IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 3, March 2023

Molluscan Biodiversity of Juhu, Mumbai, Maharashtra

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Abstract: *The intertidal zone is unique in terms of its ecological condition and faunal assemblage. Mumbai being a metropolitan island city and commercial capital of India, its ever-increasing population and infrastructure tend to take a toll on the environment. The beaches of Mumbai have been used extensively for tourism and other integrated activities. The motive of this study was to observe the gradation in species richness over a decade, surpassing the effect of factors such as climate change, human intervention and surviving extreme conditions. A visual survey was conducted for a period of 1 year (from January 2022 to January 2023) on the coastline alongside Juhu Church road (Juhu Tara road), Mumbai - latitude-19.102202° and longitude-72.824816°, an area of approximately 2 Km was covered. A total of 40 species from 24 families belonging to 6 orders of gastropods and 16 species from 9 families belonging to 6 orders of bivalves of phylum Mollusca were observed. This survey is compared with the data accessible from the literature. This showed 28.57% similarity and 62.5% similarity in gastropod and bivalve shells respectively, which means there was an increase of 71.43% in gastropod and 37.5% in bivalve biodiversity. The comprehensive checklist of molluscan shells can be used as the baseline data for future research and to develop the management strategy for the conservation of a coastal marine ecosystem.*

Keywords: Molluscan Diversity, Juhu, Climate Change, Species Richness.

I. INTRODUCTION

Biodiversity is essential for the processes that support all life on Earth, including humans. Without a wide range of animals, plants and microorganisms, we cannot have the healthy ecosystems that we rely on to provide us with the air we breathe and the food we eat. Surveys form the backbone for generating all the baseline information on biodiversity of a region. With this information, we can monitor populations and track how species respond to disturbances in their environments. Shallow marine areas are extremely sensitive to sea level changes that are often caused by climatic fluctuations. The intertidal zone, commonly known as the littoral zone, is the area between land and sea that is covered by water at high tide but not during low tide [6]. It is part of the coast which is highly variable, and one of the diverse and most productive areas providing shelter to several intertidal fauna such as crustaceans, polychetes, amphipods and molluscs. Ever increasing human population, habitat destruction and pollution along the Mumbai coast are some of the major threats to molluscan fauna [10].

Phylum Mollusca is the second largest invertebrate group after arthropods, with more than 200,000 species [7]. The molluscan fauna that lives in these settings possess a unique combination of accreting shells preserving climatic signature and a history of rapid ecological and evolutionary response to climatic shifts [5]. Molluscs are the environment indicators and play a very important role in maintaining aquatic ecosystems by recycling nutrients and surviving as nutrition for certain aquatic organisms. Also, they are an important source of food for other animals i.e., shells, birds and mammals even for human beings [13]. In particular, many molluscs are economically important as food items, such as mussels, oysters, clams and some shipworm species [2]. The macro benthic molluscan community is known for its various ecosystem services such as bioremediation [15],biomonitoring [14], carbon storage [16]. Ultimately, these surveys can help maintain ecosystem equilibrium by informing successful management policies. Accurate indicators of biodiversity are essential for managing exploited marine ecosystems.

The currently most widely adopted indicator is the 'mean trophic level' of catches, the position of a specific species in the food chain (trophic level) averaged over all the species in the catch. The current biodiversity study was carried out

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at Juhu Church road, Juhu Tara, lat-19.102202° long-72.824816° to compare the number of observed species from the literature available and study the variation in its number over a period of decade.

II. METHODOLOGY

A. Site of Study

Juhu, also named as "Juvem" by the Portuguese, is currently a very well-developed neighbourhood in the Mumbai Suburban. It is considered to be immensely famous as one of the best beaches in Mumbai and is an active Tourist attraction spot. It is also heavily occupied during Festivities, such as Ganesh Chaturthi, Navratri, etc. and a crucial destination for shooting films. It was primarily inhabited by the Bhandari, Kunbi and the Agri community.

Location Area: Surrounded by the large Arabian Sea to the West, Versova to the North, Vile Parle to the East and Santacruz to the South. It is a 6 km stretch up till Versova. Most of the beach is characterised by rocky formations unlike a few sandy beaches.

Description:

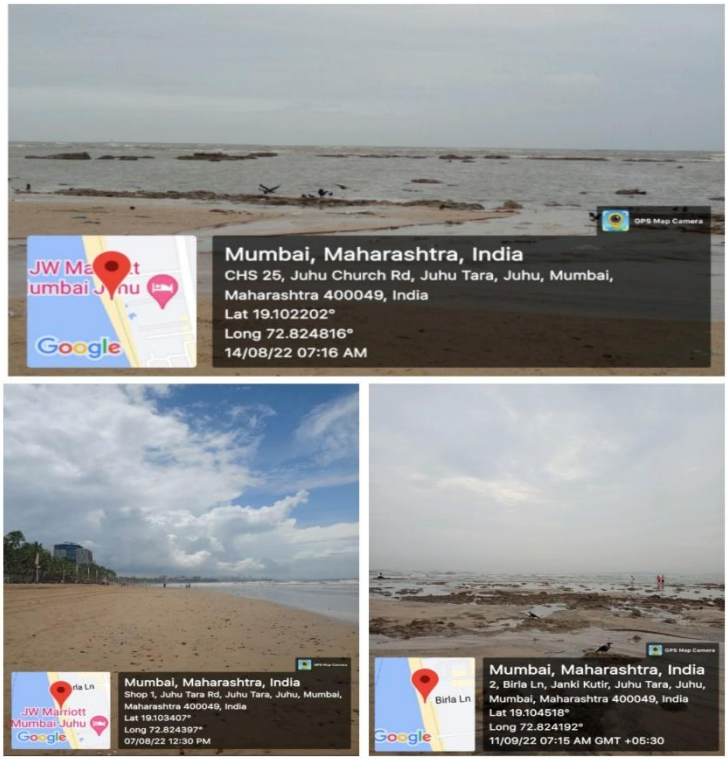
Due to the beach experiencing tidal movements, rocky patches are distinctly exposed displaying a great variety of invertebrates.

Climate:

It harbours a very linear climatic condition throughout the year. Maximum temperature attained in Summers is 35 °C (95 °F) likewise, minimum temperature is 25 °C (77 °F). It continues to remain hot even during the Winters. Monsoon period ranges from mid-July to September.

Route to Destination:

Railway stations that are the nearest are Andheri, Vile Parle and Santacruz Stations. B.E.S.T buses to reach the destination are available (Two bus depots in Juhu, present) [9].



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B.Method of Survey

A visual survey of the coast alongside Juhu Church road (Juhu Tara Road) was carried out over a period of 1 year from January 2022 to January 2023, specifically 3 times per month. To begin with our survey, we monitored and shortlisted the days on which the sea tides were comparatively low and greater shore exposure was observed. The tide range selected was between -0.5m to 1m using tide forecasts [11, 12]. An area of approximately 2 km (Santacruz to Vile Parle) was covered. We conducted a beach walk for observation and documentation of molluscan (gastropods and bivalves) shells.

For documentation purposes, Mobile phone cameras, digital cameras were used. Basic apparatus such as gloves, petri dish and forceps were used for examination and identification of the samples.

Identification was done using few standard reference books, namely:

- The Book of Indian Shells" by Deepak Apte [3].
- "Sea Shells of India" by Deepak Apte [4].

The site used for detailed classification of gastropod and bivalve species, was World Register of Marine Species (WoRMS) [1]. And a checklist of observed species was made with appropriate segregation according to their respective Orders and Families for comparative study with the data available in the literature. These observations were compared with the observations available in the literature [8] to evaluate the changes in the number of species over a decade.

III. OBSERVATIONS

We observed the gastropods and bivalves present at the site of study and classified them into their respective Orders and Families. Following the classification, we compared our data with the acquired literature and listed down the similar species observed. Those are as follows:

TABLE 1 - Species of gastropods obtained from current survey and its comparison with the species from the literature.

Sr. No.	Order	Family	Genus	Species	2011-12	2022-23
1.	Neogastropoda	Horaiclaviidae	Paradrillia	patruelis		✓
2.		Conidae	Conus	litoglyphus		✓
3.		Conidae	Conus	hyaena		✓
4.		Conidae	Conus	lentiginosus		✓
5.		Conidae	Conus	biliosus		✓
6.		Muricidae	Orania	subnodulosus		✓
7.		Muricidae	Semiricinula	tissoti		✓
8.		Muricidae	Semiricinulla	konkanensis		✓
9.		Muricidae	Indothais	lacera		✓
10.		Muricidae	Indothais	sacellum		✓

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11.		Muricidae	Ergalatax	Contracta		✓
12.		Muricidae	Murex	Muricopsisbombayanus	✓	✓
13.		Muricidae	Chicoreus	banksii		✓
14.		Babyloniidae	Babylonia	spirata	✓	✓
15.		Nassariidae	Nassarius	stolatus	✓	✓
16.		Nassariidae	Nassarius	Nassarius glans	✓	✓
17.		Nassariidae	Agaronia	nebulosa		✓
18.		Fasciolariidae	Peristernia	pulchella		✓
19.		Columbellidae	Anachis	terpsichore		✓
20.		Pisaniidae	Cantharus	spiralis grey	✓	✓
21.		Pisaniidae	Engina	EnginaZea		✓
22.		Olividae	Oliva	lignaria	✓	✓
23.		Olividae	Agaronia	nebulosa		✓
24.		Clavatulidae	Turricula	javana		✓
25.		Pseudomelatomidae	Ptychobela	nodulosa		✓
26.		Turiidae	Gemmula	speciosa		✓
27.		Cancellariidae	Scalptia	scalarina		✓
28.	Trochida	Turbinidae	Turbo	brunens		✓
29.		Tegulidae	Tectus	tentorium		✓
30.		Trochidae	Trochus	maculatus	✓	✓
31.		Trochidae	Umbonium	vestiarium		✓
32.	Littorinimorpha	Vanikaridae	Vanikoro	Vanikorocuvieriana		✓
33.		Cymatildae	Gyrineum	natator		✓
34.		Cypraeidae	Bistolida	hirundo		✓
35.	Caenogastropoda	Potamididae	Telescopium	telescopium	✓	✓

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36.	Ellobiida	Ellobidae	Cassidula	aurisfelis		✓
37.	Seguenziida	Chilodontaidae	Euchelus	asper	✓	✓
38.		Lepetellidae	Diodora	rueppellii		✓
39.		Lepetellidae	Diodora	ticaconica		✓
40.	-	Nassiliidae	Cellana	radiata		✓

TABLE II - Species of Bivalves obtained from current survey and its comparison with the species from the literature.

Sr. No.	Order	Family	Genus	Species	2011-12	2022-23
1.	Adapedonta	Pharidae	Siliqua	radiata	✓	✓
2.	Cardiida	Donacidae	Donax	scortum	✓	✓
3.		Donacidae	Donax	cuneatus	✓	✓
4.		Donacidae	Donax	incarnatus	✓	✓
5.		Tellinidae	Tellina	sinuata		✓
6.		Tellinidae	Gastrana	matadoa		✓
7.		Cardiidae	Cardium	setosum	✓	✓
8.	Carditida	Carditidae	Cardiata	antiquata	✓	✓
9.	Arcida	Arcidae	Arca	bistrigata	✓	✓
10		Arcidae	Arca	tortuosa	✓	✓
11	Venerida	Mactridae	Spisula	voyi	✓	✓
12		Veneridae	Gafrarium	divaricata		✓
13		Veneridae	Pitar	erycina		✓
14		Veneridae	Dosinia	prostrata		✓
15		Veneridae	Dosinia	gibba		✓
16	Mytilida	Mytilidae	Perna	viridis	✓	✓

IV. RESULT

A total of 39 species from 24 families belonging to 6 orders of gastropods and 16 species from 9 families belonging to 6 orders of bivalves of phylum Mollusca were observed in the current survey (2022-2023). We therefore inferred from

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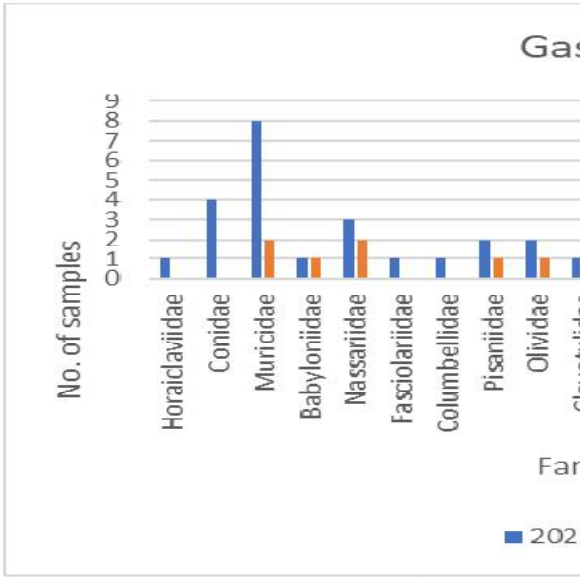
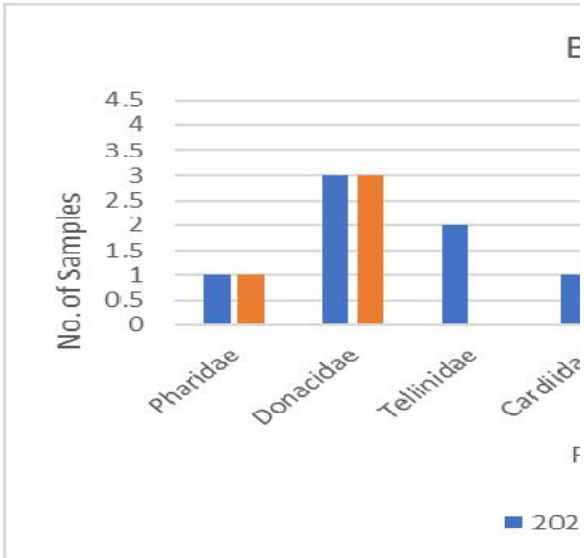
our assessment that 28.57% similarity and 62.5% similarity in gastropod and bivalve shells respectively was observed, which depicts that there was an increase of 71.43% in gastropod and 37.5% in bivalve biodiversity.

We deduce from our above conducted analysis, that under gastropods, belonging to the order Neogastropoda, 8 species from Muricidae family, 4 from Conidae family, 3 from Nassariidae family, 2 each from Pisaniidae and Olividae family, along with 1 species each from Turiidae, Cancellariidae, Horaiclaviidae, Babyloniidae, Fasciolariidae, Columbellidae, Clavatulidae were observed.UnderTrochida order, 1 species each of the Turbinidae and Tegulidae family and under Order Littorinimorpha, 1 species each of Vanikaridae, Cymatildae, Cypraeidae were spotted. 1 organism of the Potamididae family belonging to order Caenogastropoda and 1 organism from the Ellobidae Family belonging to Ellobiida Order were seen. Further, in the order Segunziida, 1 organism of Chilodontaidae and 2 species of Lepetellidae were identified. Under bivalves, 4 species of Veneridae family and singular species from Mactridae family under Order Venerida were observed. In the Order Cardiida 3 species of Donacidae, 2 species of Tellinidae and 1 species of Cardiidae were seen. 2 species from the Arcidae family of Arcida order were observed. 1 species each from the Pharidae family of Adapedonta Order, Carditidae family of Carditida, and Mytilidae family of Mytilida were observed.





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V. CONCLUSION

The above conducted study shows a significant increase in the species of gastropods and bivalves with time, specifically over a decade. Many samples were found possessing live organisms. Abundance of live colonies of Barnacles were observed. Many live molluscan shells were attached to the rocky substratum besides their eggs. Except very few shells were found to be eroded or brittle due to infestation or extreme harsh conditions, and some broken, this observation overall indicates that the molluscan diversity is vast compared to the decade old literature data. Thereby concluding that species richness has occurred over a decade, indicating that the molluscan diversity present at the site has adapted well enough to its adverse conditions such as human intervention, climatic change or predation by larger organisms. The comprehensive checklist of molluscan shells can be used as the baseline data for future research and to develop the management strategy for the conservation of a coastal marine ecosystem.

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