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Comparative account of faunal diversity of four major Islands (*Bets*) in Little Rann of Kachchh (LRK), Gujarat, India

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Abstract

'Bets' (i.e., islands) are the unique ecosystems in the saline desert of the Little Rann of Kachchh (LRK) in Gujarat State, India. There are around 74 bets in the LRK and larger ones among them can be considered to be the "oases" amidst the vast saline flats of the Rann owing to relatively better vegetation status (sometimes with freshwater availability). Owing to relatively better vegetation status, bets also support relatively richer fauna. The present study focused on having a comparative account of the faunal diversity of major islands (locally called 'bets') that have area larger than 1000 ha which included Pung bet, Jilandhar bet, Nanda bet and Mardak bet. The field study was conducted between October 2015 and March 2017. Out of the four major bets, highest faunal species diversity was recorded on Nanda bet (i.e., Birds=117 species, Mammals=22 species, Herpetofauna=12 species). The second-highest faunal species diversity was recorded on the Mardak bet (i.e., Birds=67 species, Mammals=17 species, Herpetofauna=7 species), Jilandhar bet had the third-highest faunal species, whereas Pung bet, despite its largest area among all the major bets had the lowest faunal species richness (Birds=12 species, Mammals=10 species and Herpetofauna=2 species). Remote sensing based Land Use Land Cover assessment of various bets indicated that among these bets, Nanda bet (having 2032 ha area) had the highest habitat diversity (13 habitats), followed by Mardak bet (10 habitats) and Jilandhar bet (10 habitats) in that order. Pung bet, despite its largest area (i.e., 459200 ha) had the lowest habitat diversity (8 habitats). Thus, the study has inferred that higher habitat diversity on the large sized bets (and not just the area of the bets) might be facilitating higher faunal species richness. With the use of Jaccard's Similarity Index (JSI), it was further found that faunal species composition of, Nanda bet and Mardak bet had high species similarity with respect to birds and mammal's species. On the contrary, for herpetofaunal species, Jilandhar and Pung bet had indicated high degree of species similarity.

Keywords: Faunal diversity, Jaccard's Similarity Index (JSI), Little Rann of Kachchh (LRK), major bets, species composition, species diversity.

Introduction

The Little Rann of Kachchh (LRK), which is spread over Kachchh, Banaskantha, Patan, Surendranagar and Morbi districts of Gujarat State, India, is a unique landscape with thousands of square kilometers area. A large portion of it (495300 ha) is being managed as Wild Ass Sanctuary (WAS) since 1978[1]. The LRK is a remarkably flat land[1]. It is also a seasonally flooded wetland ecosystems[2]. However, most of the Rann gets dried by end of the November or mid-December, except for low-laying parts such as Adesar (i.e., around Nanda *bet*), where the waters dry up by the month of January[3,4,1]. This unique landscape is inhabited by a large number of faunal species including 178 species of birds, 19 species of mammals and 33 species of herpetofauna[5,1].

The existing faunal species inhabit various ecosystems and micro-ecosystems in the LRK landscape for resting, roosting, foraging and breeding life requisites. *Bet*s (i.e., islands) are the unique ecosystems in the LRK landscape that are known to support a variety of wild animal species including the flagship species of LRK, viz. Indian Wild Ass (*Equus hemionus khur*)[6]. There are around 74 *bet*s in the LRK[5,1] and larger ones among them can be considered to be the oases amidst the vast saline flats of the Rann owing to relatively better vegetation status (sometimes with freshwater availability). Owing to relatively better vegetation status, *bet*s are capable of supporting relatively rich fauna.

The present study focused on depicting a comparative account of the faunal diversity of major islands (locally called '*bets*') that have area larger than 1000 ha which included Pung *bet*, Jilandhar *bet,* Nanda *bet* and Mardak *bet*. The field study was conducted between October 2015 and March 2017.

Study area: The present study was confined to the major *bets* (i.e., Pung, Jilandhar, Mardak and Nanda *bet*s) of the Little Rann of Kachchh (LRK). The LRK is geographically located between 23°10'N to 23°45'N Latitudes and 70°45'E to 71°45' E Longitudes[1]. The LRK has unique characteristics of both desert and wetland and therefore it supports unique assemblages of flora and fauna[7]. The *bets* provide vital habitat for existing

wild animals particularly during monsoon and post monsoon season. The *bets* also serve refuge and breeding ground for wild animals from surrounding areas as the whole Rann is inundated with waters from the seasonal rivers surrounding the landscape[1].

Site: 1 Nanda *bet*: The *bet* is located towards the western fringe of the LRK under the jurisdiction of the Western fringe of Adesar range of the LRK. Human settlements was observed on this *bet*. The area spreads over 2032ha with maximum area covered by mudflat followed by agriculture crop land and sparse tree cover. Of the total recorded faunal species, highest species was recorded on this *bet*.

Site: 2 Mardak *bet*: The *bet* is located on the western part of the LRK on the south east of the Pung *bet*. Amongst all major *bets*, Mardak *bet* owing highest pick (i.e., 55m) above mean sea level of the LRK[5,1]. The *bet* spreads over 2654 ha with maximum area covered by sparse herbaceous followed by salt affected land and sparse tree.

Site: 3 Pung *bet*: The *bet* is located almost in the centre of the LRK under the jurisdiction of the Eastern fringe of Bajana range of the LRK. Largest *bet* in the LRK spread over in 459200 ha area with maximum area covered by adjoining mudflat followed by sparse herbaceous and dense tree.

Site: 4 Jilandhar *bet*: The *bet* is located towards the Eastern fringe (near Zinzuwada village). Geographically, second largest *bet* of the LRK spread over 2897 ha area with maximum area covered by sparse tree followed by dense tree cover and adjoining mudflat.

Methodology

For inventorying the faunal species, point count method and transect methods are considered to be good alternative. Of these two well-known approaches, transect method was employed in the present study. Line transect method is a very appropriate strategy to estimate abundance of different species[8,9]. Therefore, for building faunal inventory, a total of 12 *Bet* transects were laid on the four major *bets* with the total length of 40.63km. These transects were conducted seasonally, covering post-monsoon, summer and winter season.

In each season, each transect was conducted once in the morning (i.e., between 0630hrs and 1000hrs) and once in the evening (i.e., between 1600hrs and 1830hrs). Identifications of birds, mammals and herpetofauna was done with the help of identification/pictorial guides i.e., for birds[10-12], For mammals[13,14], for herpetofauna[15-18]. Birds and mammals were observed using a pair of 10x50 binoculars, a spotting scope (16-48X/20-60X), a DSLR camera, GPS unit and predesigned datasheets. Camera traps were also used for detecting the presence of secretive and/or nocturnal animal (mainly mammals) on each of the four *bet*s.

Table-1: Details of transects and area of major islands (*bet*s) in the LRK.

Bet's Name	Area of the bet (ha)	No. of Transects	Length of Transects (Km)
Nanda *bet*	2032	2	8.73
Mardak *bet*	2654	4	10.8
Jilandhar *bet*	2897	2	9.2
Pung *bet*	4592	4	11.9

Results and discussion

Faunal species composition of four major islands (*bets*): Among all the four major *bets*, Nanda *bet* (near Adesar on the Western Fringe; Figure-1) recorded the highest faunal diversity. Among the four bets covered for this study, Nanda had been the smallest one having an area of 2032ha. However, this had been the *bet* with the highest number of habitats (i.e., 13 habitats; Figure-5). Some of the habitats, i.e., village settlement and agricultural land (including 462ha of cropland and 268ha of fallow land).

It was interesting to reveal that this *bet* not only had the highest habitat diversity, but also had highest faunal species richness (i.e., total 151 faunal species). Thus, it was found that this *bet* was inhabited by 117 species of birds, 22 mammalian species and 12 species of herpetofauna (Figure-1). In other words, species richness of birds, mammals and herps was the highest among those for all the four *bet*s.

Mardak *bet* had been another large *bet* (with an area of 2654 ha), which happened to be somewhat larger than the smallest *bet*, but smaller than other two larger *bets*, viz., Jilandhar and Pung bets. Interestingly, though this bet was amongst the two smallest *bets* (among the large four *bets*), it had the second-highest faunal species richness (with total 91 species) which might be due to high (second-highest) habitat diversity (i.e., total 10 habitats, Figure-6). A total of 67 species of birds, 17 species of mammals and 7 species of herpetofauna were recorded on Mardak *bet* during the study (Figure-2).

Jilandhar *bet* located adjacent to the Eastern fringe of the LRK had been the second largest *bet* with an area of 2897 ha. Despite the second largest area, it supported relatively low faunal species (i.e., 66 species including 52 species of birds, 10 species of mammals and 4 species of herpetofauna; Figure-3). The likely reason for relatively lower faunal species richness could be relatively lower habitat diversity (i.e., 10 habitats; Figure-7) with predominance of dense and sparse *Prosopis* (tree) cover. Another likely reason for the lower species richness on Jilandhar *bet* could be the human disturbance due to activities like *Prosopis* cutting, charcoal-making, pilgrim transportation etc.[1]

It was very interesting to find that though Pung had been the largest *bet* (with an area of 4592 ha) it was inhabited by the lowest number of faunal species (i.e., total 24 species including 12 species of birds, 10 species of mammals and 2 species of herpetofauna; Figure-4). The likely cause for the lowest faunal diversity on this *bet* could be the lowest habitat diversity (i.e., total 8 habitats against 13 on Nanda and 10 on Mardak). This *bet* also experiences high human disturbance due to livestock grazing of the nearby fringe villages and vehicles passing through adjacent area.

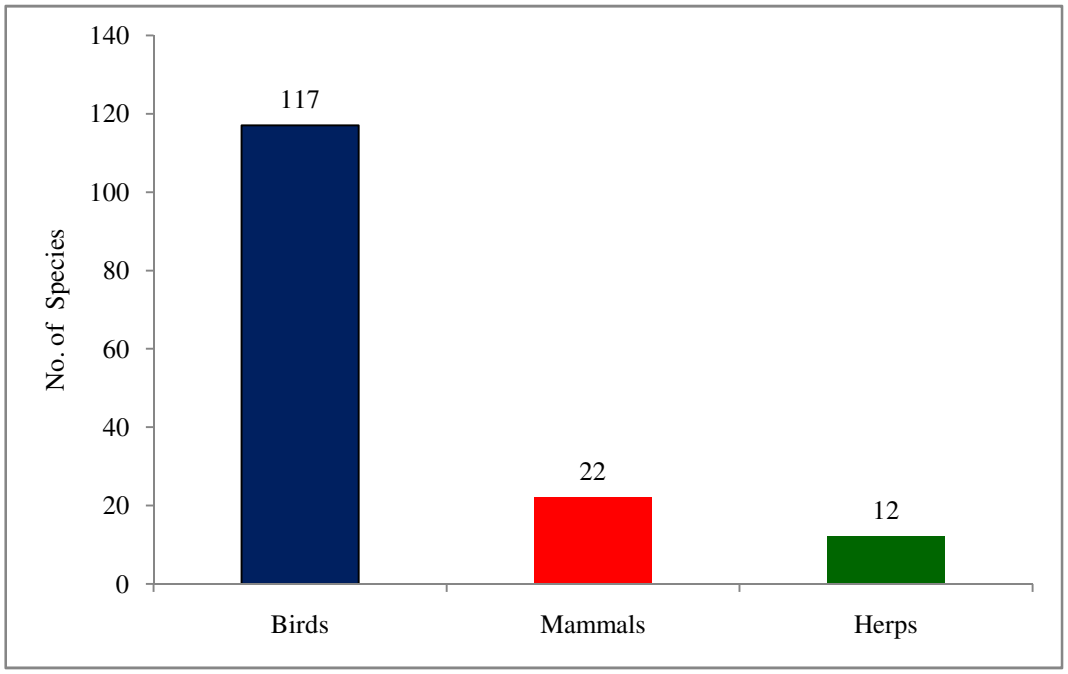

Figure-1: Species richness on Nanda *bet.*

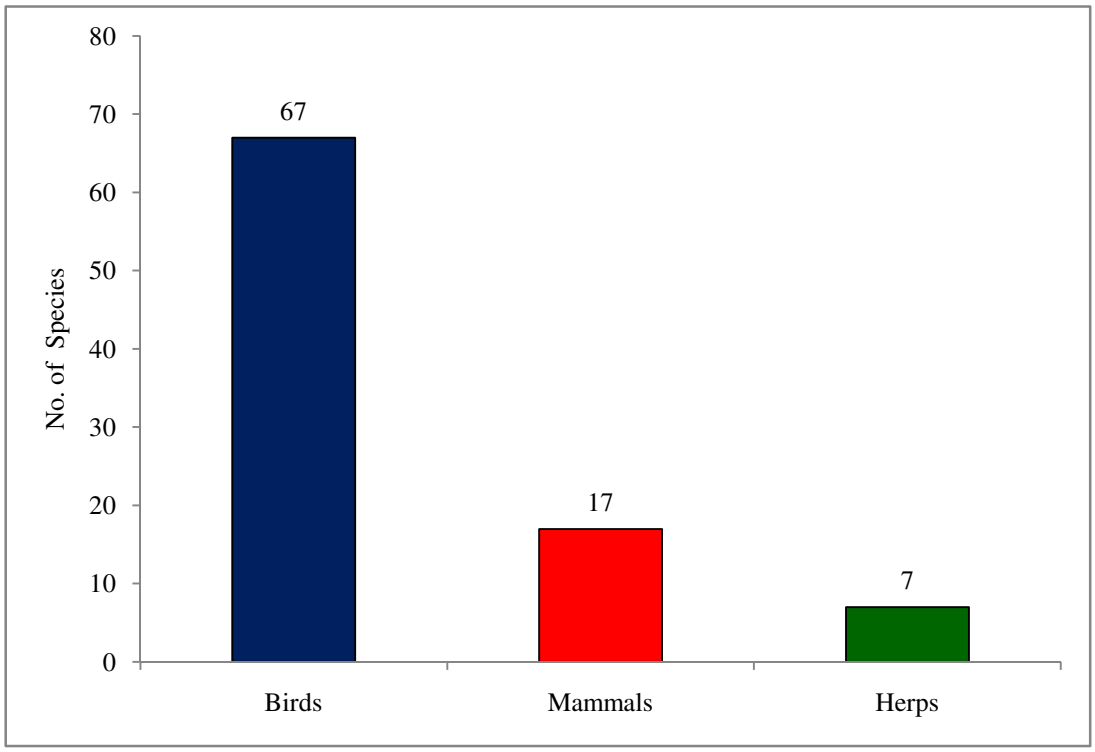

Figure-2: Species richness on Mardak *bet.*

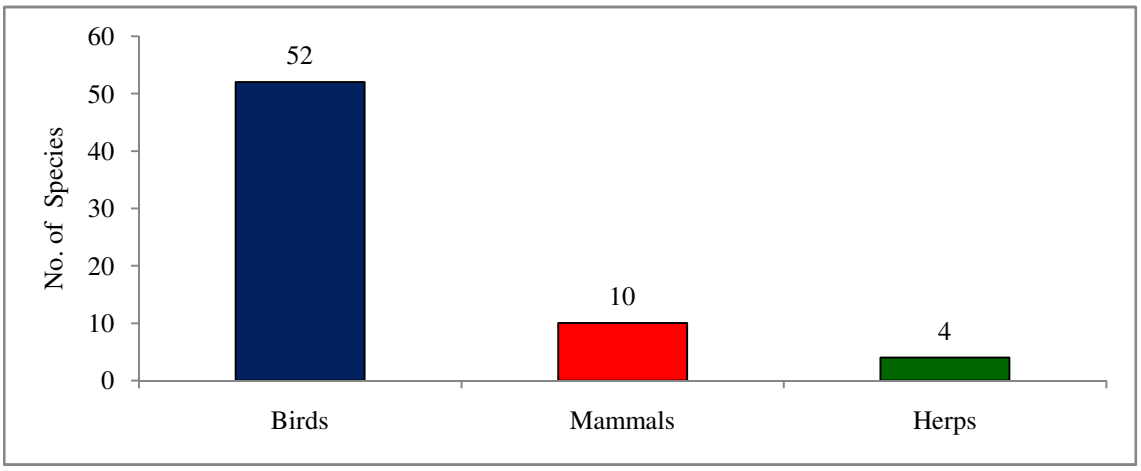

Figure-3: Species richness on Jilandhar *bet.*

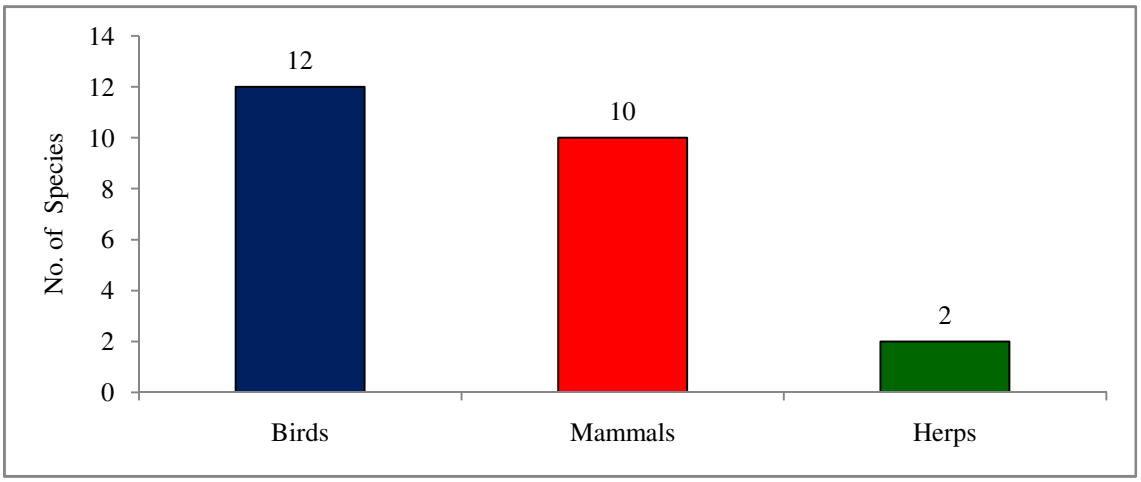

Figure-4: Species richness on Pung *bet.*

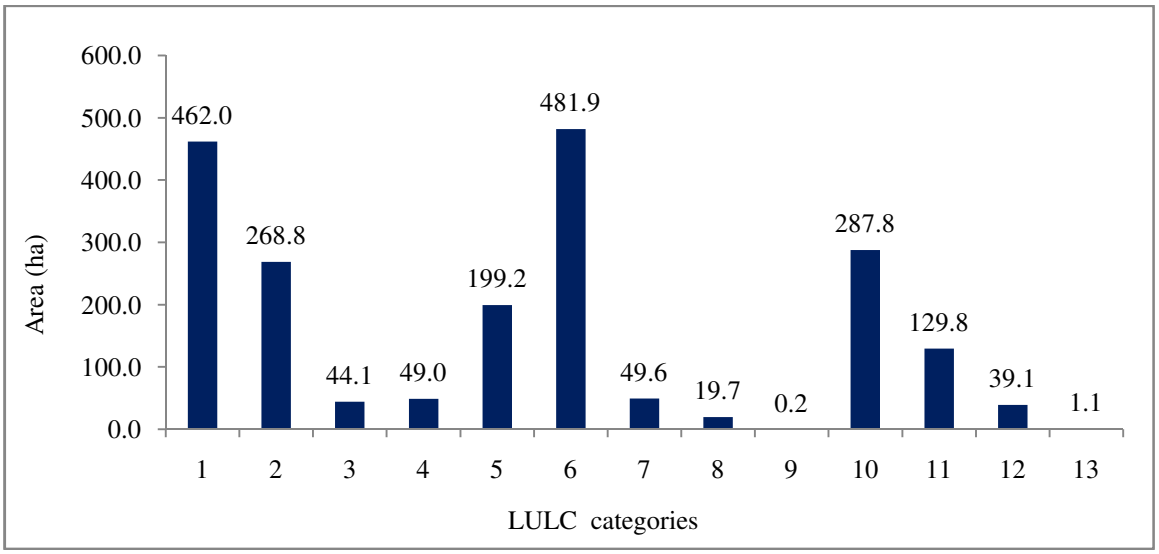

Figure-5: Habitats and their area (ha) on Nanda *bet.*

Note: 1= Agriculture Cropland, 2= Agriculture Fallow land, 3= Aquatic Vegetation, 4= Dense Herbaceous, 5= Dense Tree, 6= Mudflat, 7= Open Land, 8= Salt Affected, 9= Salt Encrusted, 10=Sparse Tree, 11= Sparse Herbaceous, 12= Village Settlement, 13= Water body.

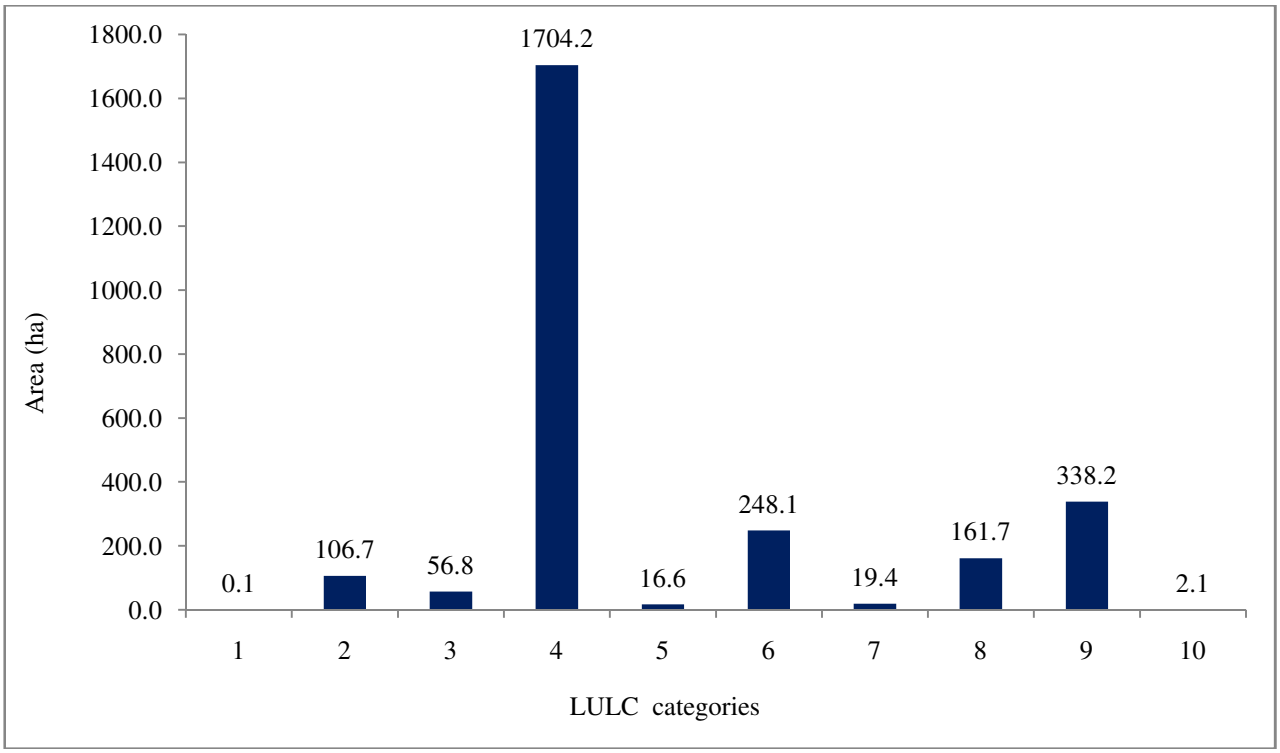

Figure-6: Habitats and their area (ha) on Mardak *bet.*

Note: 1= Aquatic Vegetation, 2= Dense Herbaceous, 3= Dense Tree, 4= Mudflat, 5= Open Land, 6= Salt Affected, 7= Salt Encrusted, 8=Sparse Tree, 9= Sparse Herbaceous, 10= Water body.

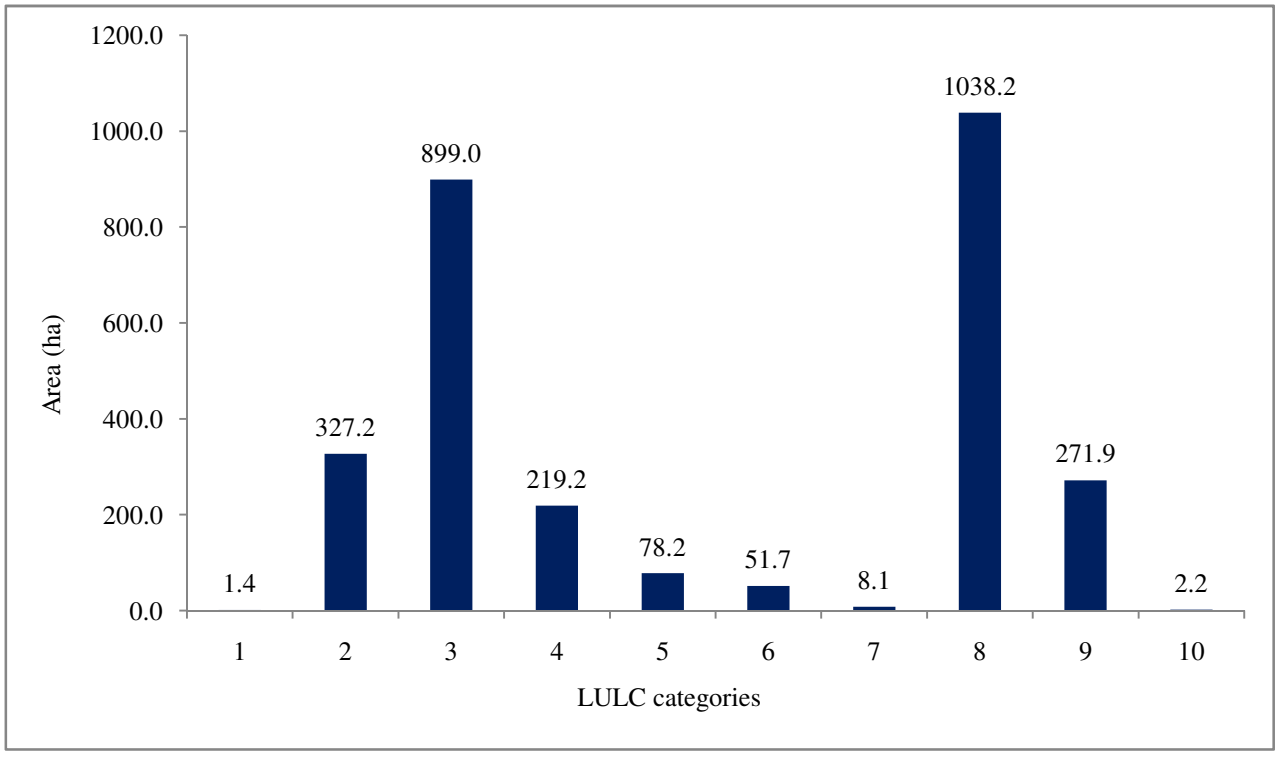

Figure-7: Habitats and their area (ha) on Jilandhar *bet.*

Note: 1= Aquatic Vegetation, 2= Dense Herbaceous, 3= Dense Tree, 4= Mudflat, 5= Open Land, 6= Salt Affected, 7= Salt Encrusted, 8= Sparse Tree, 9= Sparse Herbaceous, 10= Water body.

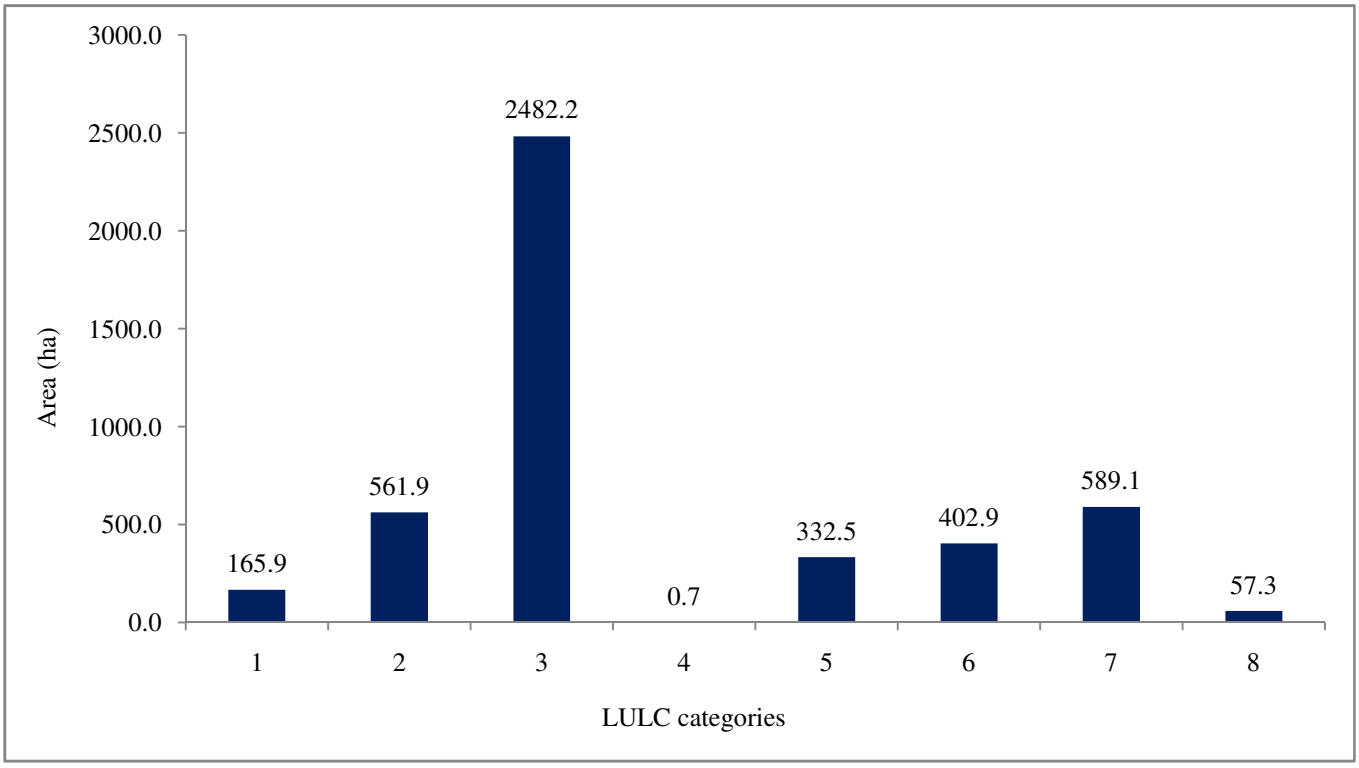

Figure-8: Habitats and their area (ha) on Pung *bet.*
Note: 1= Dense Herbaceous, 2= Dense Tree, 3= Mudflat, 4= Open Land, 5= Salt Affected, 6= Sparse Tree, 7= Sparse Herbaceous, 8= Water body.

Comparison of faunal species composition among four major islands (*bets*) using Jaccard's Similarity Index: Determining the extent of similarity/dissimilarity of the faunal species for the major *bet*s under the study might be important for deciding the degree to which each major *bet* contributes uniquely to overall species richness of the major island ecosystems of the LRK. Use of Jaccard's Similarity Index (JSI) has been a standard practice to compare species composition or extent of similarity/dissimilarity among multiple habitats/ ecosystems. Jaccard's Similarity Index (JSI) is the simplest measure of similarity between two samples. It can summarize the fraction of species they share.

The main aim of this type of analysis is to discover distribution patterns of common to different species and groups of areas with similar biota[19].

Based on the species richness of various taxa (i.e., birds, mammals and herpetofauna) recorded on the four major *bets* of the LRK, Jaccard's Similarity Index (JSI) values were determined for these *bets* (Tables 2a, 2b and 2c for birds, mammals and herpes, respectively).

Table-2a shows extent of similarity of avian species composition among the four large *bets* of the LRK (viz. Pung, Jilandhar, Mardak and Nanda). Nanda *bet* had higher species similarity (i.e., 56% as reflected by JSI=0.56) with Mardak *bet* than that with rest of the other two *bets* (JSI=0.1 or 10% similarity for Nanda-Pung and JSI=0.42 or 42% similarity Nanda-Jilandhar). Mardak *bet*, apart from having higher avian species similarity with Nanda *bet*, also had relatively good species similarity with Jilandhar *bet* as reflected from JSI being as high as 0.68 (i.e., 68% similarity). Pung *bet* has very low bird species similarity with species composition of any other *bets* (e.g., 10% with Nanda, 14% with Mardak and 16% with Jilandhar). This might be due to the fact that Pung *bet* itself had low avian species richness as compared to the species richness of other *bets*, perhaps due to low habitat diversity.

Table-2b shows extent of similarity of mammalian species composition among the four large *bets* of the LRK (viz. Pung, Jilandhar, Mardak and Nanda). Nanda *bet* had the higher mammalian species similarity with Mardak *bet* than that with rest of the other two *bets* (i.e., JSI: 0.77 or 77% similarity between Nanda and Mardak *bets* as compared to 45% similarity (JSI=0.45) for Nanda-Pung and Nanda-Jilandhar each).

Mardak *bet*, apart from having higher species similarity with Nanda *bet*, also had moderately good (i.e., > 50%) species similarity with Jilandhar *bet* and Pung *bet* as reflected from JSI being as high as 0.59 (i.e., 59% similarity) with respect to both of these *bets*. Pung *bet* and Jilandhar bets too had moderately good mammalian species similarity (JSI=0.67 or 67% similarity with each other). Thus, it has been revealed that mammalian

species composition had overall better similarities among various *bets* as compared to that of bird species composition.
Table-2c shows that only Jilandhar and Pung *bets* had moderately good similarity from the view-point of herpetofaunal species composition (i.e., 50% similarity as reflected from JSI: 0.50). JSI for any other pairs of the *bets* was found to be lower than 0.5 indicating less than 50% similarity from the view point of herpetofaunal species composition (e.g., 38% similarity with Mardak *bet* and Jilandhar *bet* and 33% similarity between Jilandhar *bet* and Nanda *bet*).

Thus, it can be inferred that except for Jilandhar *bet* and Pung *bets*, there had been good uniqueness of herpetofaunal species composition of the major *bets*.

Table-2a: JSI for Birds amongst four major islands (*bets*) in the LRK.

	Nanda	Mardak	Pung	Jilandhar
Nanda	1.00	0.56	0.10	0.42
Mardak		1.00	0.14	0.68
Pung			1.00	0.16
Jilandhar				1.00

Table-2b: JSI for Mammals amongst four major islands (*bets*) in the LRK.

	Nanda	Mardak	Pung	Jilandhar
Nanda	1.00	0.77	0.45	0.45
Mardak		1.00	0.59	0.59
Pung			1.00	0.67
Jilandhar				1.00

Table-2c: JSI for Herpetofauna amongst four major islands (*bets*) in the LRK.

	Nanda	Mardak	Pung	Jilandhar
Nanda	1.00	0.27	0.17	0.33
Mardak		1.00	0.29	0.38
Pung			1.00	0.50
Jilandhar				1.00

Table-3: Island (*bet*s) wise inventory of faunal species – Birds.

Species name	Major *bets* of the LRK			
	Nanda	Mardak	Jilandhar	Pung
Little Grebe	+	+	-	-
Dalmatian Pelican	+	-	-	-
Great White Pelican	+	+	-	-
Little Cormorant	+	-	-	-
Indian Cormorant	+	-	-	-
Oriental Darter	+	-	-	-
Grey Heron	+	-	-	-
Indian Pond Heron	+	-	-	-
Purple Heron	+	-	-	-
Black-crowned Night Heron	+	-	-	-
Little Egret	+	-	-	-
Intermediate Egret	+	+	-	-
Western Reef Egret	+	-	-	-
Great Egret	+	+	-	-
Cattle Egret	+	+	+	+
Painted Stork	+	+	-	-
Black Ibis	+	+	-	-
Black-headed Ibis	+	+	-	-
Glossy Ibis	+	-	-	-
Eurasian Spoonbill	+	+	-	-
Lesser Flamingo	+	-	-	-
Greater Flamingo	+	-	-	-
Indian Spot-billed Duck	+	+	-	-
Common Teal	+	+	-	-

Species name	Major *bets* of the LRK			
	Nanda	Mardak	Jilandhar	Pung
Northern Pintail	+	-	-	-
Northern Shoveler	+	+	-	-
Black-shouldered Kite	+	-	+	+
Black Kite	+	-	-	-
Shikra	+	+	+	+
Eurasian Marsh Harrier	+	+	-	+
Montagu's Harrier	+	+	+	-
Pallied Harrier	+	+	+	-
Oriental Honey-Buzzard	+	-	-	-
Eastern Imperial Eagle	+	+	-	-
Peregrine Falcon	+	-	-	-
Common Kestrel	+	-	-	-
Lesser Kestrel	+	+	-	-
Grey Francolin	+	+	+	+
Black Francolin	+	-	-	-
Common Quail	+	+	+	+
Indian Peafowl	+	+	+	+
Common Crane	+	+	+	+
White-breasted Waterhen	+	-	-	-
Common Coot	+	+	-	-
Houbara Bustard	+	+	-	+
Red-wattled Lapwing	+	+	+	+
Little Ringed Plover	+	-	-	-
Kentish Plover	+	-	-	-
Lesser Sand Plover	+	-	-	-

Species name	Major *bets* of the LRK			
	Nanda	Mardak	Jilandhar	Pung
Eurasian Curlew	+	-	-	-
Black-tailed Godwit	+	-	-	-
Common Redshank	+	-	-	-
Common Sandpiper	+	-	-	-
Wood Sandpiper	+	+	-	-
Temminck's Stint	+	-	-	-
Ruff	+	-	-	-
Black-winged Stilt	+	+	+	-
Pied Avocet	+	-	-	-
Eurasian Thick-Knee	+	+	+	-
Black-headed Gull	+	-	-	-
Brown-headed Gull	+	-	-	-
Yellow-legged Gull	+	-	-	-
Gull-billed Tern	+	-	-	-
Caspian Tern	+	-	-	-
Whiskered Tern	+	-	-	-
River Tern	+	-	-	-
Chestnut-bellied Sandgrouse	+	-	-	+
Rose-ringed Parakeet	+	+	+	-
Blue Rock Pigeon	+	+	+	-
Laughing Dove	+	+	+	-
Eurasian Collared Dove	+	+	+	-
Red-collared Dove	+	+	+	-
Spotted Dove	+	+	+	-
Greater Coucal	+	+	+	-

Species name	Major *bets* of the LRK			
	Nanda	Mardak	Jilandhar	Pung
Asian Koel	+	+	+	-
Pallied Scops Owl	+	-	-	-
Spotted Owlet	+	-	+	-
Green Bee-eater	+	+	+	-
Common Hoopoe	+	+	+	-
Ashy-crowned Sparrow-Lark	+	+	+	-
Rufous-tailed Finch-Lark	+	+	+	-
Greater Hoopoe-Lark	-	+	-	-
Lesser Short-toed Lark	+	+	+	-
Greater Short-toed Lark	+	+	+	-
Crested Lark	+	+	+	-
Desert Lark	+	+	+	-
Southern Grey Shrike	+	+	+	-
Isabellian Shrike	+	+	+	-
Black Drongo	+	+	+	+
Brahminy Starling	+	+	+	-
Rosy Starling	+	+	+	-
Common Myna	+	+	+	-
House Crow	+	-	-	-
Rufous Tree-pie	+	-	-	-
Red-vented Bulbul	+	+	+	-
White-eared Bulbul	+	+	+	-
Large Grey Babbler	+	-	-	-

Species name	Major *bets* of the LRK			
	Nanda	Mardak	Jilandhar	Pung
Jungle Babbler	+	+	+	-
Common Babbler	+	+	+	-
Common Tailorbird	+	+	+	-
Lesser Whitethroat	+	+	+	-
Blue throat	-	-	+	-
Zitting Cisticola	-	-	+	-
Desert Wheatear	+	+	+	-
Isabelline Wheatear	+	+	+	-
Variable Wheatear	+	+	+	-
Oriental Magpie-Robin	+	+	+	-
Indian Robin	+	+	+	-
Rufous-tailed Scrub-Robin	+	-	-	-
Black Redstart	+	+	+	-
Yellow Wagtail	+	-	-	-
Grey Wagtail	+	-	-	-
White Wagtail	+	+	-	-
Purple Sunbird	+	+	+	-
Purple-rumped Sunbird	+	-	-	-
House Sparrow	+	+	+	-
Sind Sparrow	+	-	-	-
Chestnut-shouldered Petronia	+	+	+	-
Black-headed Bunting	+	-	-	-
Grey-necked Bunting	+	-	-	-
Total	117	67	52	12

Note: (+) = Present and (-) = Absent.

Table-4: Island (*bet*s) wise inventory of faunal species – Mammals.

Species name	Major bets of the LRK			
	Nanda	Mardak	Jilandhar	Pung
Bluebull	+	+	+	+
Chinkara	+	+	-	+
Wild / Feral Boar	+	+	+	+
Indian Wild Ass	+	+	+	+
Desert Fox / White footed Fox	+	+	-	-
Grey Mongoose	+	-	-	-
Indian Fox	+	+	-	-
Golden Jackal	+	+	-	+
Jungle Cat	+	+	-	-
Small Indian Civet	+	-	-	-
Striped Hyena	+	+	+	+
Indian Wolf	+	+	-	-
Indian Pale Hedgehog	+	-	-	-
Long-Eared Hedgehog	+	-	-	-
Grey Musk Shrew	+	+	+	-
Indian Hare	+	+	+	+
Indian Porcupine	+	+	+	+
Five - Striped Palm Squirrel	+	+	+	+
Indian Field Mouse	+	+	+	-
Black Rat	+	-	-	-
Desert Jird	+	+	+	+
Common Pipistrelle	+	+	-	-
Total	22	17	10	10

Note: (+) = Present and (-) = Absent

Table-5: Island (*bet*s) wise inventory of faunal species – Herpetofauna.

Species name	Major bets of the LRK			
	Nanda	Mardak	Jilandhar	Pung
Indian bullfrog	-	+	-	-
Indian Skipper Frog	+	+	-	-
Indian Marbled Toad	+	-	-	-
Indian Flap-shelled Turtle	+	-	-	-
Bark Gecko	+	-	-	-
Brilliant/Agile Agama	-	+	-	-
Rock Agama	-	+	-	-
Brahminy Skink	+	-	-	-
Jerdon's Snake-eye	+	+	+	+
Common Garden Lizard	+	+	+	+
Hardwick's Spiny-tailed Lizard	+	+	+	-
Common Indian Monitor	+	-	-	-
Desert Monitor	+	-	-	-
Red Sand-Boa	+	-	+	-
Russell's Earth Boa	+	-	-	-
Total	12	7	4	2

Note: (+) = Present and (-) = Absent.

Conclusion

The present study on the faunal species composition of the four major *bets* of the LRK (i.e., Nanda, Mardak, Jilandhar and Pung *bet*s) has revealed that Nanda *bet*, despite having the smallest area (i.e., 2032ha) among the four major *bet*s (i.e., *bet*s with more than 1000ha area each), had the highest faunal species diversity (i.e., total 151 species including 117 bird's species, 22 mammal's species, 12 herpetofaunal species). This might be due to its highest habitat diversity (i.e., 13 habitats as compared to 10 of Mardak, 10 on Jilandhar, only 8 habitats on Pung *bet*). Mardak *bet* can also be considered as a *bet* with relatively high faunal species diversity (i.e., 91 species of fauna that was higher than that of Jilandhar and Pung *bets*) owing to good habitat diversity i.e., 10 habitats as against 10 habitats on Jilandhar and only 8 habitats on Pung *bet*. Efforts should be made to retain

high faunal species richness of Nanda and Mardak *bets* by conserving their habitat diversity and regulating/minimizing human interference. Comparison of avian and mammalian species composition for the four major *bet*s with the use of Jaccard's Similarity Index (JSI) has shown that Nanda *bet* and Mardak *bet* had highest avian and mammalian species similarity. However, for the herpetofaunal species composition, Jilandhar and Pung *bet*s had indicated high degree of species similarity.

Recommendations: These four major islands (*bets*) of the LRK had been facing high human interference and therefore for the effective conservation of fauna of these *bets*, human disturbance will have to be controlled in various ways (e.g., livestock grazing on Pung *bet*, agriculture practice and livestock grazing on Nanda bet, *Prosopis* cutting, Charcoal-making and pilgrim transport on Jilandhar *bet* etc.). Pung *bet* had indicated lowest species richness among all the four major *bet*s and that was probably due to its low habitat diversity. Therefore, efforts should be made to restore or create some habitats.

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