



## Diversity of intertidal Macro-benthic Flora and Fauna along the South Saurashtra Coastal zone, Gujarat, India

Pooja Anilbhai Agravat<sup>1</sup>, Hiren Bhagvanbhai Parmar<sup>1</sup>, Dhaval Mukeshbhai Bhatt<sup>1\*</sup>, Jatin Vijaybhai Raval<sup>2</sup>, Pradeep Chandravadan Mankodi<sup>1</sup>

<sup>1</sup> Department of Zoology, Division of Freshwater and Marine Biology, Faculty of Science, The Maharaja Sayajirao University of Baroda, Vadodara, Gujarat, India

<sup>2</sup> Department of Life Sciences, Zoology Lab, Bhakta Kavi Narsinh Mehta University, Junagadh, Gujarat, India

### Abstract

The present study was focused to investigate the biodiversity of the macro-benthic organisms along the rocky intertidal zones of the Saurashtra Coast. The study was conducted in two different phases from August 2014 to February 2016 and from January 2021 to December 2021. For the first phase, rocky coastlines of Chorwad, Aadri, Navapara and Vadodara Dodiya were selected from South Saurashtra Coast. While second phase study was conducted at Mangrol, Aadri and Veraval coast to assess the diversity of Mollusca. It reports 21 species of benthic macroflora belonging to 14 genera, 10 families, 8 orders, 3 classes and 3 divisions. It also reports 109 species of macrobenthic fauna classified under 81 genera, 58 families, 29 orders, 13 classes and 6 phyla. The highest species were recorded from division Chlorophyta (10) in flora and 68 species from phylum Mollusca in fauna. Overall, the present study revealed that the rocky intertidal zones of the South Saurashtra Coast provide the suitable habitat to the microbenthic diversity. This study emphasizes the further research on the biological and ecological aspects of the macrobenthic organisms of this region. It will also provide the baseline data to the scientists and policymakers for the conservation of rich diversity consisting of rocky intertidal zones of Saurashtra Coast, Gujarat.

**Keywords:** biodiversity, conservation, intertidal, Macro-benthic, species list

### Introduction

The aquatic ecosystems having connections with each other in different ways play a significant role in the global system of the environment. These aquatic ecosystems such as oceans, seas, lakes, gulfs and rivers cover approximately 70% of the Earth's surface and consist of maximum inhabitants (Welch and Naczk 1992). Out of these, a total of 18% of the Earth's surface is covered by the coastal zones (Balasubramanian 1999). These zones serve as a feeding, larval culturing, and spawning area, as well as an interstitial biotope between the marine and freshwater environments, indicating its great biotic potential (Nybakken 1995; Webber 1995; Balasubramanian 1999; Nabavi *et al.*, 2011). One of the most important maritime habitats with environmental, biological, and economic significance is the coastal or intertidal zone (Balasubramanian, 1999). The intertidal zone, which is defined as the space between high and low tides, is home to a diverse and abundant biota that is almost exclusively made up of marine species. The animals in this zone are constantly exposed to air and have evolved to cope with environmental pressures (Esenowo and Ugwumba 2010).

The rocky coasts are a type of coastal ecosystem that can be found all over the world, forming lengthy stretches of shoreline or patches along the coast (Cruz-Motta *et al.*, 2010). Several phyla of animals live in this important habitat, which plays an important ecological role in the construction and operation of maritime coastal habitats. (Little and Kitching, 2000; Menge and Branch, 2001), and a number of them (algae, mussels, oysters, for example) have significant social and economic significance. The rocky coasts are sensitive to a variety of factors, and research and monitoring initiatives for biodiversity conservation have increasingly focused on them (Thompson *et al.*, 2002). The upper and lower rock surfaces, as well as the substrate beneath the rocks, offer a diversified microhabitat for the development of a significant number of species that are rarely found in other habitats (Chapman., 2002; Motta *et al.*, 2003). The rocky intertidal area is divided into four zones by vertical zonation: supratidal, high tidal, middle tidal, and low tidal. Stephenson and Stephenson (1949) were the first to describe them, and they consist of unique creatures within separate zones. The rocky intertidal habitats are exposed to a wide range of physical circumstances in the wild, and their communities are remarkably resilient to these changes (Weitzman *et al.*, 2021).

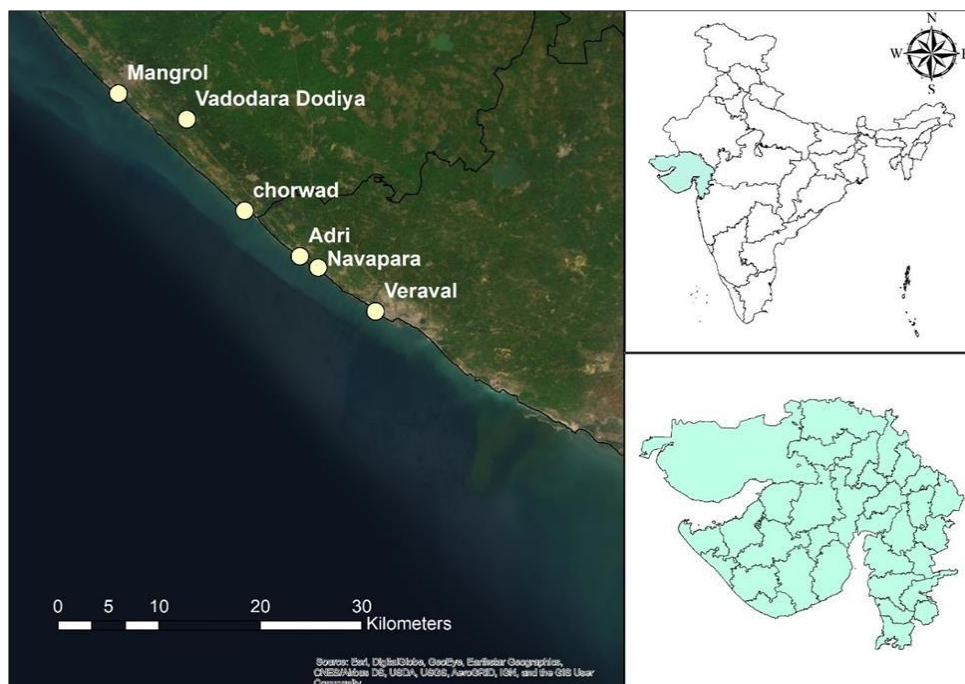
Macro benthic flora and fauna - macrobenthos (body size < 1 mm) are organisms that live on or inside the deposit at the bottom of a body of aquatic habitat. They are a significant part of the intertidal zone among the marine organisms and it plays a vital role in the aquatic environment in view of their involvement in mineralization, mixing of sediments, the flux of oxygen into sediments and cycling of organic matter (Snelgrove, 1998; Parmar and Mankodi, 2017). These are easily distinguished through the naked eye with the lower range of body size at 1

mm but usually larger than 3 mm (Idowu and Ugwumba 2005). Macro benthos are uniquely placed in food chains due to the diversity of nutrition and habitat (Nybakken 1997). They include several species of organisms, which are divided across different taxa including flora - Ochrophyta, Chlorophyta, Rhodophyta, etc. and fauna - Porifera, Annelids, Coelenterates, Molluscs, Crustaceans, Arthropods and etc. In the coastal water ecosystem, they play a significant role in the circulation and recirculation of nutrients. The distribution of macrobenthos assemblage is determined by environmental conditions such as hydrological characteristics, physicochemical factors and tidal patterns, availability of organic matter, sediment texture, predation, competition and human activities (Lee 2008; Sihombing *et al.*, 2017). The benthic macrobenthos plays a key role in the characterization and the functioning of the littoral ecosystems and constitutes a good indicator of their health (Chaouti *et al.*, 2005; Gonzalez *et al.*, 2014; Celentanoa *et al.*, 2019). This work was designed to assess the initial state of the macrobenthic biodiversity along the Saurashtra coast of the Arabian sea. The present study will be useful for the conservation of the coastal zones. It also emphasizes further research on the ecological and biological aspects of the macrobenthos.

### Materials and Methods

The present study was conducted in two different time durations i.e., from August 2014 to February 2016 (Parmar and Mankodi, 2017), and from January 2021 to December 2021. For the study, different rocky coastal zones of alluvial plains of South Saurashtra Coast were selected such as Mangrol ( $21^{\circ}06'21.92''\text{N}$ ,  $70^{\circ}06'21.92''\text{E}$ ), Chorwad ( $21^{\circ}00'02.6''\text{N}$ ,  $70^{\circ}13'34.6''\text{E}$ ), Aadri ( $21^{\circ}57'35.1''\text{N}$ ,  $70^{\circ}16'43.0''\text{E}$ ), Navapara ( $20^{\circ}56'26.7''\text{N}$ ,  $70^{\circ}18'23.3''\text{E}$ ), Vadodara Dodiya ( $21^{\circ}04'54.40''\text{N}$ ,  $70^{\circ}10'16.61''\text{E}$ ) and Veraval ( $20^{\circ}54'35.59''\text{N}$ ,  $70^{\circ}21'0.70''\text{E}$ ) (Figure 1). The diversity of macrobenthos was recorded from Chorwad, Navapara, Aadri and Vadodara Dodiya coast in the first phase of the study. In the second phase, the diversity of mollusca was recorded from Mangrol, Aadri and Veraval coast.

During the entire study, all the study sites were surveyed regularly on monthly basis during the lowest low tide period. During the examination, the encountered flora and fauna were carefully observed through random sampling and extensive photography was carried out (Figure 4, 5, 6). Some of the specimens were transported to the Division of Freshwater and Marine Biology, Department of Zoology for detailed taxonomic identification through morphology and morphometry. All the collected specimens were identified up to the lowest possible taxonomic level using authenticated taxonomic keys, research articles and websites such as Marine Species Identification Portal Website (<http://species-identification.org>) (Subrahmanyam *et al.*, 1949; Subrahmanyam *et al.*, 1951; Subrahmanyam *et al.*, 1952; Fischer *et al.*, 1955; Chhapgar, 1957; Apte, 1988; Jeyabaskaran and Wafar, 2002; Dhargalkar and Kavlekar, 2004; Picton, 2007; Dave and Mankodi, 2008; Jha *et al.*, 2009; Bhattji *et al.*, 2010; Coan and Valentich-scott 2012; Pandya and Mankodi, 2013; Pandya *et al.*, 2013; Van Soest *et al.*, 2014). Scientific names and classification were adopted from the World Register of Marine Species (Worms - <http://www.marinespecies.org>). The complete study was carried out in no or minimal destructive method to not disturb the ecosystem.



**Fig 1:** Study area: Rocky Intertidal Coasts of South Saurashtra, Gujarat, India. Mangrol ( $21^{\circ}06'21.92''\text{N}$ ,  $70^{\circ}06'21.92''\text{E}$ ), Chorwad ( $21^{\circ}00'02.6''\text{N}$ ,  $70^{\circ}13'34.6''\text{E}$ ), Aadri ( $21^{\circ}57'35.1''\text{N}$ ,  $70^{\circ}16'43.0''\text{E}$ ), Navapara ( $20^{\circ}56'26.7''\text{N}$ ,  $70^{\circ}18'23.3''\text{E}$ ), Vadodara Dodiya ( $21^{\circ}04'54.40''\text{N}$ ,  $70^{\circ}10'16.61''\text{E}$ ) and Veraval ( $20^{\circ}54'35.59''\text{N}$ ,  $70^{\circ}21'0.70''\text{E}$ )

### Results and Discussion

The present study reports 21 species of benthic macroflora belonging to 14 genera, 10 families, 8 orders, 3 classes and 3 divisions (Figure 2). Out of all the species recorded, Aadri reported highest presence of floral diversity with 19 species followed by Chorwad (15 spp.), Navapara (14 spp.) and Vadodara Dodiya (14 spp.) (Table 1). The study also reports 109 species of macrobenthic invertebrate fauna classified under 81 genera, 58 families, 29 orders, 13 classes and 6 phyla (Figure 3). In first phase of the study, the highest species richness was observed at Adri (81 spp.) followed by Chorwad (74 spp.), Vadodara Dodiya (62 spp.) and Navapara (60 spp.) (Table 2). While in the second phase, out of 68 species of Mollusca, the highest species richness was observed at Veraval (45 spp.) followed by Aadri (32 spp.) and Mangrol (31 spp.) (Table 3). If we compare the species richness of Mollusca in both the studies, Aadri shows fewer numbers compare to the first phase study. The checklist of molluscan diversity is prepared as a separate table as the study was carried out in two phases (Table 3).

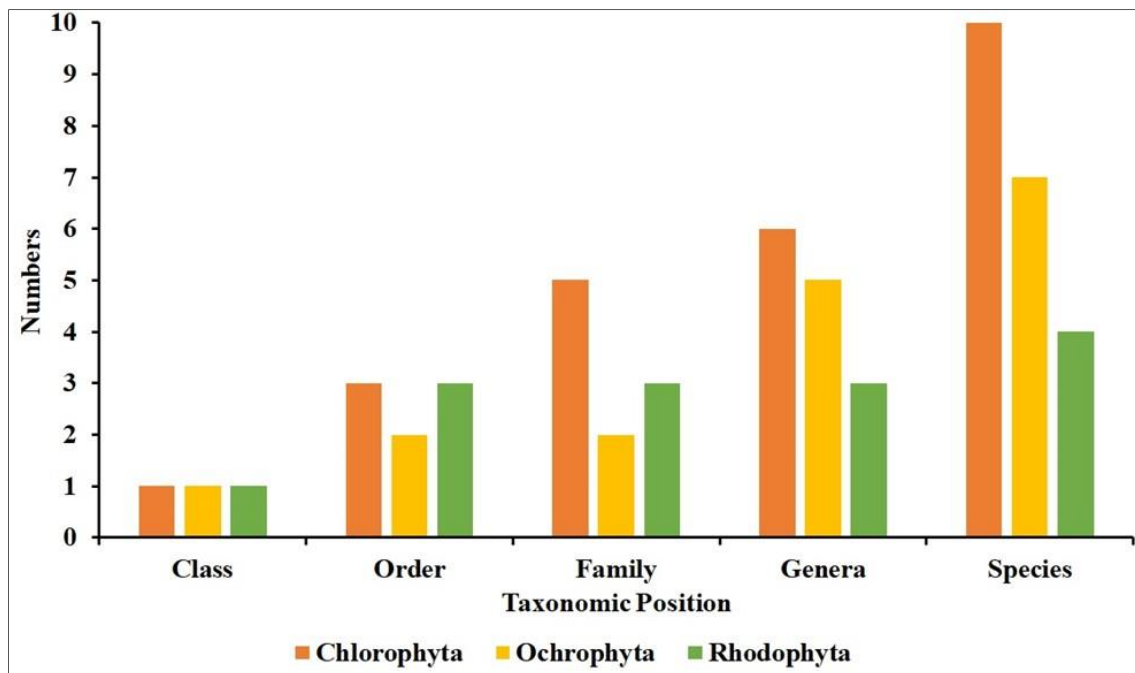


Fig 2: Taxon wise distribution of macrobenthic flora at South Saurashtra Coast, Gujarat, India

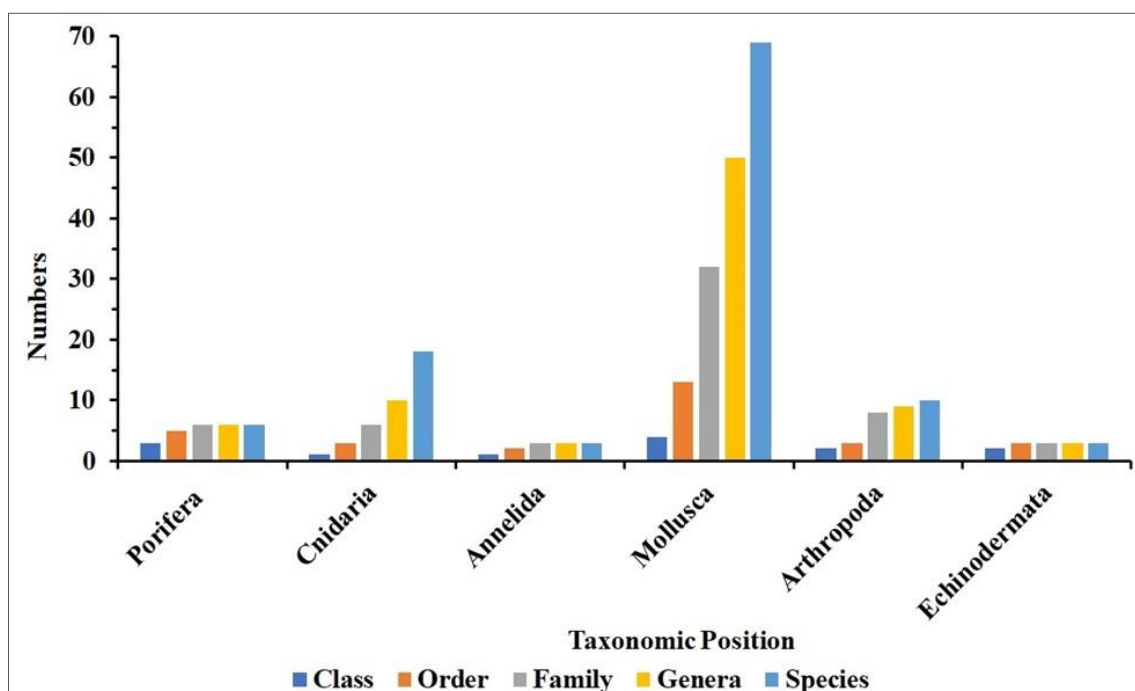
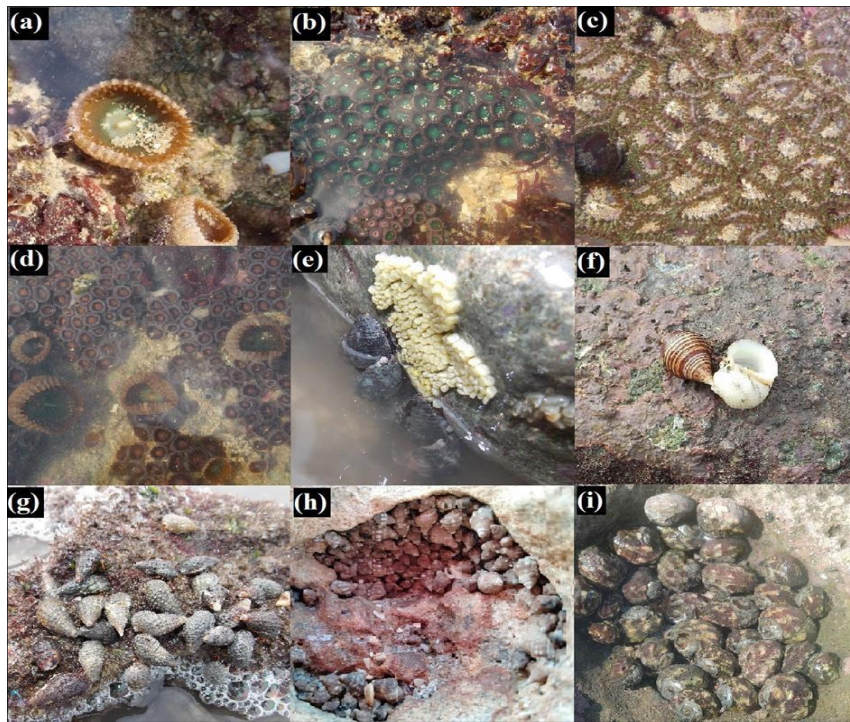
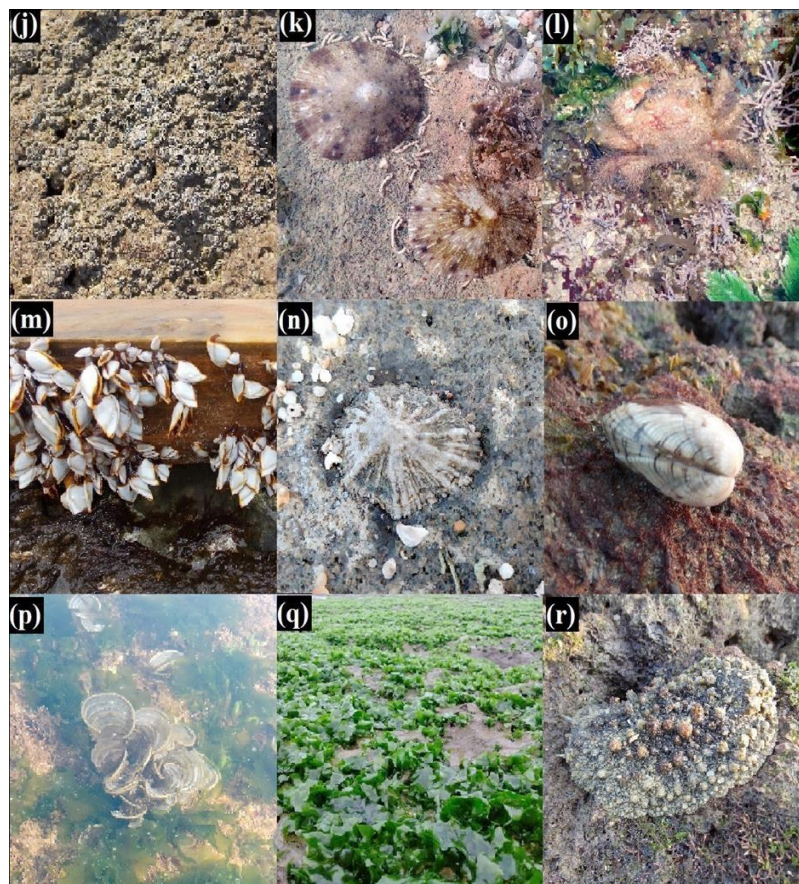


Fig 3: Taxon wise distribution of macrobenthic fauna at South Saurashtra Coast, Gujarat, India



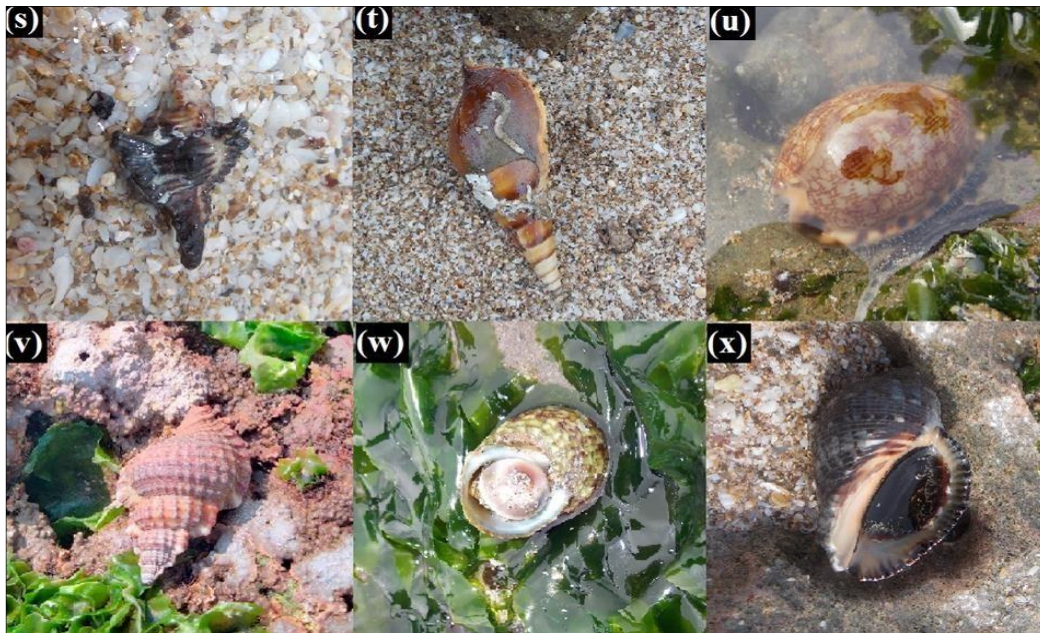


**Fig 4:** Macrofauna found at Rocky Intertidal Coasts of South Saurashtra Coast: (a) *Palythoa mutuki* (Haddon & Shackleton, 1891), (b) *Zoanthus sansibaricus* Carlgren, 1900, (c) *Zoanthus vietnamensis* Pax & Müller, 1957, (d) *Zoanthus sansibaricus* Carlgren, 1900 – Orange variant, (e) *Turbo bruneus* (Röding, 1798), (f) *Pollia undosa* (Linnaeus, 1758), (g) *Cerithium scabridum* Philippi, 1848, (h) *Echinolittorina malaccana* (Philippi, 1847), (i) *Lunella coronata* (Gmelin, 1791)



**Fig 5:** Macrofauna and Macroflora found at Rocky Intertidal Coasts of South Saurashtra Coast: (j) *Amphibalanus amphitrite* (Darwin, 1854), (k) *Cellana radiata* (Born, 1778), (l) *Pilumnus vespertilio* (Fabricius, 1793), (m) *Lepas (Anatifa) anatifera* Linnaeus, 1758, (n) *Patella vulgata* Linnaeus, 1758, (o) *Periglypta reticulata* (Linnaeus, 1758), (p) *Padina gymnospora* (Kützting) Sonder, 1871, (q) *Ulva lactuca* Linnaeus, 1753, (r) *Peronia verruculata* (Cuvier, 1830)





**Fig 6:** Macrofauna found at Rocky Intertidal Coasts of South Saurashtra Coast: (s) *Chicoreus brunneus* (Link, 1807), (t) *Tibia curta* (G. B. Sowerby II, 1842), (u) *Mauritia arabica* (Linnaeus, 1758) (v) *Gyryneum natator* (Röding, 1798), (w) *Nerita chamaeleon* Linnaeus, 1758, (x) *Purpura panama* (Röding, 1798),

**Table 1:** Diversity of macroflora at (a) Navapara, (b) Adri, (c) Vadodara Dodiya and (d) Chorwad of South Saurashtra Coast Gujarat, India (Parmar and Mankodi, 2017).

Division	Class	Order	Family	Genus	Species	Study Sites			
						a	b	c	d
Chlorophyta	Ulvophyceae	Bryopsidales	Bryopsidaceae Bory de Saint-Vincent, 1829	<i>Bryopsis</i> J.V. Lamouroux, 1809	<i>Bryopsis plumosa</i> (Hudson) (C. Agardh, 1823)	P	P	A	A
			Caulerpaceae Kützing, 1843	<i>Caulerpa</i> J.V. Lamouroux, 1809	<i>Caulerpa scalpelliformis</i> f. <i>dwarkensis</i> (Børgesen, 1932)	A	P	P	P
					<i>Caulerpa racemosa</i> (Forsskål) (J. Agardh, 1873)	P	P	P	P
					<i>Caulerpa taxifolia</i> (M. Vahl) (C. Agardh, 1817)	P	A	P	P
		Cladophorales	Cladophoraceae Wille, 1884	<i>Chaetomorpha</i> Kützing, 1845	<i>Chaetomorpha antennina</i> (Bory) (Kützing, 1847)	A	P	A	P
				<i>Cladophora</i> Kützing, 1843	<i>Cladophora glomerata</i> (Linnaeus) (Kützing, 1843)	A	P	A	A
			Siphonocladaceae Schmitz, 1879	<i>Boergesenia</i> J. Feldmann, 1938	<i>Boergesenia forbesii</i> (Harvey) (Feldmann, 1938)	P	P	P	P
		Ulvales	Ulveae J.V. Lamouroux ex	<i>Ulva</i> Linnaeus, 1753	<i>Ulva intestinalis</i>	P	A	P	A

			Dumortier, 1822		(Linnaeus, 1753)						
					<i>Ulva lactuca</i> (Linnaeus, 1753)	P	P	P	P		
					<i>Ulva linza</i> (Linnaeus, 1753)	P	P	A	P		
Ochrophyta	Phaeophyceae	Dictyotales	Dictyotaceae Lamouroux ex Dumortier, 1822	<i>Stoechospermum</i> Kützing, 1843	<i>Stoechospermum polypodioides</i> (J.V. Lamouroux, J. Agardh, 1848)	A	P	A	A		
				<i>Padina</i> Adanson, 1763	<i>Padina gymnospora</i> (Kützing) Sonder, 1871	P	P	P	P		
					<i>Padina tetrastromatica</i> (Hauck, 1887)	A	P	A	P		
				<i>Dictyota</i> J.V. Lamouroux, 1809	<i>Dictyota dichotoma</i> (Hudson) J.V. Lamouroux, 1809	P	P	A	A		
		Fucales	Sargassaceae Kützing, 1843	<i>Sargassum</i> C. Agardh, 1820	<i>Sargassum swartzii</i> (C. Agardh, 1820)	P	P	P	P		
					<i>Sargassum cinereum</i> (J. Agardh, 1848)	P	P	P	P		
				<i>Polycladia</i> Montagne, 1847	<i>Polycladia indica</i> (Thivy & Doshi) (Draisma, Ballesteros, F. Rousseau & T. Thibaut, 2010)	P	P	P	P		
		Rhodophyta	Florideophyceae	Rhodymeniales	Champiaceae Kützing, 1843	<i>Champia</i> Desvaux, 1809	<i>Champia compressa</i> (Harvey, 1838)	A	P	P	P
							<i>Champia indica</i> (Børgesen, 1933)	P	P	P	P
				Gracilariales	Gracilariaceae Nägeli, 1847	<i>Gracilaria</i> Greville, 1830	<i>Gracilaria corticata</i> (J. Agardh, 1852)	P	P	P	P
Nemaliales	Galaxauraceae P.G. Parkinson, 1983			<i>Tricleocarpa</i> Huisman & Borowitzka, 1990	<i>Tricleocarpa fragilis</i> (Linnaeus) (Huisman & R.A. Townsend, 1993)	A	P	P	A		

**Table 2:** Diversity of macrofauna at (a) Navapara, (b) Adri, (c) Vadodara Dodiya and (d) Chorwad of South Saurashtra Coast Gujarat, India (Parmar and Mankodi, 2017).

Phylum	Class	Order	Family	Genus	Species	a	b	c	d
Porifera	Calcarea	Leucosolenida	Grantiidae Dendy, 1892	<i>Grantia</i> Fleming, 1828	<i>Granita</i> sp.	P	P	P	P

	Demospongiae	Clionaida	Clionaidae d'Orbigny, 1851	<i>Cliona</i> Grant, 1826	<i>Cliona</i> sp.	A	P	A	A
		Haplosclerida	Chalinidae Gray, 1867	<i>Haliclona</i> Grant, 1841	<i>Haliclona</i> ( <i>Reniera</i> ) <i>tubifera</i> (George & Wilson, 1919)	A	P	P	A
		Suberitida	Halichondriidae Gray, 1867	<i>Halichondria</i> Fleming, 1828	<i>Halichondria</i> ( <i>Halichondria</i> ) <i>panicea</i> (Pallas, 1766)	P	P	P	P
			Suberitidae Schmidt, 1870	<i>Suberites</i> Nardo, 1833	<i>Suberite</i> sp.	A	P	A	P
Homoscleromorphia	Homosclerophorida	Oscarellidae Lendenfeld, 1887	<i>Oscarella</i> Vosmaer, 1884	<i>Oscarella</i> <i>lobularis</i> (Schmidt, 1862)	P	P	P	P	
Annelida	Polychaeta	***	Chaetopteridae Audouin & Milne Edwards, 1833	<i>Chaetopterus</i> Cuvier, 1830	<i>Chaetopterus</i> <i>variopedatus</i> (Renier, 1804)	P	A	A	P
		Phyllodocida	Nereididae Blainville, 1818	<i>Nereis</i> Linnaeus, 1758	<i>Nereis</i> sp.	A	P	P	P
		Sabellida	Serpulidae Rafinesque, 1815	<i>Serpula</i> Linnaeus, 1758	<i>Serpula</i> <i>vermicularis</i> (Linnaeus, 1767)	A	P	A	P
Cnidaria	Anthozoa	Actiniaria	Actiniidae Rafinesque, 1815	<i>Actinia</i> Linnaeus, 1767	<i>Actinia equina</i> (Linnaeus, 1758)	P	P	P	P
					<i>Actinia tenebrosa</i> Farquhar, 1898	P	P	P	P
				<i>Anthopleura</i> Duchassaing de Fonbressin & Michelotti, 1860	<i>Anthopleura sola</i> Pearse & Francis, 2000	A	P	P	P
					<i>Anthopleura elegantissima</i> (Brandt, 1835)	A	P	A	A
				<i>Utricina</i> Ehrenberg, 1834	<i>Utricina</i> sp.	A	P	A	P
		Scleractinia	Acroporidae Verrill, 1901	<i>Montipora</i> Blainville, 1830	<i>Montipora foliosa</i> (Pallas, 1766)	P	P	P	P
			Merulinidae Verrill, 1865	<i>Goniastrea</i> Milne Edwards & Haime, 1848	<i>Goniastrea pectinata</i> (Ehrenberg, 1834)	P	P	A	P
			Poritidae Gray, 1840	<i>Goniopora</i> de Blainville, 1830	<i>Goniopora planulata</i> (Ehrenberg, 1834)	P	P	P	P
					<i>Goniopora pedunculata</i> (Quoy & Gaimard, 1833)	P	P	P	P
			<i>Porites</i> Link, 1807	<i>Porites stephensoni</i> (Crossland, 1952)	A	P	A	P	
				<i>Porites lutea</i> Milne (Edwards & Haime, 1851)	A	P	P	A	
		Zoantharia	Sphenopidae Hertwig, 1882	<i>Palythoa</i> Lamouroux, 1816	<i>Palythoa mutuki</i> (Haddon & Shackleton, 1891)	P	P	P	P

			Zoanthidae Rafinesque, 1815	<i>Zoanthus</i> Lamarck, 1801	<i>Palythoa tuberculosa</i> (Esper, 1805)	A	P	P	P		
					<i>Isaurus</i> Gray, 1828	<i>Isaurus tuberculatus</i> (Gray, 1828)	P	P	P	P	
					<i>Zoanthus kuroshio</i> (Reimer & Ono in Reimer, Ono, Iwama, Takishita, Tsukahara & Maruyama, 2006)	P	P	A	P		
					<i>Zoanthus pulchellus</i> (Duchassaing & Michelotti, 1860)	A	P	P	P		
					<i>Zoanthus sansibaricus</i> (Carlgren, 1900)	P	P	P	P		
					<i>Zoanthus sociatus</i> (Ellis, 1768)	P	P	P	P		
					Cancridae Latreille, 1802	<i>Cancer</i> Linnaeus, 1758	<i>Cancer pagurus</i> (Linnaeus, 1758)	A	P	P	P
					Diogenidae Ortmann, 1892	<i>Clibanarius</i> Dana, 1852	<i>Clibanarius nathi</i> (Chopra & K.N. Das, 1940)	P	P	P	P
							<i>Clibanarius rhabdodactylus</i> (Forest, 1953)	P	P	P	P
					Arthropoda	Malacostraca	Decapoda	Menippidae Ortmann, 1893	<i>Myomenippe</i> Hilgendorf, 1879	<i>Myomenippe hardwickii</i> (Gray, 1831)	P
Grapsidae MacLeay, 1838	<i>Pachygrapsus</i> Randall, 1840	<i>Pachygrapsus crassipes</i> (Randall, 1840)	P	P				P	P		
Pilumnidae Samouelle, 1819	<i>Pilumnus</i> Leach, 1816	<i>Pilumnus vespertilio</i> (Fabricius, 1793)	P	P				A	P		
Portunidae Rafinesque, 1815	<i>Portunus</i> Weber, 1795	<i>Portunus pelagicus</i> (Linnaeus, 1758)	P	P				P	P		
		<i>Scylla</i> De Haan, 1833 [in De Haan, 1833-1850]	<i>Scylla serrata</i> (Forskål, 1775)	A				P	A	P	
Thecostraca	Scalpellomorpha	Lepadidae Darwin, 1852	<i>Lepas</i> Linnaeus, 1758	<i>Lepas (Anatifa) anatifera</i> Linnaeus, 1758				P	P	A	P
	Balanomorpha	Balanidae Leach, 1817	<i>Amphibalanus</i> Pitombo, 2004	<i>Amphibalanus amphitrite</i> (Darwin, 1854)	P	P	P	P			
Echinodermata	Ophiuroidea	Amphilepidida	Hemieuryalidae Verrill, 1899	<i>Ophioplocus</i> Lyman, 1861	<i>Ophioplocus imbricatus</i> (Müller & Troschel, 1842)	A	P	A	A		
		Ophiacanthida	Ophiocomidae Ljungman, 1867	<i>Ophiocomella</i> A.H. Clark, 1939	<i>Ophiocomella sp.</i>	A	P	P	A		



	Asteroidea	Valvatida	Asterinidae Gray, 1840	<i>Aquilonastra</i> O'Loughlin in O'Loughlin & Waters, 2004	<i>Aquilonastra</i> <i>burtoni</i> (Gray, 1840)	P	P	P	P
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**Table 3:** Diversity of Phylum Mollusca at (a) Mangrol, (b) Veraval, (c1) Adri, (c2) Adri, (d) Navapara (e) Vadodara Dodiya (f) Chorwad of South Saurashtra Coast Gujarat, India (Agravat *et al*, 2021, Parmar & Mankodi, 2016).

Order	Family	Genus	Name of Species	Agravat <i>et al</i> , (2021)			Parmar & Mankodi, 2016			
				a	b	c1	c2	d	e	f
Ostreida	Margaritidae Blainville, 1824	<i>Pinctada</i> Röding, 1798	<i>Pinctada imbricata</i> (Röding, 1798)	P	P	P	P	P	P	P
			<i>Pinctada imbricata</i> <i>fucata</i> (A. Gould, 1850)	A	A	A	P	P	P	P
Venerida	Veneridae Rafinesque, 1815	<i>Periglypta</i> Jukes- Browne, 1914	<i>Periglypta reticulata</i> (Linnaeus, 1758)	A	A	A	P	P	P	P
		<i>Sunetta</i> Link, 1807	<i>Sunetta donacina</i> (Gmelin, 1791)	A	A	A	P	A	A	A
Octopoda	Octopodidae d'Orbigny, 1840	<i>Octopus</i> Cuvier, 1798	<i>Octopus Vulgaris</i> (Cuvier, 1797)	A	P	A	P	A	A	P
***	Architectonicidae Gray, 1850	<i>Architectonica</i> Röding, 1798	<i>Architectonica arcana</i> (Röding, 1798)	A	P	P	P	P	A	P
			<i>Architectonica laevigata</i> (Lamarck, 1816)	P	P	A	A	A	A	A
Littorinimorpha	Bursidae Thiele, 1925	<i>Dulcerana</i> Oyama, 1964	<i>Dulcerana</i> <i>granularis</i> (Röding, 1798)	P	P	P	P	P	A	P
		<i>Bufonaria</i> Schumacher, 1817	<i>Bufonaria</i> <i>echinata</i> (Link, 1807)	P	P	A	A	A	A	A
	Cymatiidae Iredale, 1913	<i>Gyrineum</i> Link, 1807	<i>Gyrineum natator</i> (Röding, 1798)	P	A	A	A	A	A	A
	Rostellariidae Gabb, 1868	<i>Tibia</i> Röding, 1798	<i>Tibia insulaechorab</i> (Röding, 1798)	A	A	P	P	A	A	P
			<i>Tibia curta</i> (G. B. Sowerby II, 1842)	A	P	A	A	A	A	A
	Cypraeidae Rafinesque, 1815	<i>Mauritia</i> Troschel, 1863	<i>Mauritia eglantina</i> (Duclos, 1833)	P	A	A	A	A	A	A
			<i>Mauritia</i> <i>arabica</i> (Linnaeus, 1758)	A	P	P	A	A	A	A
			<i>Mauritia</i> <i>grayana</i> (Schilder, 1930)	A	P	P	P	P	P	P
			<i>Monetaria</i> Troschel, 1863	<i>Monetaria moneta</i> (Linnaeus, 1758)	A	A	A	P	P	A
	Littorinidae Children, 1834	<i>Naria</i> Gray, 1837	<i>Naria ocellata</i> (Linnaeus, 1758)	A	A	A	A	P	P	P
		<i>Echinolittorina</i> Habe, 1956	<i>Echinolittorina</i> <i>malaccana</i> (Philippi, 1847)	P	P	P	A	A	A	A
		<i>Littorina</i> Férussac, 1822	<i>Littorina sp.</i>	A	A	A	P	P	P	P
Trochida	Trochidae Rafinesque, 1815	<i>Umbonium</i> Link, 1807	<i>Umbonium vestiarium</i> (Linnaeus, 1758)	A	P	A	A	A	A	A
		<i>Trochus</i> Linnaeus, 1758	<i>Trochus radiatus</i> (Gmelin, 1791)	P	P	P	P	P	P	P
		<i>Monodonta</i> Lamarck, 1799	<i>Monodonta australis</i> (Lamarck, 1822)	A	P	P	P	P	P	P
	Turbinidae Rafinesque, 1815	<i>Turbo</i> Linnaeus, 1758	<i>Turbo intercostalis</i> (Menke, 1843)	P	P	P	P	P	P	P
		<i>Astralium</i> Link,	<i>Astralium</i>	A	A	P	P	P	P	P

		1807	<i>semicostatum</i> (Kiener, 1850)								
		<i>Lunella</i> Röding, 1798	<i>Lunella coronata</i> (Gmelin, 1791)	P	P	P	A	A	A	A	
Neogastropoda	Babyloniidae Kuroda, Habe & Oyama, 1971	<i>Babylonia</i> Schlüter, 1838	<i>Babylonia spirata</i> (Linnaeus, 1758)	P	P	P	A	A	A	A	
	Pisaniidae Gray, 1857	<i>Cantharus</i> Röding, 1798	<i>Cantharus spiralis</i> (Gray 1839)	P	P	P	P	P	P	P	P
		<i>Pollia</i> Gray, 1834	<i>Pollia undosa</i> (Linnaeus, 1758)	A	P	P	P	P	P	P	P
	Conidae J. Fleming, 1822	<i>Conus</i> Linnaeus, 1758	<i>Conus capitaneus</i> (Linnaeus, 1758)	P	A	A	A	A	A	A	A
			<i>Conus inscriptus</i> (Reeve, 1843)	P	P	P	P	P	P	P	
			<i>Conus miliaris</i> (Hwass in Bruguière, 1792)	A	P	P	P	P	P	P	
			<i>Conus locumtenens</i> (Blumenbach, 1791)	A	P	A	A	A	A	A	
			<i>Conus virgatus</i> (Reeve, 1849)	A	A	A	P	A	A	P	
	Muricidae Rafinesque, 1815	<i>Hexaplex</i> Perry, 1810	<i>Hexaplex cichoreum</i> (Gmelin, 1791)	P	P	A	A	A	A	A	
			<i>Purpura bufo</i> (Lamarck, 1822)	A	P	A	A	A	A	A	
		<i>Purpura</i> Bruguière, 1789	<i>Purpura persica</i> (Linnaeus, 1758)	A	P	A	A	A	A	A	
			<i>Purpura panama</i> (Röding, 1798)	P	P	P	P	P	P	P	
			<i>Chicoreus ramosus</i> (Linnaeus, 1758)	A	P	A	A	A	A	A	
		<i>Chicoreus</i> Montfort, 1810	<i>Chicoreus brunneus</i> (Link, 1807)	P	P	P	P	P	P	P	
			<i>Chicoreus virgineus</i> (Röding, 1798)	A	A	A	P	P	P	P	
	<i>Murex</i> Linnaeus, 1758	<i>Murex tribulus</i> (Linnaeus, 1758)	P	P	A	A	A	A	A		
	Mitridae Swainson, 1831	<i>Strigatella</i> Swainson, 1840	<i>Strigatella ambigua</i> (Swainson, 1829)	A	A	P	P	A	P	A	
			<i>Strigatella scutulata</i> (Gmelin, 1791)	P	A	P	P	P	P	P	
		<i>Mitra</i> Lamarck, 1798	<i>Mitra mitre</i> (Linnaeus, 1758)	A	P	A	A	A	A	A	
	Nassariidae Iredale, 1916 (1835)	<i>Nassarius</i> Duméril, 1805	<i>Nassarius olivaceus</i> (Bruguière, 1789)	A	P	A	A	A	A	A	
Olividae Latreille, 1825	<i>Oliva</i> Bruguière, 1789	<i>Oliva olive</i> (Linnaeus, 1758)	P	P	P	P	P	P	P		
Columbellidae Swainson, 1840	<i>Euplica</i> Dall, 1889	<i>Euplica scripta</i> (Lamarck, 1822)	A	P	A	A	A	A	A		
	<i>Pyrene</i> Röding, 1798	<i>Pyrene flava</i> (Bruguière, 1789)	A	A	P	P	P	P	P		
Terebridae Mörch, 1852	<i>Hastula</i> H. Adams & A. Adams, 1853	<i>Hastula</i> sp.	A	A	A	P	A	P	A		
***	Nacellidae Thiele, 1891	<i>Cellana</i> H. Adams, 1869	<i>Cellana radiata</i> (Born, 1778)	P	P	P	P	P	P	P	
***	Patellidae Rafinesque, 1815	<i>Patella</i> Linnaeus, 1758	<i>Patella vulgata</i> (Linnaeus, 1758)	P	P	P	P	P	P	P	

Cycloneritida	Neritidae Rafinesque, 1815	<i>Nerita</i> Linnaeus, 1758	<i>Nerita albicilla</i> (Linnaeus, 1758)	P	P	A	A	A	A	A
			<i>Nerita chamaeleon</i> (Linnaeus, 1758)	A	A	A	P	P	P	P
			<i>Nerita undata</i> (Linnaeus, 1758)	A	A	A	P	P	P	P
Siphonariida	Siphonariidae Gray, 1827	<i>Siphonaria</i> G. B. Sowerby I, 1823	<i>Siphonria laciniosa</i> (Linnaeus, 1758)	A	P	A	A	A	A	A
Caenogastropoda #	Cerithiidae J. Fleming, 1822	<i>Clypeomorus</i> Jousseume, 1888	<i>Clypeomorus bifasciata</i> (G. B. Sowerby II, 1855)	P	P	P	A	A	A	A
			<i>Rhinoclavis</i> Swainson, 1840	<i>Rhinoclavis sinensis</i> (Gmelin 1791)	P	P	P	P	P	P
		<i>Cerithium</i> Bruguière, 1789	<i>Cerithium caeruleum</i> (G. B. Sowerby II, 1855)	P	P	P	P	P	P	P
			<i>Cerithium scabridum</i> (Philippi, 1848)	P	P	P	P	P	P	P
	Turritellidae Lovén, 1847	<i>Turritella</i> Lamarck, 1799	<i>Turritella terebra</i> (Linnaeus, 1758)	P	A	A	A	A	A	A
	Potamididae H. Adams & A. Adams, 1854	<i>Telescopium</i> Montfort, 1810	<i>Telescopium Potamidid</i> (Linnaeus, 1758)	A	A	A	P	P	P	P
Aplysiida	Aplysiidae Lamarck, 1809	<i>Aplysia</i> Linnaeus, 1767	<i>Aplysia Oculifera</i> (A. Adams & Reeve, 1850)	P	P	P	P	P	P	P
Systellommatophora	Onchidiidae Rafinesque, 1815	<i>Peronia</i> J. Fleming, 1822	<i>Peronia verruculata</i> (Cuvier, 1830)	P	P	P	P	P	P	P
Lepetellida	Fissurellidae J. Fleming, 1822	<i>Clypidina</i> Gray, 1847	<i>Clypidina notata</i> (Linnaeus, 1758)	A	A	A	P	P	P	P
	Haliotidae Rafinesque, 1815	<i>Haliotis</i> Linnaeus, 1758	<i>Haliotis</i> sp.	A	A	A	P	A	A	P
Chitonida	Chitonidae Rafinesque, 1815	<i>Chiton</i> Linnaeus, 1758	<i>Chiton tuberculatus</i> (Linnaeus, 1758)	A	P	A	A	A	A	A
			<i>Chiton granoradiatus</i> (Leloup, 1937)	A	P	A	A	A	A	A
		<i>Rhyssoplax</i> Thiele, 1893	<i>Rhyssoplax peregrina</i> (Thiele, 1909)	P	P	P	P	P	P	P

**Note:** # = Temporary name/unassigned, \*\*\* =

Saravanakumar *et al.*, 2007 studied the benthic macrofaunal diversity consisting of 62 species in 5 groups, viz. crustaceans (18), gastropods (17), bivalves (16), polychaetes (9) and fishes (2) from the western Kutch mangroves of Gujarat. Sanagoudra and Bhat (2013) recorded 73 species out of these 31 species of polychaetes, 21 nematodes, 12 crustaceans and 09 mollusca from the rocky intertidal zones of Vadinar Shelf, Kandla Shelf and Okha Shelf of Gulf of Kutch. It shows that the rocky intertidal zone of Saurashtra coast consists more diversity compare to mangrove and rocky shores of the Gulf of Kutch region of Gujarat. According to Pawar and Al-Tawaha, (2017), a total of 151 species of benthic macrofauna representing 103 genera, 63 families, 31 orders and 12 classes were recorded. The benthic macrophytes were represented by 19 species, 16 genera, 15 families, 13 orders, 5 classes and 5 divisions from the Uran coast, Navi Mumbai. Overall, the present study revealed that the rocky intertidal zone of the Saurashtra Coast provides the suitable habitat and nourishment to the microbenthic diversity. This study emphasizes the further research on the biological and ecological aspects of the macrobenthic organisms of this region. It will also provide the baseline data to the scientists and policy makers for the conservation of rich diversity consisting rocky intertidal zones of Saurashtra Coast, Gujarat.

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**Conflict of Interest**

All authors declare that they have no conflicts of interest.

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