Journal of Research in Biology

An International Scientific Research Journal

Original Research

Distribution pattern of birds in Banni Grassland of Kachchh district, Gujarat, India

Authors:
Mukesh H. Koladiya[1], ArunKumar Roy Mahato[2], Nikunj B. Gajera[3] and Yatin S. Patel[4].

Institution:
1,2,3. Gujarat Institute of Desert Ecology, Bhuj, Kachchh-370001, Gujarat.

4. Samarth Organization Trust, Vijapur, Mehsana-382870, Gujarat.

Corresponding author:
Mukesh H. Koladiya.

Email Id:
mukeshzoology@yahoo.co.in

Web Address:
http://jresearchbiology.com/documents/RA0422.pdf.

ABSTRACT:

Birds are interesting group of animals which are distributed in all major types habitat. Banni is one of the large grassland of India invaded by *Prosopis juliflora*, an alien plant species. Invasion of this species and some other natural and anthropogenic factor leads the grassland converted into a mixture of heterogeneous habitats. A study was attempted to understand the distribution of birds in this heterogeneous grassland. The habitats were identified based on dominant species of plants. The population estimates of birds were surveyed using line transects method and point count census method.

A total of 91 species were recorded during the survey in the various habitats of this grassland. Among the seven habitats, sparse *Prosopis* was the most diverse habitat for bird species whereas *Prosopis-Capparis* was the least diverse habitat for bird species. The highest mean population density of birds were recorded in *Prosopis-Capparis* (15.9 individuals/km^2), while lowest recorded in sparse *Prosopis* habitat (9 individuals/km^2). It was found that, *Prosopis-Salvadora* (23.10±9.47) was the most dense and *Prosopis-Capperis* (8.84±5.26) was the least dense habitat for common birds of Banni grassland. In conclusion, bird species diversity and their population density estimates were varied among the various heterogeneous habitats of Banni grassland both in time and space gradients.

Keywords:
Bird, distribution, density, habitat, Banni grassland, Kachchh

Article Citation:
Mukesh H. Koladiya, ArunKumar Roy Mahato, Nikunj B. Gajera and Yatin S. Patel.
Distribution pattern of birds in Banni Grassland of Kachchh district, Gujarat, India.
Journal of Research in Biology (2014) 4(1):1228-1239

Dates:
Received: 10 Feb 2014 **Accepted:** 24 Feb 2014 **Published**: 16 April 2014

INTRODUCTION:

Various group of animals varied from survival strategies in a landscape which are evolved in long course of evolution. The distribution patterns of animals in various habitats are preferred in response to various uses and selective processes (Clark and Shutler, 1999). The distributions of life forms are not typically random in the habitat and it is generally assumed that non-random distribution of life forms is due to natural selection (Southwood, 1977). The distribution range across a heterogeneous landscape may depend on the habitat selected by the species, and animal which favors their distribution in a greater proportion of the habitat (Veech *et al.,* 2011).

Banni grassland is one of the largest remnant grassland of India. The landscape of this grassland is flat and most part of it is filled with water during monsoon which makes the grassland as a wetland. The soil salinity is normally high in most of the part due to its connection with Great Rann of Kachchh (GRK), a salt inflated marshy land. To protect the grassland from salt intrusion from GRK, *Prosopis juliflora* was introduced in fringe areas of GRK to check desertification in Banni grasslands. In present, *P. juliflora* is proved to be an invasive species for the grassland and now major part of the grassland is invaded by the species.

Birds are very important animal for this ecosystem as they are good indicators of biodiversity. Birds are one of the typical groups of animal distributed in large landscape and even some species prefer to live in heterogeneous environment distributed over continents. To understand the processes of habitat selection and preference by birds is dependent on an accurate representation of the patterns of habitat occupancy (Wiens *et al.,* 1987). Birds generally colonize in an area having presence of suitable habitat for their survival needs (Veech *et al.,* 2011). The distribution pattern of birds might also influence by distribution patterns of bird species richness (Shiu and Lee, 2003). The above understanding on the distribution pattern and habitat preference of bird communities over heterogeneous environment is very much essential for conservation and management of birds in regional as well as in local environment (Kattan and Franco, 2004).

Banni grassland is one of the rich areas of birds due to its varied micro-habitat and act as a seasonal wetland. The distribution pattern of birds across the grassland is very less understood due to the lack of study in the area. Therefore, the present study was conducted to understand the pattern of distribution of birds in time and space gradient in the grassland for their conservation and management.

MATERIALS AND METHODS:

Study Area:

Banni, the largest remnant grassland in India, situated on the south-west portion of the Kachchh Biosphere Reserve (KBR) and attached to the fringes of greater Runn of Kachchh (23°19' to 23°52' N latitude and 68°56' to 70°32' E longitude), encompassing an area of over 2,600 km^2 is taken into consideration for our study (Fig-1). A large tract of the southern part of Banni grassland is marshy land and salty waste remains a wetland in the monsoon season, known as Little Rann of Banni, which separates the Banni grassland from the mainland of Kachchh district (Shah and Somusundaram, 2010). The climate of the Banni is arid and semi-arid type therefore, the temperature is high during most of the time and it reaches a maximum of 48°-49°C during May-June and low during winter season (8°-10°C) in the month of January and February. The average yearly rainfall of this grassland is 317 mm with scanty rainfall and droughts are the common phenomenon of this area.

The grassland is situated in the semi-arid bio-climatic zone of India. The major part of grassland is now invaded by *Prosopis juliflora*, an invasive alien species. The grassland has varied types of habitat patches that attract large number of birds. Further, the seasonal

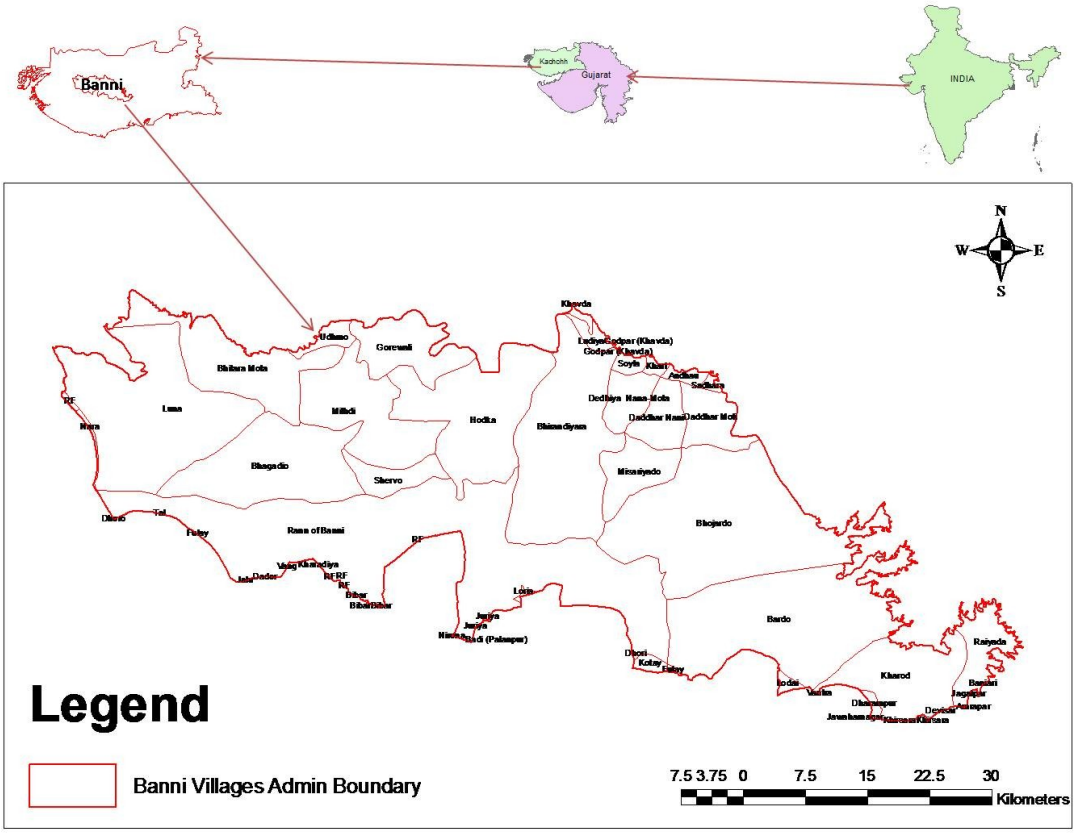

Figure 1. A map of Banni grassland, and its location in the Kachchh district of Gujarat.

water bodies (locally known as Dhandh) inside the Banni region serve as the wintering ground for many migratory species of birds.

METHODOLOGY:

A preliminary survey was made to whole of the Banni grassland for identifying transect location and number of transect location required for the survey. Based on this survey various micro-habitats were identified. A total of 60 km distance was covered by walking through various transects. The field data were collected by two observers during the whole study period between the months of June 2009 to May 2011. The birds were identified using the field guide produced by Ali (1996) and survey was conducted by using standard data sheet, GPS-Garmin, binocular (8X40) and camera.

Habitat classification:

Banni was earlier divided by 10 habitat types by Koladiya *et al.* (2012). In the present study, the Banni grassland was divided into 7 major habitat types based on the dominant plant species. It includes; Dense *Prosopis*, Moderate *Prosopis* (medium *Prosopis* density), Sparse *Prosopis, Prosopis-Capparis* Mixed, *Prosopis-Suaeda-Calotropis* Mixed, *Prosopis-Salvadora* Mixed and *Suaeda* Dominant. The vegetation of the study area was also recorded by making quadrate on the line transect and calculated the density of vegetation by using Misra (1968).

Avi-faunal Survey:

The population and distribution of birds were recorded using line transect method and point count census method (Bibby *et al.,* 1992; Bhupathy, 1991). A total of 51 transects were laid down in the whole

Table 1. Major plant species density and birds population density in various micro-habitats of Banni grassland

Habitat class	Vegetation		Mean individuals of bird/Km^2		
	Dominant species	Density/ Ha	Winter	Summer	Monsoon
Dense *Prosopis* (DP)	*Prosopis juliflora*	1200.00	12.4	4.50	20.5
Moderate *Prosopis* (MP)	*Prosopis juliflora*	833.33	12.3	4.30	17.4
Sparse *Prosopis* (SP)	*Prosopis juliflora*	483.33	8.9	2.80	15.3
Prosopis-Capparis mixed (PC)	*Prosopis juliflora*	733.33	15.5	3.00	29.1
	Capparis decidua	1400.00			
Prosopis-Suaeda-Calotropis mixed (PSC)	*Prosopis juliflora.*	1050.00	7.8	4.40	16.6
	Suaeda sps.	2133.30			
	Calotropis sps.	8933.30			
Prosopis-Salvadora mixed (PS)	*Prosopis juliflora*	433.33	21.4	5.70	17.2
	Salvadora sps.	366.67			
Suaeda dominant (SD)	*Suaeda sps.*	10000.00	13.0	4.20	20.4
Mean±SD	-	-	13.1±4.50	4.12±0.98	19.5±4.64

surveyed area. The presence of individual and group of birds within 25 m radius of circular plot was made in every 200 m distance along the line transect. The species of bird was identified using binoculars and with the help of Ali and Ripley (1983) and Grimmett *et al.*(2006). Generally, the surveys were made during the morning (7.30 am to 11.30 am) and afternoon (4.00 pm to 6.30 pm) hours of each season during 2009 and 2011.

The data recorded during the study was used to calculate vegetation density, bird's population density (Gaston, 1973; Burnham *et al.,* 1980) and tested by ANOVA between micro-habitat using Microsoft Excel 2007.

RESULTS AND DISCUSSION:

Habitat category & Vegetation density:

Among the seven identified habitats of Banni grassland *Prosopis juliflora* is the most dominant species and found in all habitats except *Suaeda* dominant habitat. The flag ship and dominant species of plants in the seven identified habitat were *Prosopis juliflora, Capparis decidua*, *Suaeda spp., Calotropis spp.* and *Salvadora spp.* The density of major plant species calculated in each habitat type is given in table-1.

Species Richness and diversity:

A total of 91 Species of avi-fauna belonging to 62 genera under 35 families and 11 orders were observed during the whole study period (given in Annexure-I). Among the total observed bird species, 59 were resident and 32 were migratory in nature. The number of bird species recorded in Banni grassland based on their feeding guilds included; granivorous (32 species), insectivorous (30 species), frutivorous (12 species), piscivorous (10 species) and others (7 species). Based on the transect survey in various seasons, the maximum bird species recorded during monsoon (83 species), next

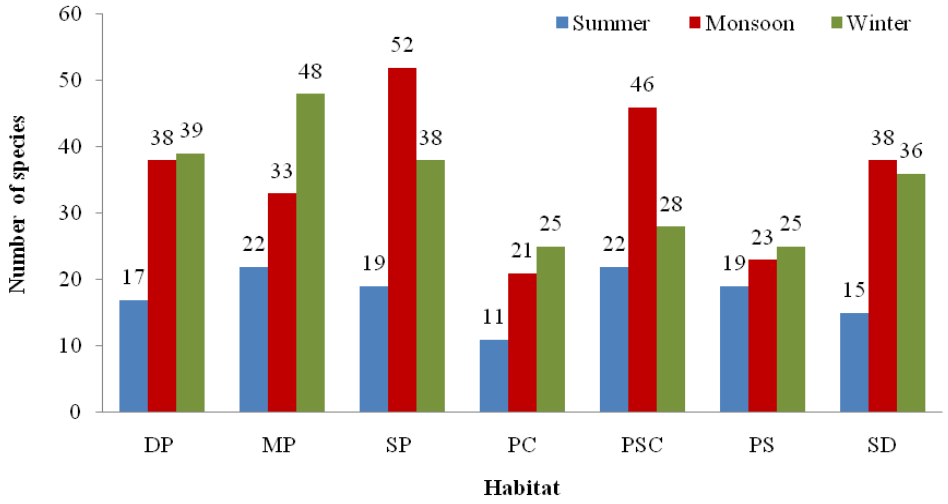

Figure 2. Seasonal Avian species richness in various habitat of Banni grassland

to that in winter (67 species) and minimum during summer (32 species).

The total number of avian species was recorded lower than number of species (163) recorded by Gajera *et al.* (2012, 2013a, 2013b) in wetland, arid grasslands and mining areas respectively distributed in western part of Kachchh district. It is also noted that 56 species of birds recorded alone from the Pena thattah, a seasonal wetland located in the western part of Banni grassland by Koladiya *et al.* (2013).

The species diversity (Shannon_H) was recorded to found highest in *Sparse Prosopis* (H=2.20) habitat and lowest in *Prosopis-Capparis* mixed (H= 0.91) habitat (fig-2). The above result highlighted that avian species diversity was also lower in comparison to the species diversity recorded by Gajera *et al.* (2012, 2013a, 2013b) in wetland, grassland and mining areas distributed in western parts of Kachchh district.

Distribution of birds in various micro-habitat:

Out of the total species recorded during the whole study period, the number of bird species recorded in 7 identified habitats were as follows; dense *Prosopis* (45 species), moderate *Prosopis* means Prosopis density between more than 500 and less than 1000 individuals/

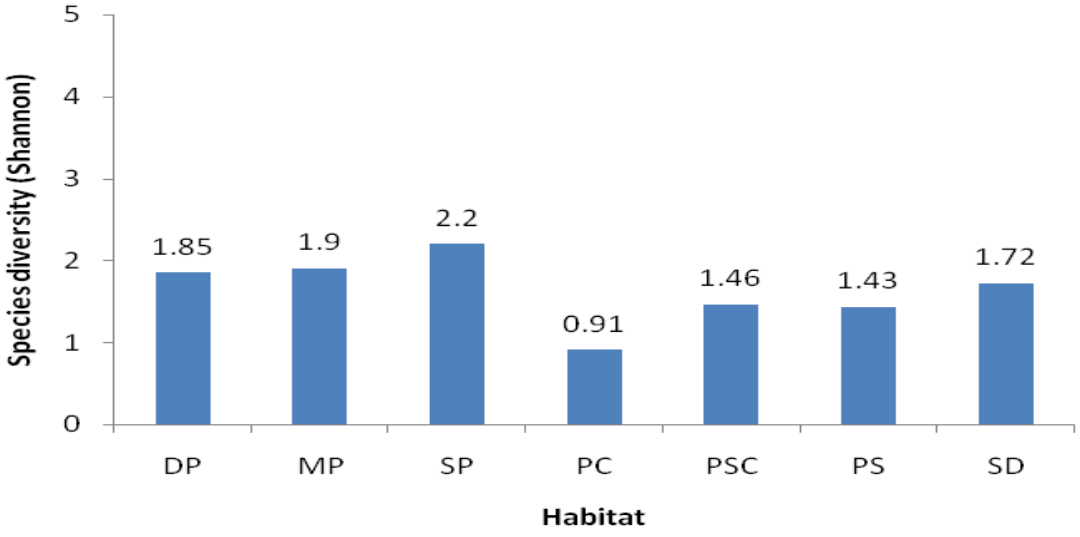

Figure. 3. Bird species diversity in various habitats of Banni grassland, Kachchh

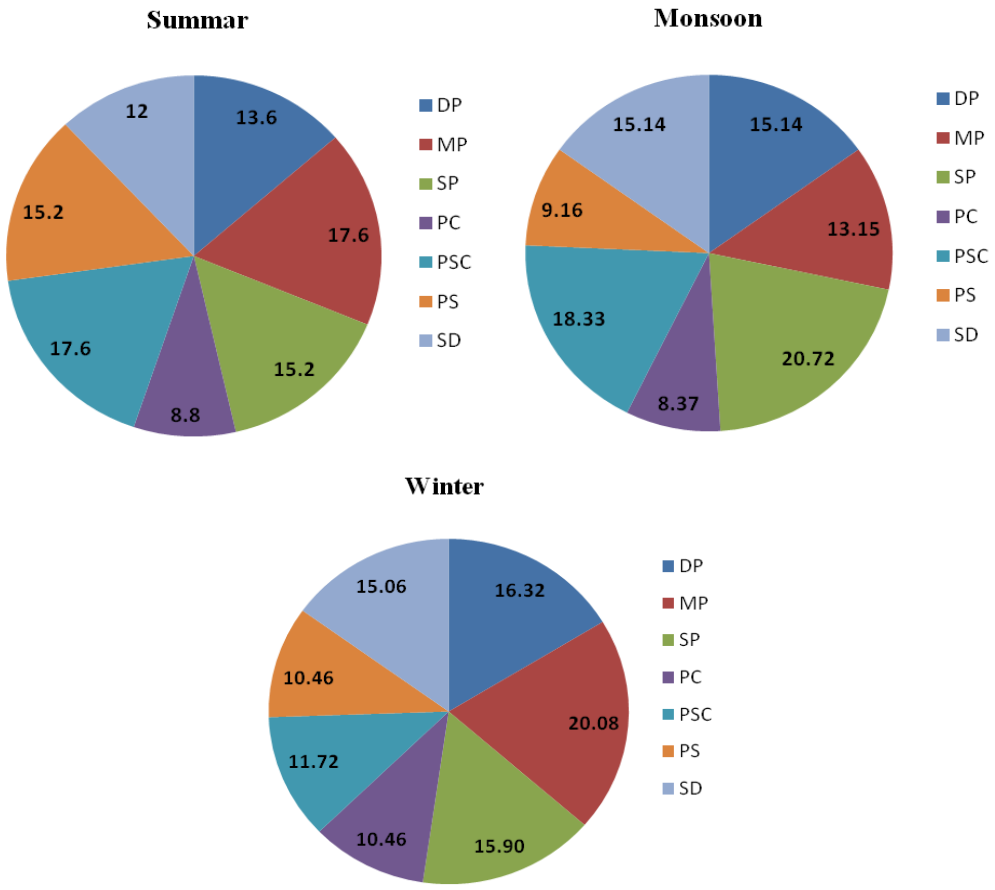

Figure 4. Seasonal abundance (%) of birds in Banni grassland of Kachchh, Gujarat

ha. (56 species), sparse *Prosopis* (60 species), *Prosopis-Capparis* mixed (28 species), *Prosopis-Suaeda-Calotropis* mixed (50 species), *Prosopis-Salvadora* mixed (30 species) and *Suaeda* dominant (40 species) respectively. The above result highlighted that sparse *Prosopis* was the rich habitat for bird species diversity and *Prosopis-Capparis* mixed was the least supportive habitat for bird species diversity in Banni grassland. The number of species diversity between three season (summer, monsoon and winter) was significantly varied ($F=14.40$, $df=2$, $p<0.001$) while species diversity between various habitat were significantly not varied.

On analysis of seasonal distribution of bird species in 7 identified habitats of Banni grassland, it was found that sparse *Prosopis*, *Prosopis-Suaeda-Calotropis* and dense *Prosopis* were the preferred habitat during monsoon season; moderate *Prosopis*, dense *Prosopis* and *Suaeda* dominant are the preferred habitat during winter season; moderate *Prosopis* and *Prosopis-Suaeda-Calotropis* are the most preferred habitat during the month of summer (Fig-3). The percent of species recorded in each type of habitat in seasonal basis is shown in Figure-4.

We found that the mean population density (Mean ± SD) of birds was highest during monsoon season (19.5±4.64) and least density during summer season (4.12±0.98). The seasonal population density of birds in various habitats of Banni grassland is given in table-1. It was found that the highest population density of birds was found in *Prosopis-Capparis* mixed habitat (29.1 individuals/km^2) during monsoon and least density was recorded in sparse *Prosopis* habitat (2.8 individuals/ km^2) during summer season. The mean population density of birds recorded in various habitats of Banni grassland is shown in fig-5. Among the various habitat, the highest mean population density of birds were

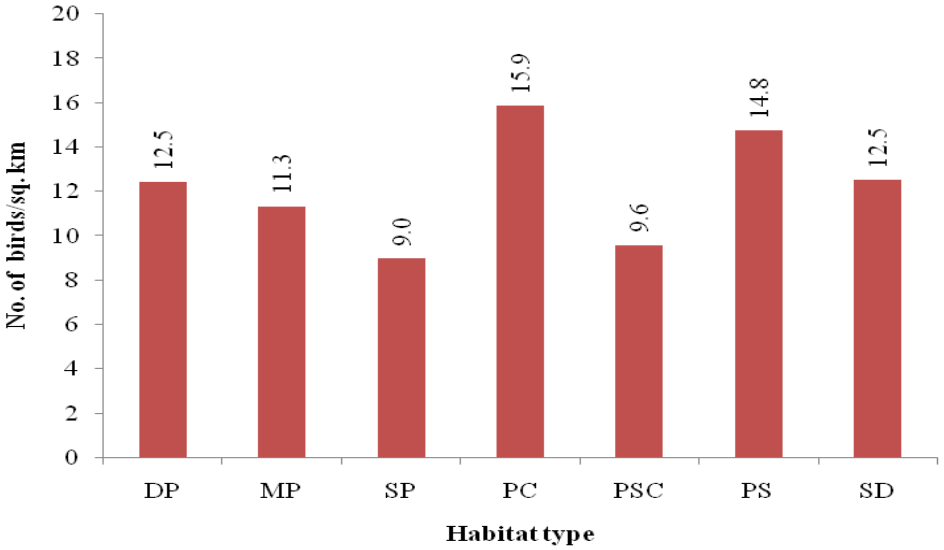

Figure 5. Population density of birds in various habitats of Banni grassland, Kachchh

recorded in *Prosopis-Capparis* (15.9 individuals/km^2) and *Prosopis-Salvadora* habitats (14.8 individuals/km^2) while lowest mean population density was recorded in sparse *Prosopis* habitat (9 individuals/km^2). The result revealed that the density of birds in Banni grassland was higher in relation to the density of birds recorded by Gajera *et. al* (2013b) in western part of Kachchh.

Distribution pattern of common birds:

We analyse the population density estimates of commonnly occuring 10 species of birds in identified seven habitat types of Banni grassland (Table-1). It was found that, *Prosopis-Salvadora* was the most dense habitat of six common species of birds viz. house crow, lark, babblar, dove, bee eater and bul bul; sparse *Prosopis* was the most dense habitat of pegion and drongo; dense *Prosopis* for sand groose and *Prosopis-Suaeda-Capparis* was the most dense habitat for francolin. Similarly, *Suaeda* dominent was the least dense habitat of four species viz. babblar, dove, bee eater and bul bul; *Prosopis-Capparis* and *Prosopis-Suaeda-Capparis* were the least dense habitat for three species of common birds viz. house crow, francolin, dansgroose and lark, pigeon, drongo respectively. On estimating the overall mean density (Mean±SD) of common birds, it was found that, *Prosopis-Salvadora* (23.10±9.47) was the most dense habitat and *Prosopis-Capparis* (8.84±5.26) was the least dense habitat for the common birds of Banni grassland.

CONCLUSION:

In conclusion, the diversity of birds in banni grassland is rich with sparse *Prosopis* is the richest habitat compare to other habitat in relation to species diversity. *Prosopis juliflora*, an invasive alien species of plant in the grassland is playing major role in the distribution of avi-fauna in this region. *Prosopis juliflora* is the dominant species of plant of this grassland which provide habitat for nesting of birds and greater visibility of birds for preying. Based on the results of the study, it was found that monsoon season attracts more number of species of birds in the grassland because large portion of the grassland is converted into seasonal wetland during the season. However, habitats with dominance of mixed vegetation are the dense in habitat for birds compared to other habitats of the grassland.

ACKNOWLEDGEMENTS:

We would like to thank Dr. R. V. Asari, Director, Gujarat Institute of Desert Ecology (GUIDE) for providing logistic supports and his encouragement. We

are thankful to Mr. Yatin Patel for his help in Plant data analysis for the manuscript. We are also thankful to all scientist and scholars of Terrestrial Ecology Division of GUIDE for their help and valuable comments. We are grateful to State Forest Department, Gujarat for providing funds for conducting this study.

REFERENCES:

Ali S and Ripley SD. 1983. A Pictorial Guide to the birds of the Indian subcontinent. Bombay Natural History Society. Oxford University Press, Bombay.165p.

Ali S. 1996. The book of Indian birds, Bombay Natural History Society. 345 p.

Bhupathy S. 1991. Population and resource utilization of waterfowl in Keoladeo National Park, Bharatpur. Ph.D. Thesis. Rajasthan University, Jaipur.

Bibby CJ and Burgess ND. Hill DA. 1992. Bird census Techniques. Academic press, U.K. London.

Burnham KP, Anderson DR and Laake JL. 1980. Estimation of Density from Line Transect: Sampling of Biological populations. Wildlife Monograph. 72: 202 p.

Clark RG, Shutler D. 1999. Avian habitat selection: Pattern from process in nest-site use by ducks? Ecol., 80 (1): 272-287.

Gajera NB, Mahato AK Roy and Vijay Kumar V. 2012. Wetland birds of arid region-a study on their diversity and distribution pattern in Kachchh. Columban J Life Sci., 13(1&2): 47-51.

Gajera NB, Mahato AK Roy and Vijay Kumar V. 2013a. Status, Distribution and Diversity of Birds in mining environment of Kachchh, Gujarat. *Intern J Biod.,* http://dx.doi.org/10.1155/2013/471618.

Gajera NB, Mahato AK Roy and Vijay Kumar V. 2013b. Status, diversity and conservation of grassland birds in arid region of Kachchh. Intern J Rec Sci Res., 4 (3):166-170.

Gaston AJ. 1973. Methods for estimating bird populations. J Bomb Nat Hist Soc., 72(2): 271–283.

Grimmett R, Inskipp C and Inskipp T. 2006. Pocket Guide to the birds of the Indian sub-continent. Oxford University Press, New Delhi. 384 p.

Kattan GH, Franco P. 2004. Bird diversity along elevational gradients in the Andes of Colombia: area and mass effects. Global Ecol Biog. 13(5): 451-458.

Koladiya MH, Gajera NB and Vijay Kumar V. 2013. Status, diversity and distribution of avifauna in Banni Grassland of Kachchh district. 3(1): 43-47.

Koladiya MH, Mahato AK Roy, Shah JP and Vijaykumar V. 2013. Avifauna of *"Pena Thathh"*: A Lesser known Wetland in Banni Grassland of Kachchh district, Gujarat, India. Intern J Res BioSci. 2(1): 59-65.

Misra R. 1968. Ecology Work Book, Oxford and IBH Publication Co. Calcutta. 244 p.

Shah J and Somusundaram S. 2010. Preliminary GIS and Remote sensing analysis on Banni grasslands, Kachchh. PRAJÑĀ – J. Pure App. Sci. 18: 15 - 17.

Shiu HJ, Lee PF. 2003. Seasonal Variation in Bird Species Richness along Elevational Gradients in Taiwan. Acta Zool Taiwan. 14(1):1 -21.

Southwood TRE. 2011. Habitat, the Templet for Ecological Strategies? J Ani Ecol., 46(2):337-365.

Veech JA, Small MF and Baccus JT. 2011. The effect of habitat on the range expansion of a native and an introduced bird species. J Biog. 38(1): 69–77.

Wiens JA, Rotenberry JT. Horne BV. 1987. Habitat Occupancy Patterns of North American Shrubsteppe Birds: The Effects of Spatial Scale. Oikos. 48(2):132-147.

Annexure I
List of bird species recorded in various habitat of Banni grassland

S. No	Family	Scientific Name	Common Name	MS	Habitat
1	Phasianidae	*Francolinus pondicerianus*	Grey Francolin	R	DP, MP, SP, PSC,SD
2	Upupidae	*Upupa epops*	Common Hoopoe	R	MP, SP, SD
3	Coraciidae	*Coracias garrulus*	European Roller	RM	MP, SP, SD
4		*Coracias benghalensis*	Indian Roller	R	SP, PC
5	Meropidae	*Merops orientalis*	Green Bee-eater	R	DP, MP, SP, PC, PS
6		*Merops leschenaulti*	Chestnut-Headed Bee-Eater	R	DP, MP, SP, PC, PS
7	Cuculidae	*Eudynamys scolopacea*	Asian Koel	R	SP, PC, PS
8	Centropodidae	*Centropus sinensis*	Greater Coucal	R	MP, SP, SD
9	Psittacidae	*Psittacula krameri*	Rose-Ringed Parakeet	R	PC, PS, SD
10	Apodidae	*Apus affinis*	House Swift	R	MP, SP, SD
11	Strigidae	*Bubo bubo*	Eurasian Eagle-Owl	R	DP, MP, SP
12	Columbidae	*Columba livia*	Blue Rock Pigeon	R	DP, MP, SP, PC
13		*Streptopelia decaocto*	Eurasian Collared Dove	R	DP, MP, SP, PC
14		*Streptopelia tranquebarica*	Red Collared Dove	R	DP, MP, SP, PC
15		*Streptopelia chinensis*	Spotted Dove	R	DP, MP, SP, PC
16		*Streptopelia senegalensis*	Little Brown Dove	R	DP, MP, SP
17	Pteroclididae	*Pterocles exustus*	Chestnut-bellied Sandgrouse	R	DP, MP, SP, PC
18		*Pterocles indicus*	Painted Sandgrouse	R	DP, MP, SP, PC
19	Accipitridae	*Circus pygargus*	Montagu's Harrier	RM	MP, PSC
20		*Circus aeruginosus*	Eurasian Marsh Harrier	WV	DP, MP, PSC
21		*Circus cyaneus*	Hen Harrier	WV	DP, MP, PSC
22		*Circus macrourus*	Pallid Harrier	R	DP, MP, PSC
23		*Accipiter badius*	Shikra	R	MP, SP, PSC
24		*Elanus caerulus*	Black-Shouldered Kite	R	MP, SP, PSC
25		*Milvus migrans*	Black Kite	R	MP, SP
26		*Pandion haliaetus*	Osprey	RM	SP, SD
27		*Aquila pomarina*	Lesser Spotted Eagle	R	DP, MP, PSC
28		*Aquila nipalensis*	Steppe Eagle	WV	DP, MP, PSC
29	Falconidae	*Falco tinnunculus*	Common Kestrel	WV	DP, MP, PSC
30	Lanidae	*Lanius excubitor*	Grey Shrike	RM	DP, MP, PSC, PS

31		*Lanius cristatus*	Brown Shrike	M	DP, MP, PS, SD
32		*Lanius vittatus*	Bay-backed Shrike	R	DP, MP, PS, SD
33		*Lanius schach*	Rufous-tailed Shrike	R	DP, MP, PS, SD
34		*Lanius meridionalis*	Southern Grey Shrike	RM	DP, MP, PS, SD
35	Corvidae	*Corvus splendens*	House Crow	R	DP, MP, SP, SD
36		*Corvus macrorhynchos*	Jungle Crow	R	DP, MP, SP, SD
37		*Dicrurus macrocerus*	Black Drongo	R	DP, MP, PS, SD
38	Muscicapidae	*Saxicola jerdoni*	Jerdon's Bushchat	R	MP, SP, PS, SD
39		*Saxicola caprata*	Pied Bush Chat	R	MP, SP, PS, SD
40		*Oenanthe deserti*	Desert Wheatear	RM	MP, SP, PSC, SD
41		*Oenanthe picata*	Variable Wheatear	M	SP, PSC, SD
42		*Oenanthe isabellina*	Isabelline Wheatear	M	SP, PSC, SD
43		*Copsychus saularis*	Oriental Magpie Robin	R	DP, MP, SP, PC, SD
44		*Saxicoloides fulicata*	Indian Robin	R	DP, MP, SP, PC, SD
45	Sturnidae	*Sternus roseus*	Rosy Starling	WV	DP, MP, PS
46		*Acridotheres tristis*	Common Myna	R	DP, MP, PS
47		*Acridotheres ginginias*	Bank Myna	R	DP, MP, PS
48	Paridae	*Parus nuchalis*	Pied Tit	R	MP, SP, SD
49	Hirundinidae	*Hirundo rustica*	Barn Swallow	WV	SP, SD
50		*Hirundo smithii*	Wire-tailed Swallow	R	SP, SD
51		*Hirundo daurica*	Red-Rumped Swallow	R	SP, SD
52		*Delichon urbica*	Northern House-Martin	RM	SP, SD
53	Pycnonotidae	*Pycnonotus cafer*	Red-Vented Bulbul	R	DP, MP, PC, PSC,PS,SD
54		*Pycnonotus leucotis*	White-eared Bulbul	R	DP, MP, PC, PSC,PS,SD
55	Cisticolidae	*Prinia buchanani*	Rufous-fronted Prinia	R	DP, SP, PSC, PS
56		*Prinia inornata*	Plain Prinia	R	DP, SP, PSC, PS
57		*Prinia sylvatica*	Jungle Prinia	R	DP, SP, PSC, PS
58		*Prinia socialis*	Ashy Prinia	R	DP, SP, PSC, PS
59	Sylvidae	*Orthotomus sutorius*	Common Tailorbird	R	DP, MP, PC, PSC, PS
60		*Hippolais caligata*	Booted Warbler	R	DP, SP, PC, PSC, PS
61		*Turdoides caudatus*	Common Babbler	R	DP, MP, PC, PSC, PS
62		*Turdoides malcolmi*	Large Grey Babbler	R	DP, MP, PC, PSC, PS
63		*Turdoides striatus*	Jungle Babbler	R	DP, MP, PC, PSC, PS
64	Alaudidae	*Galerida cristata*	Crested Lark	R	SP, PC, PSC
65		*Eremopterix grisea*	Ashy-crowned, Sparrow-Lark	R	SP, PC, PSC

66		*Mirafra erythroptera*	Indian Bushlark	R	DP, MP, PC, PSC
67		*Mirafra cantillans*	Singing Bushlark	R	MP, SP, PC, PSC
68		*Calandrella raytal*	Short-toed lark	M	MP, SP
69		*Galerida deva*	Sykes's Crested Lark	R	MP, SP, PSC
70	Nectarinidae	*Nectarinia asiatica*	Purple Sunbird	R	DP, SP, PC, PSC, PS
71	Passeridae	*Passer domesticus*	House Sparrow	R	SP, PSC, PS
72		*Anthus rufulus*	Paddyfield Pipit	RM	DP, PSC, PS
73		*Lonchura malabarica*	Indian Silverbill	R	DP, PC, PSC, PS
74		*Motacilla alba*	White Wagtail	WV	SP, PSC
75		*Motacilla flava*	Yellow Wagtail	WV	SP, PSC
76		*Motacilla cinerea*	Grey Wagtail	WV	SP, PSC
77		*Ploceus philippinus*	Baya Weaver	R	SP, PC
78	Alcedinidae	*Alcedo atthis*	Common Kingfisher	R	MP, PSC
79	Dacelonidae	*Halcyon smyrnensis*	White-breasted Kingfisher	R	SP, PSC
80	Cerylidae	*Ceryle rudis*	Pied Kingfisher	R	SP,PC, SD
81	Gruidae	*Grus grus*	Common Crane	WV	SP, PSC, SD
82		*Grus virgo*	Demoiselle Crane	WV	SP, PSC, SD
83	Charadridae	*Vanellus indicus*	Red-Wattled Lapwing	R	MP, PSC, SD
84	Anhingidae	*Anhinga melanogaster*	Darter	R	PSC, SD
85	Ardeidae	*Bubulcus ibis*	Cattle Egret	R	MP, PSC, SD
86		*Casmerodius albus*	Great Egret	R	SP, PSC, SD
87		*Egretta garzetta*	Little Egret	R	SP, PSC, SD
88		*Mesophoyx intermedia*	Intermediate Egret	R	SP, PSC, SD
89	Threskiornithidae	*Pseudibis papillosa*	Black Ibis	R	MP, PC, SD
90		*Platalea leucorodia*	Eurasian Spoonbill	R	SP, PC, SD
91	Ciconidae	*Mycteria leucocephala*	Painted Stork	R	SP, PC, SD

MS: Migratory Status, R: Resident, RM: Resident Migratory, WV: Winter visitor, DP: Dense Prosopis, MP: Moderate Prosopis, SP: Sparse Prosopis, PC: *Prosopis-Capparis* mixed PSC: *Prosopis-Suaeda-Calotropis* mixed, PS: *Prosopis-Salvadora* mixed, SD: *Suaeda* dominant

Annexure II. Photographs showing Banni grassland and a few birds sited

Banni grassland

Galerida deva

Accipiter badius

Grus grus

Aquila nipalensis

Upupa epops