Alpha - Beta (α and β) Diversity Assessment of the Mangroves of Two Districts along the Coast of Maharashtra State

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ABSTRACT

Alpha-Beta Diversity (α and β): During the present study the alpha and beta diversity of mangrove in the study area has been analyzed. Twenty-nine estuaries from Ratnagiri and Sindhudurg districts of Maharashtra State are studied and data analyzed for calculating alpha and beta diversity.

Keywords: Alpha-Beta Diversity, Mangroves, Maharashtra

INTRODUCTION

The study area is the coastal Maharashtra which lies between 15°44' N to 20°08' N and 72°44' E to 73°39' E. The Ratnagiri district lies between 16°13' N to 18°04' N and 73°02' E to 73°52' E and Sindhudurg district lies between 15°37' N to 16°40' N and 73°13'E to 73°19' E. The study area has tropical climatic conditions. There are 29 estuaries in Ratnagiri and Sindhudurg districts, Out of these, sixteen estuaries are in Sindhudurg district and thirteen are in Ratnagiri district. Alpha and Beta diversity of the mangrove species has been analyzed by using Jaccard's index of similarity formula.

MATERIAL AND METHODS

During the present study the alpha and beta diversity of mangrove in the study area has been analyzed. Alpha diversity, defined as species packing within a demarcated area, was measured as an absolute number of species (Whittaker, 1972), whereas the change or replacement of the taxon composition from one plot to another (beta-diversity) was calculated as 1-Jaccard's index of similarity (Magurran, 1988). The Jaccard's Index of similarity between two plots / estuaries was calculated using following formula. Negi (2001) has analyzed the liverworts of Garhwal Himalaya region using the similar technique. Where, C is the number of species found in both the plots and A is the number of species in plot x and B the number of species in plot y (here x and y represent estuary). The index has been designed to equal 1 in case of complete similarity and 0 if the plots of no species in common.

$$Jxy = \frac{C}{(A + B) - C}$$

RESULTS AND DISCUSSIONS

Alpha and Beta diversity index has been designed to equal 1 in case of complete similarity and 0 if the plots/estuaries have no species (genera, families) in common, i.e. total dissimilarity. The change in the species composition or assemblage of species across the area appears to reflect the characteristics of the macro habitats in which they occur. Mangroves are very sensitive to the micro and macro habitat conditions. It is observed in the present study that mangrove species like *Avicennia marina* var. *acutissima*, *Avicennia officinalis, Aegiceras corniculatum, Excoecaria agallocha, Rhizophora mucronata, Sonneratia alba* and *Acanthus ilicifolius* are more or less commonly occurring in estuaries as compared to the species like *Avicennia marina* var. *resinifera, Bruguiera cylindrica, Kandelia candel, Sonneratia apetala, Sonneratia caseolaris, Xylocarpus granatum* and *Cynometra iripa* which are uncommon in their occurrence and are mainly responsible to decide the alpha and beta diversity status.

Jaccard's index of similarity (alpha diversity) for different estuaries in Sindhudurg district is recorded in Table 1. Whereas that for Ratnagiri district is recorded in Table 2. Beta diversity i.e. 1- Jaccard's index of similarity for different estuaries in Sindhudurg district and Ratnagiri district is recorded in Table 3 and Table 4 respectively. As the value of beta diversity is (1-alpha diversity) they are inversely proportional. From the results it is found that some of estuaries have sites with greater values of alpha and beta diversity from Sindhudurg district and Ratnagiri district these plots need the conservation. Kulkarni (2006).

CONCLUSION

The analysis of Alpha-Beta Diversity (α and β) is found to be helpful in understanding the numerical values of diversities from two or more comparable plots. These values gives the idea about the species diversity present the in the plots under investigation. This helps to undertake the detailed investigation or the conservation program. It also demarcates the diversity picture of one plot from the other. From the present study it can be conclude that this method is equally applicable for mangrove vegetation and can be used for other types of vegetation's also.

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Table 1. Jaccards Index of Similarity (alpha diversity) for different estuaries in Sindhudurg district.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	0.54	0.53	0.57	0.53	0.43	0.5	0.61	0.61	0.61	0.63	0.71	0.67	**0.86**	0.57	0.69
		0.35	0.78	0.7	0.75	0.66	0.64	0.64	0.64	0.54	0.44	0.58	0.54	0.66	0.5
			0.9	0.54	0.55	0.8	0.75	0.5	0.75	0.53	0.44	0.47	0.53	0.5	0.5
				0.58	0.5	**0.89**	**0.82**	0.54	**0.82**	0.57	0.47	0.5	0.57	0.55	0.53
					0.7	0.5	0.62	0.75	0.5	0.44	0.44	0.57	0.64	0.5	0.6
						0.5	0.64	0.64	0.5	0.54	0.35	0.46	0.54	0.5	0.5
							0.73	0.46	0.73	0.5	0.41	0.43	0.5	0.45	0.47
								0.69	**0.83**	0.71	0.5	0.53	0.71	0.58	0.67
									0.57	0.71	0.59	0.64	0.71	0.58	0.66
										0.6	0.5	0.53	0.6	0.58	0.56
											0.81	0.66	0.73	0.5	0.69
												0.65	**0.81**	0.5	0.76
													0.79	0.67	0.73
														0.62	**0.93**
															0.57

Localities : 1) Terekhol   2) Shiroda 3) Vengurla   4) Mochemad 5) Khavane 6) Kalvi (Kelus) 7) Vaigani 8) Nivti 9) Tarkarli 10) Kolamb 11) Kalavali 12) Achara 13) Mithbav 14) Mumbra 15) Deogad 16) Vijaydurg

Table 2. Jaccards index of similarity (alpha diversity) for different estuaries in Ratnagiri district.

1	2	3	4	5	6	7	8	9	10	11	12	13
1	0.71	0.63	0.6	**0.85**	0.71	0.71	0.6	0.71	0.79	0.79	0.69	0.53
		0.85	0.69	**0.83**	**0.83**	**0.83**	0.83	0.69	0.77	0.77	**0.82**	0.75
			0.60	0.71	0.71	0.71	0.71	0.71	**0.92**	0.79	0.69	0.64
				0.69	0.69	0.69	0.69	0.69	0.64	0.53	0.67	0.62
					0.83	0.83	0.69	0.69	0.77	0.77	**0.82**	0.62
						1	**0.83**	**0.83**	0.77	0.64	**0.82**	0.75
							0.83	0.83	0.77	0.64	**0.82**	0.75
								0.83	0.64	0.64	0.67	0.75
									0.77	0.53	0.67	0.75
										0.71	**0.82**	0.62
											0.75	0.57
												0.73

Localities : 1) Rajapur 2) Vetye 3) Purnagad 4) Pavas 5) Bhatye 6) Kalbadevi 7) Are 8) Kelye 9) Malgund 10) Jaigad 11) Dabhol 12) Harhai (Anjarle) 13) Savitri

Table 3. Beta diversity (1-Jaccard's Index of similarity) for different estuaries in Sindhudurg district.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0	0.46	0.47	0.43	0.47	0.57	0.5	0.39	0.39	0.39	0.37	0.29	0.33	0.14	0.43	0.31
		0.65	0.22	**0.93**	0.25	0.34	0.36	0.36	0.36	0.46	0.56	0.42	0.46	0.34	0.5
			0.1	0.46	0.45	0.2	0.25	0.95	0.25	0.47	0.56	0.53	0.47	0.5	0.5
				0.42	0.5	0.11	0.18	0.46	0.18	0.43	0.53	0.5	0.43	0.45	0.47
					0.3	0.5	0.38	0.25	0.5	0.56	0.56	0.43	0.36	0.5	0.4
						0.5	0.36	0.36	0.5	0.46	0.65	0.54	0.46	0.5	0.5
							0.27	0.54	0.27	0.5	0.59	0.57	0.5	0.55	0.53
								0.31	0.17	0.29	0.5	0.47	0.29	0.42	0.33
									0.43	0.29	0.41	0.36	0.29	0.42	0.34
										0.4	0.5	0.47	0.4	0.42	0.44
											0.19	0.34	0.27	0.5	0.31
												0.35	0.19	0.5	0.24
													0.21	0.33	0.27
														0.38	0.07
															0.43

Localities : 1) Terekhol   2) Shiroda 3) Vengurla   4) Mochemad 5) Khavane 6) Kalvi (Kelus) 7) Vaigani 8) Nivti 9) Tarkarli 10) Kolamb 11) Kalavali 12) Achara 13) Mithbav 14) Mumbra 15) Deogad 16) Vijaydurg

Table 4. Beta diversity (1-Jaccard's index of similarity) for different estuaries in Ratnagiri district.

1	2	3	4	5	6	7	8	9	10	11	12	13
0	0.29	0.37	0.40	0.15	0.29	0.29	0.4	0.29	0.21	0.21	0.31	**0.47**
		0.15	0.31	0.17	0.17	0.17	0.17	0.31	0.23	0.23	0.18	0.25
			0.40	0.29	0.29	0.29	0.29	0.29	0.08	0.21	0.31	0.36
				0.31	0.31	0.31	0.31	0.31	0.36	**0.47**	0.33	0.38
					0.17	0.17	0.31	0.31	0.23	0.23	0.67	0.38
						0	0.17	0.17	0.23	0.36	0.18	0.25
							0.17	0.17	0.23	0.36	0.18	0.25
								0.17	0.36	0.36	0.33	0.25
									0.33	**0.47**	0.33	0.25
										0.29	0.18	0.38
											0.25	**0.43**
												0.27

Localities : 1) Rajapur 2) Vetye 3) Purnagad 4) Pavas 5) Bhatye 6) Kalbadevi 7) Are 8) Kelye 9) Malgund 10) Jaigad 11) Dabhol 12) Harhai (Anjarle) 13) Savitri