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Assessment of inter tidal fauna along the Ribandar Causeway

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Submitted by

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December 2022

DECLARATION

We hereby declare that the project report entitled “Assessment of inter tidal fauna along the Ribandar Causeway” has been authored and submitted by Sona Gaonkar and Toobaa Nizami is a record of bonifide project work under the guidance of SUJEETKUMAR DONGRE Scientist E Centre for Environment Education CEE Goa State Office to the Goa University in partial fulfilment of requirements for the award of Degree of Master of Science in Zoology. We further declare that the work reported in this project has not been submitted previously or to any other University.

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CERTIFICATE

This is to certify that the project report entitled "Assessment of inter tidal fauna along the Ribandar Causeway" submitted by Sona Gaonkar and Toobaa Nizami to the Goa University, in partial fulfilment for the award of Degree of Master of Science in Zoology is a bonafide record of the project work carried out by them under my supervision during December 2022 for the time period 1 month. To best of my knowledge the work reported in this project has not been submitted previously or to any other University.

Advisor

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ABSTRACT

The present study was carried out at the Ribandar Causeway where in Species Diversity was covered in the intertidal zone at subsequent Low and High tide. Intertidal mudflats are a prominent geomorphological component of estuaries and the development of an estuarine mudflat is both complex and difficult to predict because of the multiple relationship between the physical, chemical and biological properties of the sediment. Besides, mudflats aid in preventing coastal erosion, and mangroves preserving the environmental balance. Mudflats and mangroves being part of the intertidal zone interact sturdily with marine and terrestrial ecosystems and support a diverse flora and fauna of marine, freshwater and terrestrial species.

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CHAPTER 1 INTRODUCTION

Mudflats are areas of land near a body of water that are frequently inundated by tides and are generally barren (without any vegetation).Fernandes et al.,(2009). Mudflats, also known as tidal flats, arise as a result of mud deposition by tides or rivers. This coastal landform is commonly found in sheltered coastal locations such as bays, coves, lagoons, estuaries, and so on. Because the majority of a mudflat's sedimented area is inside the intertidal zone, the mudflat is submerged in water and exposed twice daily. Misra et.,(2015)

Mudflats, mangroves, and salt marshes form a vital ecosystem. Mudflats attract a significant number of migrating shorebirds. These intertidal zones are also home to a variety of crabs, fish, and mollusks that provide food for migratory birds.

Mudflats have ridges and mounds generated by changes in sediment texture and deposition rates, as well as tidal channel networks. On nearby mudflats, signs of both erosion and deposition may be found. Bhangle et al.,(2021)

Despite strong hydrodynamics, intertidal estuary mudflats are favoured places for the accumulation of fine-grained sediments, organic matter, and metals from a variety of marine and terrestrial sources, including human sources. Water in suspension transports very fine-grained sediments. It may appear logical to think that silts and clays are deposited only when water bodies are slow and sluggish. However, rivers and coastal waters are rarely slack enough for settling to occur by gravity alone. Mud is therefore deposited by the interaction of biological, physical and chemical processes.

As they filter the water for organic stuff, organisms in the water column consume minute particles of inorganic silt. These and other particles are expelled as sand-sized pellets, which sink faster and settle to the bottom. The presence of algal mats that grow on muddy surfaces also aids deposition.Singh et al.,(2007). Clay grains have physical and chemical qualities that cause them to bond together in seawater to form aggregations large enough to sink via a process known as flocculation.

The presence of tidal flats, mudflats, and salt marshes characterises the intertidal zone. Tidal flats and mudflats support a varied diversity of creatures, whereas salt marshes support higher plants. Tidal flats may be found in two sorts of environments. The first is an exposed coast with low topography and relatively little tidal energy, whereas the second is a coastal zone sheltered from the local high tidal energy, such as an estuary, lagoon, bay, or other regions hidden behind a barrier island.Siraswar et al.,(2021)

In other words, the creation of a tidal flat requires a quantifiable tidal range and the lack of substantial wave activity. Large amounts of intertidal mudflats can be found along the shorelines of estuaries and coastal regions. Intertidal mudflats are an important geomorphological component of estuaries, and their development is both complicated and difficult to forecast due to the numerous relationships between the physical, chemical, and biological aspects of the sediment.

Mudflat morphology, sediments, bedforms, and ecology are all quite diverse. Nanajkar et al.,(2010).Intertidal zones are important natural features with a diverse flora and fauna. They maintain significant bird populations and serve as nursery and feeding grounds for coastal fisheries. Mudflats and salt marshes are particularly vulnerable to changes in sea level as well as the impacts of reclamation and industrialization. To forecast the response of mudflats to environmental and human stressors, a better knowledge of the observed variances amongst mudflats is required.

Intertidal mudflats have received comparatively less attention in compared to sandy flats and salt marshes, despite their importance. They safeguard many kilometres of shoreline by absorbing waves, and they are home to varied and productive ecosystems that sustain higher creatures such as wading birds, shellfish, and fish stocks. Pandey et al.,(2013). The interaction and feedback between physical, sedimentary, biological, and chemical processes is extremely complicated, necessitating interdisciplinary observations. This has hampered a thorough knowledge of the response of mudflat structure and function to changing temperature and sea level, as well as human inputs.There is not even a well established classification system that can help us to understand the reasons for the 12 variety of mudflats, or to establish the hierarchy of processes causing those differences.Nagi et al.(2008).

1.1 Objectives

1. To identify and document Arthropod, Molluscs, Lepidopterans, Ichyofauna, Reptile, Avifauna and mammal diversity at study site.

2. To work out species diversity and species richness during the high tide and low tide from the generated data set.

1.2 Scope of the Work

1. The study will fill the lacuna of knowledge about the fauna diversity of the Ribandar Causeway.

2. The study has critical implications for biodiversity and ecosystem health.

3. The generated data will serve as baseline for future research and habitat management programme.

1.3 Literature review

Mudflats and associated mangroves conjecture the tropical estuarine ecosystems, which support a diversity of fauna and flora. Besides, mudflats aid in preventing coastal erosion, and mangroves preserving the environmental balance (Ganpati N. Nayak et al, 2020). It is often assumed that high productivity in mudflats is due to increased nutrient availability. Because of the greater interstices, the fine particles of mudflats tend to absorb more nutritional particles. At high tide, the mudflats are submerged and serve as a sink for nutrients carried by water from the surrounding regions. Estuarine mudflats are said to be abundant in meiofauna (Azhra et al , 2001). The rapid development of the agricultural and industrial sectors has raised demand for electricity in emerging nations, particularly in India. Because of the simple access to water necessary for the power plants, intertidal zones are regarded the greatest places for the installation of nuclear power stations (Sivaperumal et al, 2021). The mudflats and burrows abandoned by marine borers in mangrove environments have been discovered to be good homes for polychaete worms (Das et al ,1989). Intertidal mudflats are a key geomorphological component of estuaries, and the formation of an estuary mudflat is both complicated and difficult to predict due to the many relationships between the physical, chemical, and biological aspects of the sediment (Dias et, 2016). Intertidal mudflats have received comparatively less attention in compared to sandy flats and salt marshes, despite their importance. They safeguard many kilometres of shoreline by absorbing waves, and they are home to varied and productive ecosystems that sustain higher creatures such as wading birds, shellfish, and fish stocks. The interaction and feedback between physical, sedimentary, biological, and chemical processes is extremely complicated, necessitating interdisciplinary observations (Singh et al ,2007). The salt marsh/mudflat cores show unambiguous vertical zonation with separate oxidising and reducing environments, and early diagenetic events significantly altered the initial metal distribution (Deloffre et al, 2005). The findings from the tidal flat sediments show a very varied depositional regime in which organic matter is substantially degraded both before and after absorption into the sediments. The organic matter content was highly connected to the mud fraction abundance, showing the role of organic matter sorption onto particles in the preservation of both marine and terrestrial organic matter (Volkman et al, 2000).

CHAPTER 1 METHODOLOGY

2.1 Study Area

Goa with an area of 3,702 sq. km adjoins Karnataka in the south and the east and Maharashtra in the north. It houses 110 kilometres of Arabian Sea coastline in the west and 125 km long Western Ghats in the east. The state is distinctly marked with three landscapes that being the Western Ghats, mid highlands (Malabar plains) and coastal plain (coast) (Baidya and Bhagat 2017). About 10% of Goa is set aside as wildlife Sanctuary and National parks and this area include seven large protected areas (Jalal 2019). The northern section of the Goa ghats holds formation of the Deccan Trap type and these are characterised by a horizontal top and vertical slopes frequently referred as tabletops. These diverse amalgamations of diverse habitat results in Goa's rich biodiversity and distribution of species in the region (Baidya and Bhagat 2017).

Figure 1: Study area

Ribandar is located at 15.505227 and 73.863598 and has an elevation of 3 metres on average (9.8 ft) harbouring mangroves along making up for tidal forest.The Rio de Ourém (River of Gold) separates it from Panjim, forming a vast, broad, and swampy estuary at its confluence with the Mandovi River. Chorao and Divar islands are located to the north and north-east of Ribandar, respectively.

2.2 Transect

The study was conducted implying belt transect. A transect of 2kms was laid from 15.505227 and 73.863598 to 15.905278 and 73.72245. Ten points were laid at equidistant of 200 meters to document the faunal diversity. Individual reading of a high tide and a low tide of a single cycle was noted. Other characters such as date, time, temperature, Humidity and Cloud cover were noted to account for the conforting factors.

Table 1: Coordinates of ten equidistant points over the transect

	Latitude	Longitude
1	15.505841	73.86422
2	15.50501	73.863242
3	15.503798	73.861858
4	15.503437	73.860123
5	15.50317	73.85834
6	15.502906	73.856489
7	15.502647	73.854656
8	15.502376	73.852955
9	15.502012	73.850941
10	15.501626	73.849224

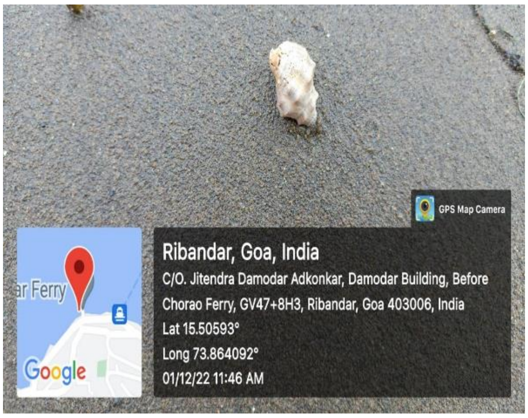
2.3 Data collection

The lepidopteran and avifauna were documented using point count. Random search along the sampling points were implied from documenting Arthropodal and Molluscan diversity at study site. Secondary data from the local fishermen will be collected.

Figure 2: Local fishermen with a catch during low tide secondary data collection

Figure 3: Mud puddling by Common crow on the mud flat at low tide

Figure 4: Toad purpura on the mud flat at low tide



CHAPTER 3 RESULTS

3.1 Species documented across tidal influx

Table 2: Secondary data collected on Ichyofauna, Reptile and mammal from the local fishermen during high tide and low tide

	Common name	**Vernecular name**	**Genus**	**species**	High tide	Low tide
1	Giant tiger prawn		*Penaeus*	*monodon*	+	+
2	Indian Prawn		*Fenneropenaeus*	*indicus*	+	+
3	Black crab	Bendo			0	+
4	Oysters	Kaalwa			0	+
1	Eel	Bado	*Anguilla*	*bengalensis*	0	+
2	Mud Skipper		*Apocryptes*	*bato*	+	0
3	Giant cat fish	Tigur	*Netuma*	*thalassina*	+	+
4	Pearl Spot	Kalundar	*Etroplus*	*suratensis*	0	+
5	Tilapia	Tilapia	*Tilapiini*	*sp.*	+	+
6	Indian Tarpon		*Megalops*		+	+
7	Common carp		*Cyprinus*	*carpio*	+	+
8	Indian Salmon	Raus	*Eleutheronema*	*tetradactylum*	0	+
9	Japanese threadfin bream	Rano	*Nemipterus*	*japonicus*	+	+
10	Perch	Palu	*Perca*	*sp.*	+	+
11	Asian sea bass	Chonak	*Lates*	*calcarifer*	+	+
12	Common ponyfish	Khapi	*Leiognathus*	*equulus*	0	+
13	Tongue sole fish	Leppo	*Cynoglossus*	*lida*	+	+
14	Silver croaker	Dhodiyaro	*Micropogonias*	*undulatus*	+	+
15	Gold spotted anchovy	capsali	*Coilia*	*dussumieri*	+	0
16	Ribbonfish	Baale			0	+
17	Ray	vaghole			0	+
18	Indian Dog Shark	Mori	*Scoliodon*	*laticaudus*	0	+
19	Rock fish	ookir			+	+
20	Barracuda	Tonki	*Sphyraena*	*arabiansis*	+	0

21	Mangrove Red Snapper	Tamoshi	*Lutjanus*	*argentimaculatus*	+	+
22	Silver Belly	Khapi	*Gerres*	*subfasciatus*	+	+
23	Common silver biddy	Shetki	*Gerres*	*erythrourus*	+	+
24	Naked head glassy perchlet	Burranto	*Ambassis*	*vachellii*	+	+
25	Grey Mullet	Shevto	*Mugil*	*cephalus*	+	+
26	Yellow Fin Goby	Kharchani	*Acanthogobius*	*flavimanus*	+	0
27	Lady Fish	Mudoshi	*Elops*	*saurus*	+	0
28	Spotted Scat		*Scatophagus*	*argus*	0	+
29	Barramundi		*Latus*	*calcarifer*	+	+
30	Giant Trivallis		*Caranx*	*ignobilis*	+	+
31	Spinycheek grouper		*Epinephelus*	*diacanthus*	0	+
32	Indian Tarpon		*Megalops*	*cyprinoides*	+	+
33	Goldsilk Seabream		*Acanthopagrus*	*berda*	+	0
34	Scart fish	Akhret			+	+
35	Silver snapper				+	+
36	Puffer fish				+	+
37	Fin fish	Keri	*Megalops*	*spp*	+	+
38	Saw fish				+	+
39	Long fin cavalla	Konkar	*Carangoides*	*armatus*	+	+
40	Squids				0	+
1	Dog-faced sea Snake		*Cerberus*	*rynchops*	0	+
2	Glossy Marsh Snake		*Gerarda*	*prevostiana*	0	+
1	Smooth Coated Otter		*Lutrogale*	*perspicillata*	0	+

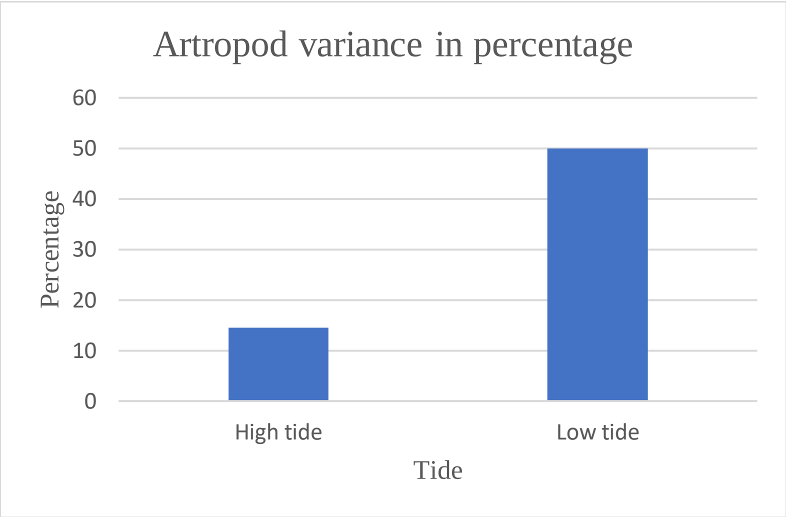
Table 3: Documented Arthropod, Molluscs, Lepidopterans, and Avifauna at study site

Sr no	**Common name**	**Phylum**	**Class**	**Order**	**Family**	**Genus**	**species**
1	Giant mud crab	Arthropoda	Malacostraca	Decapoda	Portunidae	*Scylla*	*serrata*
2	Fidler Crab	Arthropoda	Malacostraca	Decapoda	Ocypodidae	*Uca*	*sp.*
1	Common rose	Arthropoda	Insecta	Lepidoptera	Papilionidae	*Pachliopta*	*polymnestor*
2	Common grass yellow	Arthropoda	Insecta	Lepidoptera	Pieridae	*Eurema*	*hecabe*
3	Plane tiger	Arthropoda	Insecta	Lepidoptera	Nymphalidae	*Danaus*	*chrysippus*
4	Common crow	Arthropoda	Insecta	Lepidoptera	Nymphalidae	Euploea	core
1	Mud clams	Mollusca	Bivalvia	Venerida	Cyrenidae	*Polymesoda*	erosa
2	Clams	Mollusca	Bivalvia	Venerida	Veneridae	*Paphia*	*malabrica*
3	Oyster	Mollusca	Bivalvia				
4	Bladder moon shell	Mollusca	Gastropoda		Naticidae	*Neverita*	*didyma*
5	Toad purpura	Mollusca	Gastropoda	Neogastropoda	Muricidae	*Thais*	*bufo*
6	Carinate rock shell	Mollusca	Gastropoda	Neogastropoda	Muricidae	*Indothais*	*lacera*
1	Intermediate egret	Chordata	Aves	Pelcaniformes	Ardeidae	*Egretta*	*garzetta*
2	Coomon Redshank	Chordata	Aves	Charadriiformes	Scolopacidae	*Tringa*	*totanus*
3	Gull-billed tern	Chordata	Aves	Charadriiformes	Laridae	*Gelochelidon*	*nilotica*
4	Brahminy kite	Chordata	Aves	Accipitriformes	Assipitridae	*Haliastur*	*indus*
5	Little Cormorant	Chordata	Aves	Siluriformes	Phalacrocoracidae	*Microcarbo*	*niger*
6	Great Egret	Chordata	Aves	Pelcaniformes	Ardeidae	*Ardea*	*alba*
7	Indian Pond Heron	Chordata	Aves	Pelcaniformes	Ardeidae	*Ardeola*	*grayii*
8	Black headed Ibis	Chordata	Aves	Pelcaniformes	Threskiornithidae	*Threskiornis*	*melanocephalus*
9	House crow	Chordata	Aves	Coraciiformes	Corvidae	*Corvus*	*splendons*
10	Black Kite	Chordata	Aves	Accipitriformes	Assipitridae	*Milvus*	*migrans*
11	Wood Sandpiper	Chordata	Aves	Charadriiformes	Scolopacidae	*Tringa*	*glareola*
12	Paddy field pipe	Chordata	Aves	Passeriformes	Motacillidae	*Anthus*	*rufulus*
13	Little slints	Chordata	Aves				

14	Little ring plower	Chordata	Aves	Charadriiformes	Charadriidae	*Charadrius*	*dubius*
15	Gull-billed tern	Chordata	Aves	Charadriiformes	Laridae	*Gelochelidon*	*nilotica*
16	Black-winged stilt	Chordata	Aves	Charadriiformes	Recurvirostridae	*Himantopus*	*himantopus*
17	White-throated Kingfisher	Chordata	Aves	Coraciiformes	Alcedinidae	*Halycon*	*smyrnensis*
18	Barn Swallow	Chordata	Aves	Passeriformes	Hirundinidae	*Hirundo*	*rustica*
19	Common sandpiper	Chordata	Aves	Charadriiformes	Scolopacidae	*Actitis*	*hypoleucos*
20	White breasted waterhen	Chordata	Aves	Gruiformes	Rallidae	*Amaurornis*	*phoenicurus*
21	Asian Koel	Chordata	Aves	Cuculiformes	Cuculidae	*Eudynamys*	*scolopaceus*

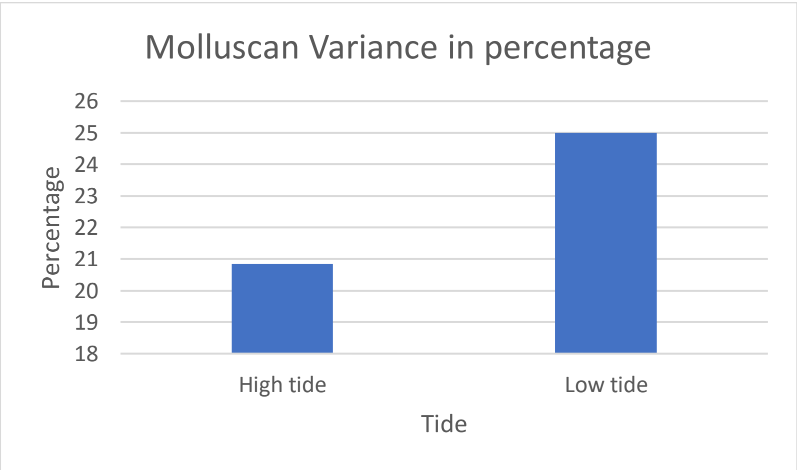
3.2 Species diversity across tidal influx

Graph 1: Arthopodal variance in percentage during the tidal influx



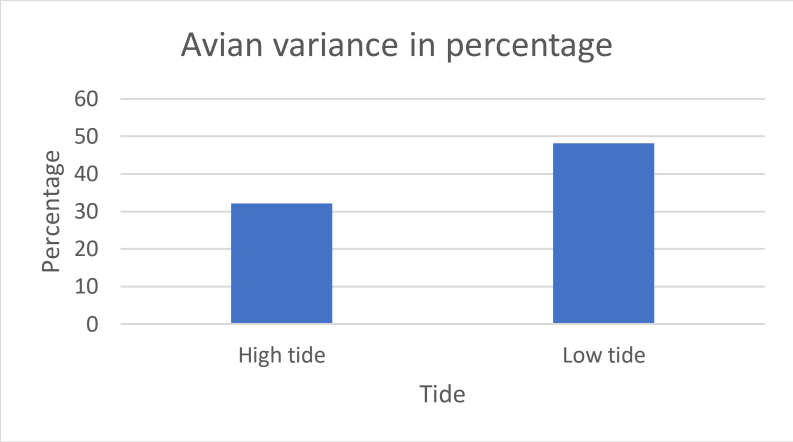
High tide	Low tide
14.58333	50

Graph 2: Molluscan variance in percentage during the tidal influx



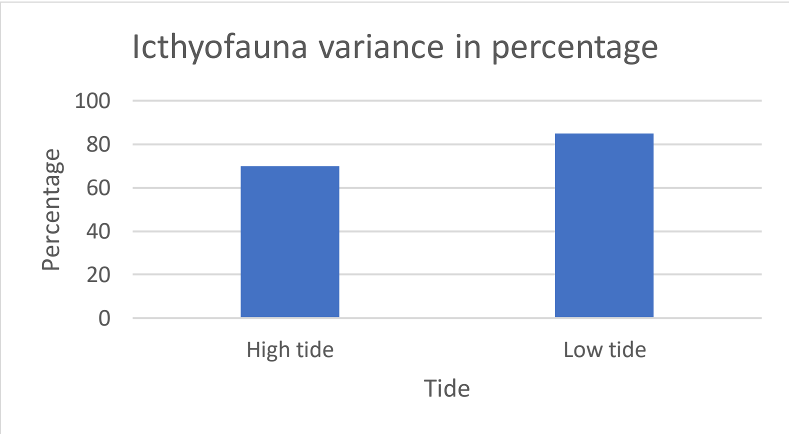
High tide	Low tide
20.83333	25

Graph 3: Avian variance in percentage during the tidal influx



High tide	Low tide
32.14286	48.21429

Graph 4: Icthyofauna (secondary data) variance in percentage during the tidal influx



High tide	Low tide
70	85

3.3 Species richness across tidal influx

$$\text{Species Richness} = \frac{S - 1}{\log N}$$

Where
S = Number of species present in community
N = Number of Individuals in community

3.3.1 Species richness during high tide

S = 18

N = 105

Species richness = 8.411

3.3.2 Species richness during low tide

S = 31

N = 264

Species richness = 12.3915

CHAPTER 4 CONCLUSION

The arthopodal diversity across the tidal influx was found to be distinctly high at low tide (50%) as compared to high tide (14.5%). Not much distinct observation was made for molluscans by being 25% at low tide and 20 at high tide. The species diversity for avifauna was found to be 48.2% at high tide and 32.14 % during low tide. On accessing the faunas of interest at the tidal influx it was found that low tide harbours high species diversity as compared to high tide.

On applying species richness; high tide stood at 8.411 and low tide stood at 12.39. On accessing the faunas of interest at the tidal influx it was found that low tide harbours high species richness as compared to high tide.

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