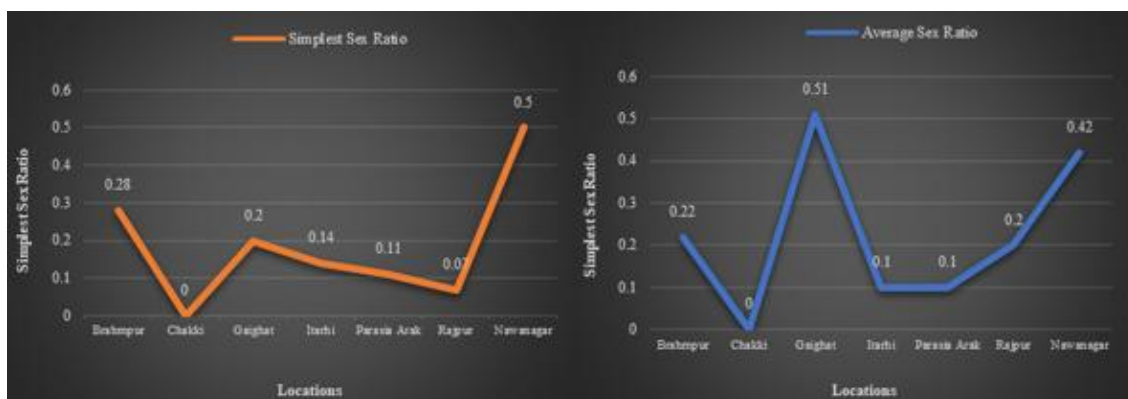
During the visit of Brahmpur village (25°36'20"N 84°17'42"E), of the Brahmpur Block, located in the eastern region of the district Buxar, the herd of blackbuck were sighted having total 23 in numbers out of which

5 were males and 18 were females exhibiting sex ratio 1:3.6. While visiting Chakki village (25°38'46"N 84°11'59"E), of the Chakki Block, located in the northern regions of the district, only female blackbucks were sighted and surprisingly, no male blackbucks were observed in the herd. One potential reason might be a territory establishment in which male blackbucks keep moving to other areas and find suitable territory for dominance. Male blackbucks, in particular, may be more affected as they need larger territories to establish dominance and access to mates. Similarly, during the visits to Gaighat village (25°37'16"N 84°16'41"E), of the Brahmpur Block, located in the northern region of the district, the herd of blackbuck were sighted having total 24 in numbers out of which 4 were males and 20 were females exhibiting sex ratio 1:5. Subsequently, at Itarhi village (25°29'18"N 84°00'01"E), of Itarhi Block, located in the western region of the district, the herd of blackbuck were spotted having total 25 in numbers out of which 3 were males and 22 were females exhibiting sex ratio of 1:7.33. In Parasia Arak village (25°36'43"N 84°13'33"E), of the Brahmpur Block, located in the northern region of the district, the herd of blackbuck were sighted having total 19 in number out of which 2 were males and 17 were females exhibiting sex ratio of 1:8.5. Thereafter, Rajpur village (25°32'30"N 84°18'43"E), located in Rajpur Block, in the south-west region of the district, the herd of blackbuck were sighted having total 30 in number out of which 2 were males and 28 were females exhibiting sex ratio 1:14. Further, the researchers visited Nawanagar village (25°24'50"N 84°11'55"E) located in Nawanagar Block, in the south region of the district and are happy to be reported that the herd of blackbuck were sighted there having total 129 in number out of which 43 were males and 86 were females exhibiting sex ratio of 1:2. That was the only region with a relatively more balanced sex ratio among all locations as shown in the following Histogram -2.



Histogram - 2: Numbers of Blackbuck observed across various locations in Buxar, Bihar

On the basis of the above data, the simplest sex ratio of the herds of blackbuck was estimated at different locations of the district Buxar and it was 0.28 at Brahmpur village, 0.2 at Gaighat village, 0.14 at Itarhi village, 0.11 at Parasia Arak village, 0.07 at Rajpur village located in the Rajpur Block. The sex ratio was estimated at Nawanagar village, located in the Nawanagar Block, was 0.5 which was quite satisfactory. But, as reported in the earlier paragraph, no male blackbuck was observed at Chakki village as shown in the Graph - 2.



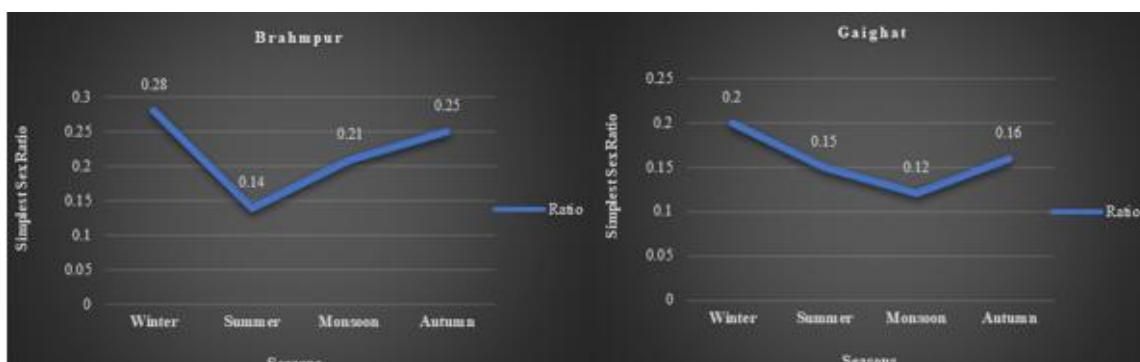
Graph 2: Variation in the simplest sex ratio of blackbuck across different locations in Buxar, Bihar
Graph 3: Variation in the average sex ratio of blackbuck across different seasons in Buxar, Bihar

Further, the seasonal variations of sex ratio in the herds of blackbucks were observed at all the above-mentioned locations, illustrated in the following Table – 4. The researchers also observed the effects of the seasonal variations on the social behaviour of their herds.

Table – 4: Seasonal variation of numbers and sex ratio of blackbuck at different locations in Buxar, Bihar

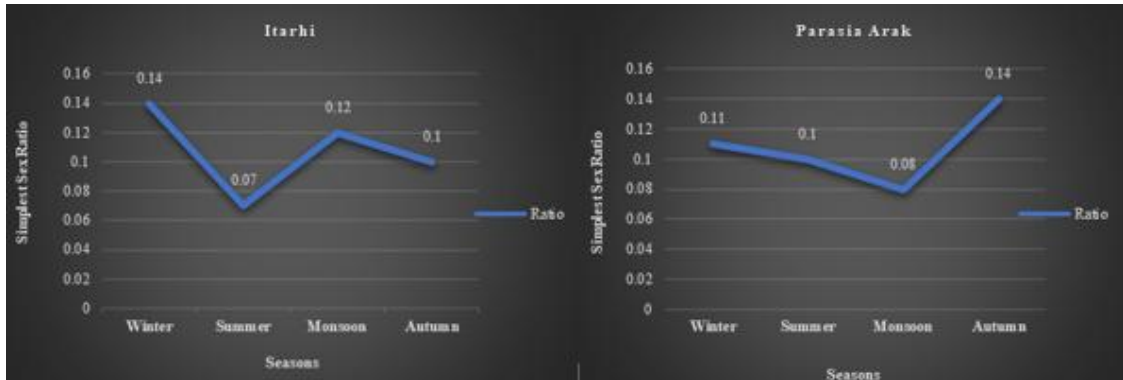
Locations	Seasons	Herd Size	Male	Female	Ratio (f/m)	Simplest Ratio	Average Sex Ratio
Brahmpur	Winter	23	5	18	1:3.6	0.28	0.22
	Summer	16	2	14	1:7	0.14	
	Monsoon	17	3	14	1:4.6	0.21	
	Autumn	20	4	16	1:4	0.25	
Chakki	Winter	6	0	6	0	0	0
	Summer	3	0	3	0	0	
	Monsoon	3	0	3	0	0	
	Autumn	6	0	6	0	0	
Gaighat	Winter	24	4	20	1:5	0.2	0.51
	Summer	15	2	13	1:6.5	0.15	
	Monsoon	18	2	16	1:8	0.12	
	Autumn	21	3	18	1:6	0.16	
Itarhi	Winter	25	3	22	1:7.3	0.14	0.10
	Summer	15	1	14	1:14	0.07	
	Monsoon	18	2	16	1:8	0.12	
	Autumn	21	2	19	1:9.5	0.10	
Parasia Arak	Winter	19	2	17	1:8.5	0.11	0.10
	Summer	11	1	10	1:10	0.1	
	Monsoon	13	1	12	1:13	0.08	
	Autumn	16	2	14	1:7	0.14	
Rajpur	Winter	30	2	28	1:14	0.07	0.20
	Summer	12	1	11	1:11	0.09	
	Monsoon	18	1	17	1:17	0.58	
	Autumn	25	2	23	1:11.5	0.086	
Nawanagar	Winter	129	43	86	1:2	0.5	0.42
	Summer	70	20	50	1:2.5	0.4	
	Monsoon	86	21	65	1:3	0.32	
	Autumn	110	35	75	1:2.1	0.46	

During the visit of Brahmpur village, the researchers observed the highest number of blackbuck in winter and the lowest number in summer, having total 16 in numbers out of which 2 were males and 14 were females exhibiting sex ratio of 1:7. The simplest sex ratio of blackbuck was 0.14 and the overall average sex ratio of 0.22 as shown in Graph - 4. Surprisingly, during visits to Chakki village across all seasons, no male blackbuck was sighted. In the same way, during the visits of Gaighat Village, the highest number of blackbucks was sighted in winter and the lowest number in summer, having total 15 in numbers and out of which 2 were males and 13 were females exhibiting the sex ratio of 1:4. The simplest sex ratio of blackbuck was 0.15 and the overall average sex ratio of 0.51 as shown in Graph - 5.

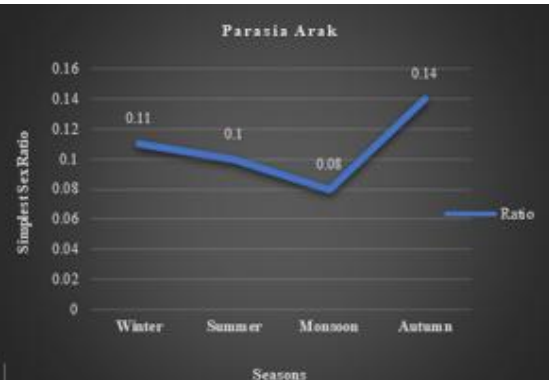


Graph 4: Variation in the sex ratio of blackbuck in Brahmpur across different seasons in Buxar, Bihar

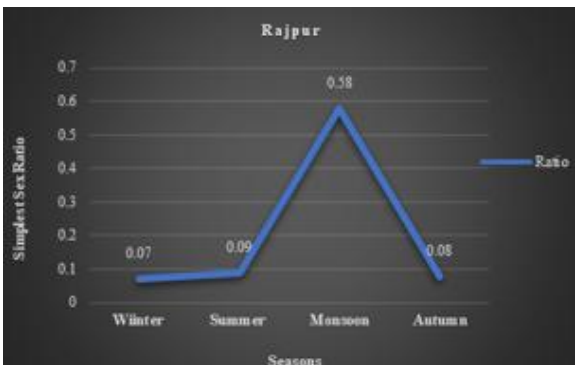
Graph – 5: Variation in the sex ratio of blackbuck in Gaighat across different seasons in Buxar, Bihar



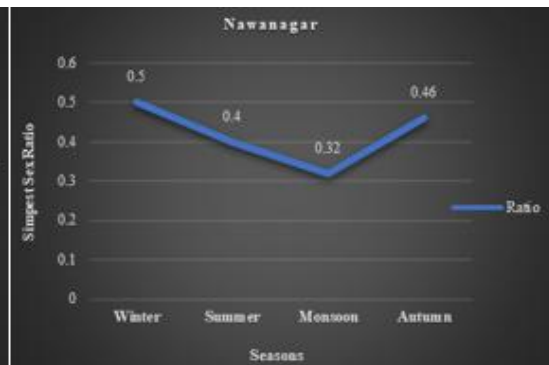
Graph – 6: Variation in the sex ratio of blackbuck in Itarhi across different seasons in Buxar, Bihar



Graph 7: Variation in the sex ratio of blackbuck in Parasia Arak across different seasons in Buxar, Bihar



Graph 8: Variation in the sex ratio of blackbuck in Rajpur across different seasons in Buxar, Bihar



Graph 9: Variation in the sex ratio of blackbuck in Nawanager across different seasons in Buxar, Bihar

Subsequently, at Itarhi village, the highest number of blackbucks was sighted in winter and the lowest number in summer, having total 15 in numbers and out of which 1 were male and 14 were females exhibiting the sex ratio of 1:14. The simplest sex ratio of blackbuck in summer was 0.07 and overall average sex ratio of 0.10 as shown in Graph – 6. Whereas, in Parasia Arak village, the highest number of blackbucks was observed in winter and the lowest in the summer, having total 11 in numbers out of which 1 were male and 10 were females exhibiting the sex ratio of 1:10. The simplest sex ratio of blackbuck in summer was 0.1 and the overall average sex ratio of 0.10 as shown in Graph – 7. Meanwhile, in Rajpur village, the highest number of blackbucks was sighted in winter and the lowest in summer, having 12 in numbers and out of which 1 were males and 11 were females exhibiting sex ratio of 1:11. The simplest sex ratio of blackbuck was estimated in summer was 0.09 and the overall average sex ratio of 0.20 as shown in Graph – 8. During the visit of Nawanager village similar to all locations, the highest number of blackbucks was sighted in winter and the lowest in summer, having total 70 in numbers and out of which 20 were males and 50 were females exhibiting sex ratio of 1:2.5. The simplest sex ratio of blackbuck was estimated in summer was 0.4 and overall average sex ratio was 0.42 as shown in Graph - 9.



Fig - 2: Blackbuck, an adult male, in the open field of Buxar, Bihar



Fig - 3: A herd of females blackbuck in the open field of Buxar, Bihar

IV. Discussion

The researchers observed and analysed the above-mentioned data along with the survey reports and reports of interviews conducted with locals during the visits at different locations of the district Buxar, and found various reasons for the variations in the sex ratio of the herds of the blackbuck. Simultaneously, the impact of seasonal variation on the sex ratio was also analysed at those locations, namely Brahmpur, Chakki, Gaighat, Itarhi, Parasia Arak, Rajpur, and Nawanagar of the district Buxar, Bihar.

At Brahmpur village, in winter season, larger herd sizes of blackbucks are easily sighted grazing in open fields, especially during daytime, and it is more steady in nature as compared to all the other seasons. However, at night, they preferred to rest and stay hidden. While in summer, the smallest size of herds of blackbucks were observed and the obvious reasons may be the scorching heat felt during the season due to which animals preferred to stay shaded rather than grazing in open fields. In this season, mostly grasses, crops, or other foods used by the animals are dried and scarce. Drinking water was also not easily available for them in this season as water bodies are mostly dried due to high temperatures. These are the striking reasons why blackbucks migrated towards human settlements in search of food and drinking water which increased the chances of conflicts with humans and other animals too. During the monsoon season, the sighting of blackbucks was reduced due to heavy rainfall in this area. It is observed that blackbucks preferred to avoid muddy areas created due to waterlogging as they often got stuck in the mud, which makes them an easy target for predators such as feral dogs (*Cuon alpinus*) and jackals (*Canis aureus*) which is life-threatening and fatal. In comparison to summer and monsoon seasons, larger size of herds of blackbucks are observed in autumn. Their movements were more frequent with increased grazing activity in this season and easily observed in open agricultural fields due to the availability of plenty of food, such as newly sprouted crops and grasses. Availability of drinking water and climatic conditions such as temperature and pleasant weather are favourable for mating and breeding which is supportive for their increased social activities during this season.

Similarly, all the data and report analysis revealed that at Gaighat, patterns of herd size, sex ratio and social behaviour are observed and found almost similar to Brahmpur during the winter and autumn seasons. But when the behaviour of the animal was observed and compared during the summer and monsoon season, the smallest herd size was observed during the monsoon in contrast to Brahmpur, where the smallest size of herds of blackbuck is observed during summer season. The probable reason for the same is that the area is low-lying and situated at the bank of the river Ganges which is highly prone to flood. Flooded area of the village was full of mud and waterlogging seemed as driving force for blackbucks to migrate towards the border area of Uttar Pradesh connected to the district Buxar, Bihar, for their survival. While comparing data, reports and patterns of herd size, sex ratio and social behaviour of the target animal at another location, Itarhi village, of the district Buxar, it was evident that it was similar as at Brahmpur and Gaighat in winter and summer seasons. But it exhibited different patterns during monsoon and autumn as sex ratio was lower in autumn in comparison to monsoon, contrasting to the pattern at Brahmpur and Gaighat and also contrasting to the fact that the autumn is considered as breeding period for the blackbucks.

At a different location, Parasia Arak village of the district, all the data and reports analysis revealed the highest sex ratio observed in the autumn season in comparison to winter, summer and monsoon and irrespective of all other study locations of the district. The observed results supported the facts and behaviour of the species as this season is the breeding period for them. It was also evident in their social behaviour and activities during this season. Frequent movement of blackbucks was sighted grazing on lush greenery grasses having better herd size in open agricultural fields might be due to favourable temperature and other climatic conditions. Whereas in the monsoon season, the smallest herd size was observed possibly due to less availability of foods and higher risk of floods in low-lying areas near Ganges, similar to the Gaighat region which impacts their overall herd distribution in the rainy season. Another factor observed in the season was that the hooves of blackbuck frequently stuck in mud, making them almost immovable and become easy targets for predators. All the data and reports analysis at Rajpur village, Buxar revealed a different pattern of herd size, sex ratio and animal behaviour. The most striking shift observed during the monsoon season was, the sex ratio was found the highest among all seasons at this location contrasting with all the other studied locations of the district Buxar, Bihar, probably due to the compatibly higher location than the other locations. Due to this blackbuck could easily find safer areas for their habitat, particularly in the monsoon season.

As mentioned in the earlier section, the surprising results were observed during all visits conducted in different seasons at Chakki village, Buxar, Bihar, as no male blackbuck at all was sighted in the herds observed there at different points of time and different seasons even in a single visit during this research work. However, according to survey reports and interviews conducted among the locals during the visits, male blackbucks had been seen frequently in open agricultural fields around 6 to 8 years ago in this area. The probable reason might be the changes that took place over the time in that area, in the form of different types of land use patterns, such as increased human settlement, agricultural expansion and infrastructure development resulted in the reduced

natural habitat for the target animal. Some other reason might be the location of this village. As this is located near the river Ganga, it is more prone to flood, especially during the monsoon season.

The researchers are happy to inform that all the data and reports analysis presented a quite different scenario of the sex ratio and social behaviour of the blackbucks in Nawanganar during the visits conducted in different seasons in comparison to all the above-mentioned locations. Throughout the research work, several key factors were identified that contributed to this variation in the herds of blackbucks, which distinguished Nawanganar from other locations of district Buxar. During the investigations, the researcher came to know that this area is designated as a Blackbuck Rehabilitation Centre in 2023 by the Government of Bihar. However, the development work is still under progress in the rehabilitation centre for the blackbucks to make it a fully established centre. Currently, at this centre, continuous monitoring of the blackbucks is being done by the officials of the Bhojpur Forest Division, Ara, Bihar. It was also observed that blackbucks had better access to essential resources such as food, drinking water, and shelter in this area throughout the year. Here, blackbucks are restricted in their distribution due to the availability of resources for their survival. Additionally, the open grassland of Nawanganar village played a crucial role in facilitating "lekking" behaviour, where male blackbucks marked their territories to attract females for mating. This behaviour was more constant in this area with enough open spaces, contributing to the higher numbers of males in this region. It was also observed that human and wildlife conflict pressure in Nawanganar was low in comparison to other isolated locations of the district Buxar. These unique combinations of open grasslands, abundant resources and minimal human interference have created a more favourable habitat for blackbucks in Nawanganar.

Further researchers tried to compare the results and trend analysis of the sex ratio of the blackbuck herds with other regions of India, but the only relevant research found was done in Jodhpur, Rajasthan, India and was reported by Meena and Jaipal, 2020. Comparative data analysis of Jodhpur, Rajasthan and Buxar, Bihar, exhibited marked differences between the sex ratio in the herds of blackbucks as the simplest ratio in Jodhpur was found > 0.5 as reported by Meena and K. Jaipal, 2020 and < 0.3 in Buxar, Bihar, estimated during the present research work. The observed range of sex ratio of blackbuck in Jodhpur is 0.21 while the same in Buxar was 0.51 which shows the sex ratio balance is better in Jodhpur than in Buxar. Both regions exhibited higher number of females, but the imbalance in the sex ratio of the herds was more noticeable in Buxar as compared to Jodhpur, Rajasthan. The imbalance of sex ratio directly affects the fecundity as well as the natality of the blackbuck population which ultimately create disturbance in the food chain and food web of that habitat. As a result, the ecological imbalance within that ecosystem might have a long-term impact on the ecological aspects.

The above result might be due to, blackbucks are well adapted in Jodhpur due to the availability of open grassland as the region is covered under the protected area declared by the Government of Rajasthan, India, and the area is under continuous monitoring by the officials of the Department of Forest. However, in Buxar, Bihar, not much area is well protected for the blackbucks. Only the newly established Rehabilitation Centre in Nawanganar, Buxar, helps in the continuous monitoring of blackbucks in the district, therefore, blackbucks in unprotected areas encountered significant threats as observed during the study period. The habitat in Jodhpur was reported comparatively more suitable for stable herds, while in Buxar non availability of protected natural habitat for blackbucks directly affects their natural behaviour due to which they are sometimes compelled to raid agricultural fields. As a result, occurrence of crop damages and economic losses of the farmers as well as conflict between human beings and animals takes place frequently.

Furthermore, male blackbucks are often targeted by poachers due to their distinctive horns and skin, which have medicinal significance (Suman & Sinha, 2024). Today, as cities and towns expand rapidly, roads have become everywhere, stretching across agricultural fields across the country (Solanki et al., 2017). However, as evident from recent findings in Buxar suggested that the development of infrastructures and roads posed a serious threat to the natural habitat of blackbucks in Buxar, Bihar, India.

V. Conclusions

On the basis of the analysis of all the above-mentioned data, the researchers are confident to state that this research work might provide important baseline data and insights regarding the ecological conditions affecting the sex ratio of the herds of blackbuck, which could support making the strategies for future conservation and better management for the species and minimize the human-wildlife conflicts in district Buxar. Future research should be focussed on monitoring the population, especially in isolated areas, controlled anthropogenic activities and it also be ensured the conservation efforts of the species in the Buxar district. If such situations will be persisted in the coming decades, it could severely impact the overall presence of blackbuck in the region. Finally, it would not only biologists but also the local government and people who are involved in regional development need to understand the importance and geographical distribution of blackbucks by ensuring a balanced ecosystem for the species in Buxar, Bihar. The establishment of the rehabilitation centre in Nawanganar, Buxar, is a significant step towards the conservation of blackbuck. This initiative not only aided the protection and conservation of blackbuck but also set a foundation for future research opportunities for the biologist. With

continued government and local people's support, more such centres can be established in the coming year ensuring a safer and more suitable environment for blackbuck in Buxar, Bihar, India. By addressing all these challenges, we would be able to contribute more towards the long-term survival of blackbuck in Bihar and other parts of the country.

Acknowledgement

The authors wish to express their deep sense of gratitude and due regard to the Vice Chancellor, Pro-Vice-Chancellor, Dean, Faculty of Science and the Head of the University Department of Zoology of Patliputra University, Patna, for providing me the opportunity and support as well as encouragement to write this research paper. The authors are extremely grateful to the Principal, T.P.S. College, Patna and the head of Department, Zoology, T.P.S. College, Patna, for providing the proper facilities for working well. No words of the authors would adequately express love of their respective families and friends for their continuous unconditional support. The authors also extend their sincere appreciation to the local people, farmers, and government officials of the district Buxar, Bihar, India, for their valuable input during this research work.

Declaration Of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in the paper.

References

- [1] Archunan, G., & Rajagopal, T. (2013). Detection Of Estrus In Indian Blackbuck: Behavioural, Hormonal And Urinary Volatiles Evaluation. *General And Comparative Endocrinology*, 181(1), 156–166. <https://doi.org/10.1016/j.ygcen.2012.11.012>
- [2] Das, U. K., & Kar, S. (2015). Study On The Population Dynamics And Habitat Occupancy Of Blackbuck (*Antelope Cervicapra*) In Ganjam District, Odisha, India. In *Journal Of Natural Sciences Research* www.iiste.org ISSN (Vol. 5, Issue 3). <https://www.iiste.org/Journals/Index.Php/JNSR/Article/View/20079/20334>
- [3] Debata, S. (2017). Population Size, Herd Structure And Sex Ratio Of The Blackbuck *Antelope Cervicapra* (Mammalia: Cetartiodactyla: Bovidae) In A Human Dominated Area In Odisha, India. In *Journal Of Threatened Taxa* (Vol. 9, Issue 11, Pp. 10953–10955). Wildlife Information Liaison Development Society. <https://doi.org/10.11609/Jott.2658.9.11.10953-10955>
- [4] Gaisinsky, A., Regonda, S., Nguyen, L., Mennill, D., & Advisor, (2023). Sexual Dimorphism Affects Herd Composition In African Antelopes. DOI: <https://doi.org/10.47611/Jsrv.12i3.2056>
- [5] Meena, R., & Saran, R. P. (2018). Distribution, Ecology And Conservation Status Of Blackbuck (*Antelope Cervicapra*): An Update. *International Journal Of Biology Research*. www.biologyjournal.in
- [6] Meena, M., & Jaipal, A. K. (2020). Blackbuck (*Antelope Cervicapra*) Population Status Around Jodhpur, Rajasthan. *Bull. Env. Pharmacol. Life Sci*, 9, 103-107. DOI: https://www.researchgate.net/publication/350992135_blackbuck_antelope_cervicapra_population_status_around_jodhpur
- [7] Meena, R., Saran, R. P., & Chourasia, V. (2017). Population Characteristics, Habitat Availability, Forage Preferences And Threats To The Blackbuck *Antelope Cervicapra* (Linn) In The Sorsan Region Of Baran, Rajasthan. *World Journal Of Zoology*, 12(3), 53–59. <https://doi.org/10.5829/idosi.wjz.2017.53.59>
- [8] Prasad, S., & Ahmed, R. (2021). Report Of An Elegant Species *Antelope Cervicapra* (Linn.) In Non-Protected Area Of Shahabad, Bihar, India. *Journal On New Biological Report*, 10(1), 31-37. DOI: https://www.researchgate.net/publication/351548669_report_of_an_elegant_species_antelope_cervicapra_linn_in_non-protected_area_of_shahabad_bihar_india
- [9] Raj Kumar Singh. (2013). Ground Water Information Booklet Buxar District, Bihar State.
- [10] Suman S. And Sinha S. (2024). An Overview Of Declining Population Of Blackbuck In Bihar And Other States Of India. *Bulletin Of Pure And Applied Sciences-Zoology*, 43A (1), 105-114. DOI: <https://doi.org/10.52710/Bpas-Zoo.29>
- [11] Solanki, D., Beleem, I., Kanejiya, J., & Gohil, B. (2017). A Study On Animal-Vehicle Collision In Bhavnagar City And Nearby Area, Gujarat, India. *Journal Of Entomology And Zoology Studies*, 5(1), 622-625. DOI: <https://www.entomoljournal.com/archives/2017/vol5issue1/Parti/5-1-23-230>