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Case Study

BIODIVERSITY INDICES OF TERRESTRIAL FAUNA ASSOCIATED WITH THE GULF OF KACHCHH MARINE NATIONAL PARK OF PIROTAN ISLAND

K. Ramkumaran[1#], J.S. Yogesh Kumar[1], R. Chandran[1], G. Arun[1], Ch.Satyanarayana[2] and K.Venkataraman[3]
[1]Zoological Survey of India – Jamnagar Field station, India
[2]Zoological Survey of India, (II Floor), Fire Proof Spirit Building, Indian Museum Complex, 27, Jawagarlal Nehru Road, Kolkata – 700 016, India.
[3]Zoological Survey of India, M-Block, New Alipore, Kolkata – 700 053, India.
[#] Corresponding author: ramkumarantpg@gmail.com

ABSTRACT
India is being the home to a remarkable faunal diversity. Comprehensive biodiversity study of a single island namely Pirotan in the Gulf of Kachchh Marine National Park was carried out. Shannon-weiner diversity and evenness indices of the total fauna inhabiting in the Pirotan Island was calculated as 2.745 and 0.139 respectively whereas Simpson's diversity and evenness indices were 13.331 and 0.667 respectively. Among the surveyed faunal group, birds were most abundant (H =2.591 and D = 13.792). Foraging of the island inhabiting fauna also modified on the basis of the tidal influx.

KEY WORDS: Shannon-weiner index, Simpson's index, Diversity, evenness, inter-tide, foraging.

INTRODUCTION

India, in spite of fast depletion of wildlife during present century, still has a remarkable variety of terrestrial and avifaunal diversity, as that of most tropical countries. Because of its location in convergence of three Bio-geographic realms-Indomalayan, Paleartic and Ethopian, India is being the home to this many faunal diversity (Mackinnon, 1974; Mani, 1974). Gulf of Kachchh (hereinafter termed as Gulf) which occupies an area of 7300 km^2 is biologically one of the most productive and diversified habitats along the west coast of India. The high tidal influx covers vast low lying areas of about 1500 km^2 comprising a network of creeks, marshy tidal flats and rocky regions which provide congenial environment to a wide variety of marine biota. The southern shore has numerous Islands and inlets which harbour vast areas of mangroves and coral reefs with living corals. The northern shore which is predominantly sandy or muddy confronted by numerous shoals and creeks also sustains large stretches of mangroves. A variety of marine wealth existing in the Gulf includes algae, mangroves, corals, sponges, molluscs, prawns, fishes, reptiles, birds and mammals. In order to protect the rich biodiversity of the Gulf, several intertidal mudflats and coral reefs along its southern shore are declared as Marine National Park and Marine Sanctuary (Vijayalakshmi nair-2002). A number of inland vertebrate species are found in the Marine National Park. Skink, different species of garden lizards and minor lizards, monitor, saw scaled wiper, cobra and rat snake are the recorded herpetofauna. The mammals like Blue bull, Jackal, Fox, wolf are very common. The Jackal and fox are found on the Gulf's islands also. The shrews, gerbil, rats, hare, porcupine and jungle cat are also found along the coastal regions of Dwarka and Kalyanpur Taluka. The area near Poshithra is full of terrestrial wildlife and small mammals. The hyaena and rattle are also recorded here. Occasionally visit by panther is also recorded. However, most of the Mammals found here little impact or dependency on marine flora and fauna except species like jackal and fox which are found on the islands. There are about 165 species of terrestrial birds recorded in the coastal area and islands of Marine National Park. The terrestrial birds are generally associated with shrub forests found along the coastal and island margins. They are depend on the fruit species like Pilu, Zizyphus, Cordia and other mangrove associated shrubs and their associated insects and insects larvae. The reef flats of the islands which are exposed during the low tide are being the important feeding ground for the birds and jackals (Management plan of Marine national park of Gulf of Kachch, 2007-2008). This can be attributed partly to the presence of several freshwater and coastal wetland habitats and partly to the fact that the region lies along the major migration-route into the Indian subcontinent to the west of the Himalayas (Khacher, 1996). Although, several studies have shown that there is both a high species-diversity as well as a great abundance of birds in this region (AWC report, 1997), there is no detail comprehensive studies available on the faunal studies of individual islands of the Gulf. Hence this study was carried out.

MATERIALS & METHOD

Pirotan Island (also known as Pirothan) is an Arabian Sea island in the Marine National Park, Jamnagar District of Gujarat state, India. It is located 12 nautical miles (22 km) off the coast (Bedi Port), consists of mangroves and low-tide beaches and has an area of 3 square kilometres. Faunal diversity of the Pirotan Island was accessed

following Line transect method (Burnhan *et al*, 1980) Each 100m transect was laid randomly along the beach and the intertidal regions. All surveys were carried out during morning and evening low-tide time (6:00 am to 7:00 am and evening 5:00 pm to 6:00 pm). The species diversity was calculated using Shannon- Weiner diversity Index (Shannon, 1948). This statistical analysis of data was made with Simpson's diversity Index (Simpson, 1949). This study was carried out for a period of one year (June 2014 to June 2015).

Shannon-weiner diversity Index:

$$H = -\sum_{i=1}^{s} p_i \ln p_i$$

Shannon's equitability (E_H) can be calculated by dividing H by H_{max} (here $H_{max} = \ln S$). Equitability assumes a value between 0 and 1 with 1 being complete evenness.
Simpson's diversity Index: $D = 1-[\sum (Pi)^2]$

RESULT

During the present study, a total of 19 species of terrestrial fauna was recorded in the Pirotan Island (Table 1 & 2). Among the mammalian fauna of the Island, Golden Jackal is the dominant species. Among the avifauna, grey heron is the dominant species throughout the study period. Saw scale viper is the most frequently encountered reptile. The birds diversity was represented with more species in this Island than other phyla group (mammals and Reptiles). The birds were more species diversity and evenness in the Island because of the feeding status is very rich in this study area. Total faunal diversity of the Pirotan Island was calculated as 2.744868 (Shannon (H) index) and 0.13911 (Simpson's Diversity Index (D) (Figure 1). Highest Shannon-Weiner diversity index (H) represented by Avifauna (2.590873) followed by Mammals (0.996601). Reptiles represented lowest diversity index (0.058649). Likewise Simpson's diversity index (D) was also showed maximum in avifauna (0.927493) followed by mammals (0.998227) and lowest diversity was shown by reptiles (0.999266) (Figure 2).

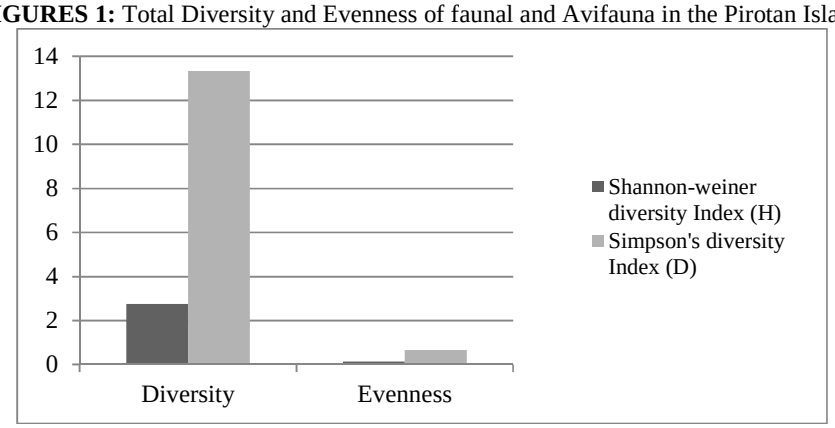
TABLE 1: Shannon-weiner diversity Index of Pirotan Island

Common Name of the animal	Species name of the animals	# of individual	pi	pi*(ln(Pi)	-1*(ln(Pi)
Golden jackal	*Canis aureus*	13	0.024904	-0.091964	0.091964
Jungle Cat	*Felis chaus*	5	0.009579	-0.044523	0.044523
Rat	*Rattus*	17	0.032567	-0.111524	0.111524
Common crow	*Corvus brachyrhynchos*	45	0.086207	-0.211294	0.211294
Erusian Dove	*Erusian Dove*	29	0.055556	-0.160576	0.160576
House sparrow	*Passer domesticus*	20	0.038314	-0.124978	0.124978
Yellow bellied Sun bird	*Neodrepanis hypoxantha*	39	0.074713	-0.193813	0.193813
Large Egret	*Ardea alba*	53	0.101533	-0.232243	0.232243
Little Egret	*Egretta garzetta*	26	0.049808	-0.149404	0.149404
Intermediate Egret	*Mesophoyx intermedia*	12	0.022989	-0.08673	0.08673
Western reef Egret	*Egretta gularis*	15	0.028736	-0.102	0.102
Painted stork	*Mycteria leucocephala*	25	0.047893	-0.145536	0.145536
Little tern	*Sternula albifrons*	35	0.06705	-0.18119	0.18119
Grey heron	*Ardea cinerea*	78	0.149425	-0.284051	0.284051
Night Heron	*Nycticorax nycticorax*	18	0.034483	-0.116114	0.116114
Balck headed Ibis	*Threskiornis melanocephalus*	27	0.051724	-0.153198	0.153198
Orienter Darter	*Anhinga melanogaster*	23	0.044061	-0.137567	0.137567
Little Stint	*Calidris minuta*	40	0.076628	-0.196842	0.196842
Saw scale viper	*Echis*	4	0.007663	-0.037329	0.037329

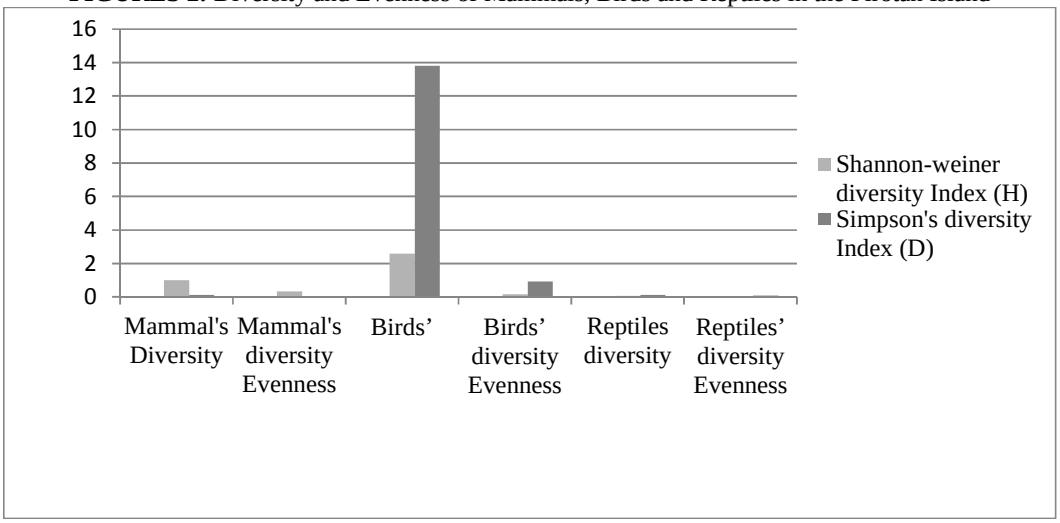
TABLE 2: Simpson's diversity index of Pirotan Island

Common Name of the animal	Species name of the animals	# of individual	pi	(pi)2
Golden jackal	Species name of the animals	13	0.024904	0.0006202
Jungle Cat	*Canis aureus*	5	0.009579	9.175E-05
Rat	*Felis chaus*	17	0.032567	0.0010606
Common crow	*Rattus*	45	0.086207	0.0074316
Erusian Dove	*Corvus brachyrhynchos*	29	0.055556	0.0030864
House sparrow	*Erusian Dove*	20	0.038314	0.001468
Yellow bellied Sun bird	*Passer domesticus*	39	0.074713	0.005582
large Egret	*Neodrepanis hypoxantha*	53	0.101533	0.0103089
little Egret	*Ardea alba*	26	0.049808	0.0024809
Great Egret	*Egretta garzetta*	12	0.022989	0.0005285
Western reef Egret	*Mesophoyx intermedia*	15	0.028736	0.0008257
Painted stork	*Egretta gularis*	25	0.047893	0.0022937
Littile tern	*Mycteria leucocephala*	35	0.06705	0.0044957
Grey heron	*Sternula albifrons*	78	0.149425	0.0223279
Night Heron	*Ardea cinerea*	18	0.034483	0.0011891
Balck heated Ibis	*Nycticorax nycticorax*	27	0.051724	0.0026754
Orienter Darter	*Threskiornis melanocephalus*	23	0.044061	0.0019414
Common land Stint	*Anhinga melanogaster*	40	0.076628	0.0058719
Saw scale viper	*Calidris minuta*	4	0.007663	0.0005872

FIGURES 1: Total Diversity and Evenness of faunal and Avifauna in the Pirotan Island



FIGURES 2: Diversity and Evenness of Mammals, Birds and Reptiles in the Pirotan Island



SYMBOLS:

H = Shannon's diversity index
S = total number of species in the community (richness)
p_i = proportion of *S* made up of the i^{th} species
E_H = equitability (evenness)
D = Simpson's diversity index
E_D = equitability (evenness)

DISCUSSION

The legacy of a unique evolutionary history, many island species are endemic and found nowhere else on Earth. Islands harbour higher concentrations of endemic species than do continents, and the number and proportion of endemics rises with increasing isolation, island size and topographic variety. For instance, over 90% of Hawaiian island species are endemic. In Mauritius, some 50% of all higher plants, mammals, birds, reptiles and amphibians are endemic, and the Seychelles has the highest level of amphibian endemism in the world. Madagascar is home to more than 8000 endemic species, making it the nation with the highest number of endemic species in sub-Saharan Africa. It has often been remarked that islands make a contribution to global biodiversity that is out of proportion to their land area. In this sense, they can be thought of collectively as biodiversity "hot spots", containing some of the richest reservoirs of plants and animals on Earth.

Prajapati and Dharaiya (2014) assessed the birds and macrofauna diversity like Molluscan and polychaetes in the mangrove ecosystem of Jakhau creek of Gulf of Kachchh. They have not studies the other associated fauna. Bhuva and Soni (1998) carried out a study on the wintering population of 4 migratory brids in Narara and Rozi port mangrove regions. Ufri (2002) studied the waders of Byet Dwarka Island in the Gulf of Kachchh. He reported about 30 waders. But this study had not included the other wildlife of the Island. This is the first comprehensive study on a individual island of Gulf of Kachchh Marine National Park. The Pirotan Island has mangrove forest, mud flat and coastal area which act as a main feeding ground for the island inhabiting fauna and avifauna. Marine reserves are important for preserving the biological diversity of the marine habitat. Present study evident the benefit of the Marine Reserve which preserve the marine fauna and associated terrestrial faunal diversity. Since the Pirotan Island is water covered, the island inhabiting animals are wholly depends on dew waters and water from their prey muscles for their metabolic needs. Moreover the feeding behaviour of the animals also varied and they fully depend on the tidal influx. During the present study, animals were found utilizing even midnight

low-tides for foraging. Since the intertidal region is more wider than the island area during low tide with so many pools with live corals and its associated fishes and crabs. These pools are typical feeding grounds for the avifauna. So that the highest diversity index of the Pirotan Island was represented by avifauna. Moreover the herons, egrets are found roosted in the mangrove vegetation of the island itself in all the seasons.

CONCLUSION

Islands and their surrounding near-shore marine areas s often comprising genetically isolated fauna and flora species. Pirotan Island in the Gulf of Kachchh Marine National Park supports a total of 19 resident fauna species. The faunal species modified their foraging with the tidal influx and the available marine food chain of the island.

RECOMMENDATION

The Gulf of Kachchh is being a fragile ecosystem for so many marine and terrestrial fauna in particularly avifaunal diversity. Detailed study to the threats of the fauna should be studied in detail. The concerned authorities should have a vigilance on the industrial pollution of the Gulf.

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