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Checklist of benthic marine macrophytes and macrofauna from Uran coast, Navi Mumbai, off the Arabian Sea

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ABSTRACT

The species composition of benthic macrophytes and macrofauna was studied in three localities (Sheva creek, Peerwadi coast and Dharamtar creek) along Uran coastline, off Arabian Sea. Uran is located along the eastern shore of Mumbai harbor opposite to Coloba and is included in the planned metropolis of Navi Mumbai and its port, the Jawaharlal Nehru Port (JNP). The intertidal and shallow subtidal region of the study sites were surveyed during spring low tides for diversity of macrobenthos monthly from June 2013 to May 2015. The study recorded a total of 170 species of macrobenthos belonging to 119 genera, 83 families, 44 orders and 17 classes. Of the 10 macrobenthic taxa recorded, phylum mollusca exhibited highest contribution with 90 species (60 gastropods, 26 bivalves and 4 cephalopods). Phylum arthropoda appeared as the second most dominant group contributed with 33 species of brachyuran and anomuran crabs. 16 species of sponges, 5 species of polychaetes, 19 species of seaweeds were also reported. Other reported taxa include flat worms (4 species), soft corals (2 species) and tunicates (1 species). Results of the study showed that intertidal region of Uran coast is fertile and provides a suitable habitat for diverse and wide range of organisms. The comprehensive checklist of macrobenthos provided can be used as the baseline for future research and to develop the management strategy for the conservation of coastal marine ecosystem.

KEYWORDS: Checklist, Macrobenthos, Intertidal region, Jawaharlal Nehru Port, Uran, Species composition

INTRODUCTION

Checklists are comprehensive lists covering all species of a certain group known to occur in a specific area. They provide an overall view of an area's diversity, its species composition and biological history, and functions as a living document. The list is the foundation document of a particular region and includes all background information [23]. The comprehensive evaluations and inventories serve as the basis for local practices of conservation. A checklist of regional marine species provides base line information and important data for comparative studies on biodiversity, and plays an important role in the estimation of resource availability [27].

Coastal marine systems are among the most ecologically and socio-economically vital on the planet. Marine habitats from the intertidal zone out to the continental shelf break provides ecosystem goods (e.g. food and raw materials) and services (e.g. disturbance regulation and nutrient cycling) [22]. The provision of protein for human consumption and the ecosystems that sustain fisheries are the products and functions of marine

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ecosystems that benefit humankind [51]. Coastal-zone habitat includes highly productive estuaries and bays, which are essential nursery grounds for a number of commercial and recreational fish species and home to a number of invertebrates [40].

Benthos refers to the community of organisms that live on, or in, the bottom of a water body and are generally classified according to size. Macrobenthos are the benthic communities with greater than 0.5 mm in size and play an important role in transitional ecosystems [50]. Macrobenthos acts as an ecosystem engineers which substantially modify the physical structure of the abiotic or biotic materials forming the habitat, and thus directly or indirectly change the availability of resources to other species [15].

Macrobenthos play various ecological roles in transitional ecosystems like, food source for larger organisms [24, 41], linking primary production with higher trophic levels [26, 43], structure and oxygenate the bottom by reworking sediments [37, 56], break down organic material before bacterial remineralization [1, 13], food for human e. g. clams, gastropods, cephalopods etc [29], bait for recreational purposes as fishing e. g. worms [50], biological indicators of ecological health and coastal pollution [3, 6, 21, 55], indicator species for the detection of types and levels of stress [57], improving and preserving water quality through mineralization and recycling of organic matters [39], bioindicators of heavy metal pollution in aquatic system [12, 20], provide shelter and profitable foraging sites for invertebrate feeders [38], and is useful to assess the fishery production of a particular area [42].

Marine resources are major source of food for local inhabitants and of major economic value in terms of commercial exploitation [54]. Sridhar and Bhaskaran [44] reported that recovery and dredging; industrial effluents, sewage, and oil pollution are the main anthropogenic effects crucial for biodiversity. Seitz et al., [40] noted that coastal habitats are threatened by coastal development, habitat degradation, rising temperature and sea levels, nutrient and sediment run-off, overfishing, dredging, commercial fishing, sand mining, and habitat loss [4, 8].

Literature review suggests that baring few reports [5, 23, 27, 28, 49], meager information is available on the checklist of marine benthic macrophytes and macrofauna. Considering the incomplete knowledge of the species diversity associated to the intertidal and shallow subtidal marine ecosystems, the main objective of this study was to produce a comprehensive checklist of marine macrobenthos inhabiting three localities of Uran coast (Sheva creek, Peerwadi coast and Dharamtar creek).

MATERIALS AND METHODS

Study Area:

Uran (18º 50'5" to 18º50'20" N, 72º57'5" to 72º57'15" E) with the population of 28,620 is located along the eastern shore of Mumbai harbor opposite to Coloba. Uran is bounded by Mumbai harbor to the northwest, Thane creek to the north, Dharamtar creek and Karanja creek to the south, and the Arabian Sea to the west. Uran is included in the planned metropolis of Navi Mumbai and its port, the Jawaharlal Nehru Port (JNPT) (Fig. 1).

The Uran coast is a tide-dominated and the tides are semidiuranal. The average tide amplitude is 2.28 m. The flood period lasts for about 6–7 h and the ebb period lasts for about 5 h. The average annual precipitation is about 3884 mm of which about 80% is received during July to September. The temperature range is 12–36ºC, whereas the relative humidity remains between 61% and 86% and is highest in the month of August.

Study Location:

For the present study, three sampling sites, namely Sheva creek, site I (18º 50' 20" N, 72º 57' 5" E), Peerwadi coast, site II (18º 50' 10" N, 72º 57' 1" E) and Dharamtar creek, site III (18º 48' 3" N, 72º 58' 31" E) separated approximately by 10 km were selected. These sites were selected on the basis of their strategic locations for Jawaharlal Nehru Port (JNP, an International Port), industries, port related infrastructural facilities and different anthropogenic activities along the entire coastal area.

Sheva creek is characterized by extensive mud flats with sparse mangrove vegetation and less rocky stretches. Jawaharlal Nehru Port (JNP) and other port related establishments are located in the stretch of the creek. Gharapuri Island (Elephanta caves), a famous tourist spot is present on the north side of the creek. Intertidal region of Peerwadi coast has major portion of rocky substratum. Dharamtar creek is with rocky and coral substratum towards the Dronagiri Mountain whereas remaining part of the creek is dominated by the marshy areas and mud flats. Towards the Revas and Karanja side, the Dharamtar creek has mangrove associated habitats due to presence of dense and natural mangrove habitat. Sheva creek and Dharamtar creek are considered as high anthropogenic pressure zones.

Field Sampling:

Studies on the diversity of macrobenthos from the intertidal regions of these sites were carried for a period of two years, i.e., from June 2013 to May 2015. The entire intertidal belt of each sampling site was subdivided

into upper, middle and lower littoral zones. The diversity and distribution of macrobenthos in the intertidal belt at each station were studied during the spring low tide.

The macrobenthos were collected by hand picking method from intertidal regions and shallow coastal waters. Sponges, bivalves and seaweeds attached to the boulders, jetties, rocks on the shores, stones, pebbles, fishing nets and pneumatophores of mangrove were collected by scrapping. Collected specimens were washed with seawater to remove the debris, and were transferred to the clean polythene bags; one sample per bag and were brought to the laboratory.

In the laboratory, morphological features of each specimen were recorded. The specimens were washed under tap water and then fixed in 10% formaldehyde-seawater solution and transferred into 90% ethanol. Empty shells were washed in water containing mild detergent and were rinsed in diluted hydrochloric acid to remove the hard outer coat and to reveal the natural colours.

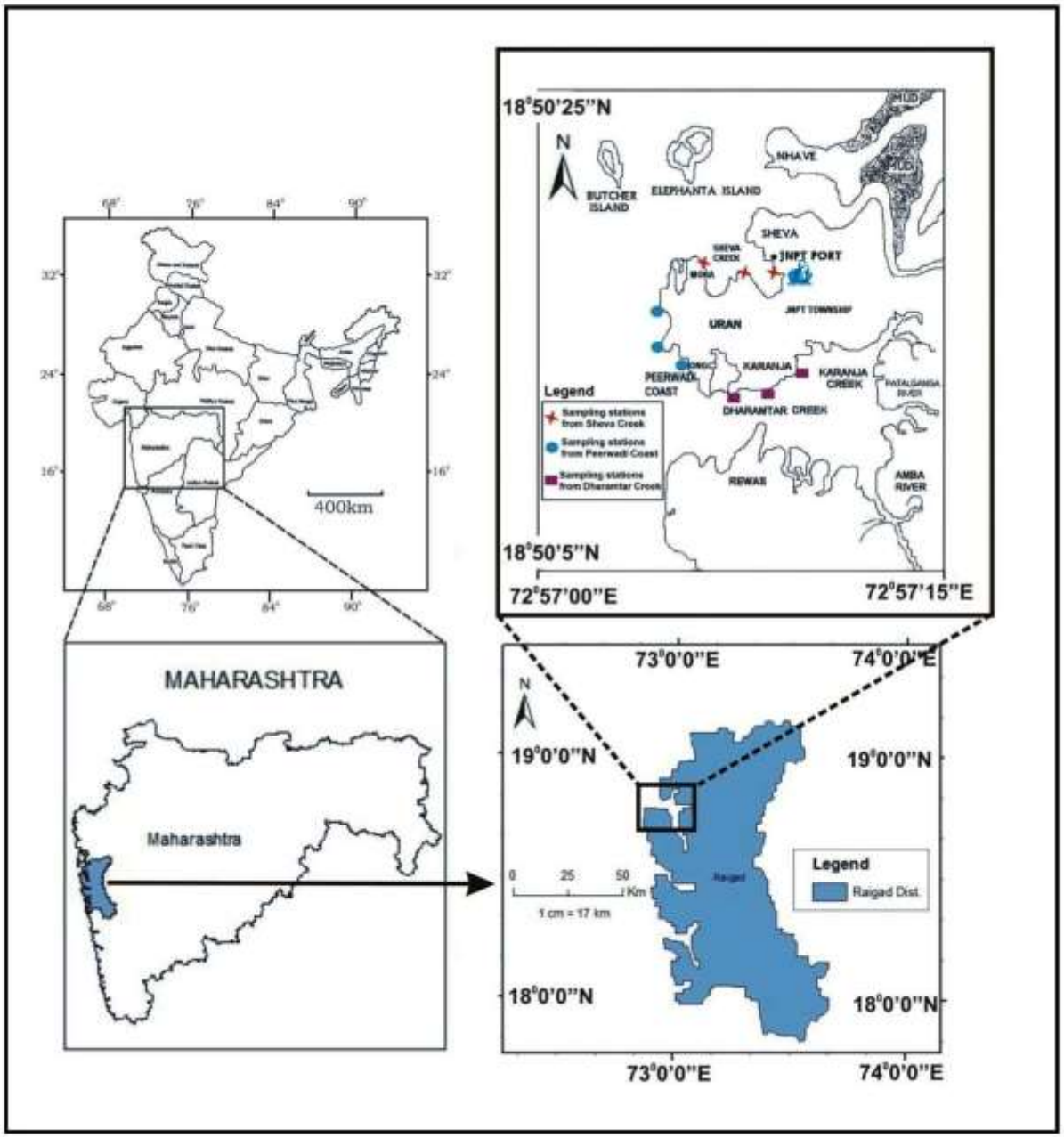

Fig. 1: Map showing the location of three study sites namely the Sheva creek, Peerwadi coast and the Dharamtar creek along Uran coastline off the Arabian Sea

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Identification of macrobenthos:

All collected organisms were photographed with Cannon EOS1100D digital camera and were identified up to the lowest possible taxonomic level following Marine Species Identification Portal website (http://species-identification.org) and standard taxonomic keys of Dhargalkar & Kavlekar [16] and Bhavanath Jha et al. [7] for seaweeds, Picton [37] and Van Soest et al., [52] for sponges, Subrahmanyam et al. [47, 48] and Apte [2] for gastropods, Subrahmanyam et al [45, 46] and Coan & Valentich-Scott [14] for bivalves, Chhapgar [10, 11] and Jeyabaskaran and Wafar [25] for crabs, Cantera [9] and Fischer et al. [17] for other invertebrates. Scientific names and classification of gastropods was adopted from World Register of Marine Species (WoRMS) website (http://www.marinespecies.org).

RESULTS AND DISCUSSION

A total of 170 species of macrobenthos belonging to 119 genera, 83 families, 44 orders and 17 classes were recorded (Table 1). Total 151 species of benthic macrofauna representing 103 genera, 63 families, 31 orders and 12 classes were collected. The benthic macrophytes were represented by 19 species, 16 genera, 15 families, 13 orders, 5 classes and 5 divisions (Table 1).

Of the 10 macrobenthic taxa recorded in present study, phylum mollusca exhibited highest contribution with 90 species (60 gastropods, 26 bivalves and 4 cephalopods). Phylum arthropoda appeared as the second most dominant group with 33 species of brachyuran and anomuran crabs. 16 species of sponges, 5 species of polychaetes, 19 species of seaweeds were also reported. Other reported taxa include flat worms (4 species), soft corals (2 species) and tunicates (1 species) (Fig. 2).

In the present study, diversity of benthic organisms were in the sequence of gastropods (35.29%) > crabs (19.41%) > pelecypods (15.29%) > seaweeds (11.18%) > sponges (9.41%) > polychaetes (2.94%) > flat worms and cephalopods (2.35%) > soft corals (1.18%) > tunicates (0.59%).

Table 1: % composition of macrobenthos recorded along Uran coast.

Sr. No.	Benthos	Division	Class	Order	Family	Genus	Species	Percentage Representation
1	Sea weeds	05	05	13	15	16	19	11.176 %
2	Sponges	---	03	08	10	12	16	9.412 %
3	Soft corals		01	01	01	01	02	1.176 %
4	Flat worms	---	01	01	04	04	04	2.353 %
5	Polychaetes	---	01	03	04	04	05	2.941 %
6	Crabs	---	01	01	12	21	33	19.411%
7	Gastropods	---	01	08	25	38	60	35.294 %
8	Pelecypods	---	01	04	08	18	26	15.294 %
9	Cephalopods	---	01	03	03	04	04	2.353 %
10	Tunicates	---	01	01	01	01	01	0.588 %
	TOTAL	05	17	44	83	119	170	100%

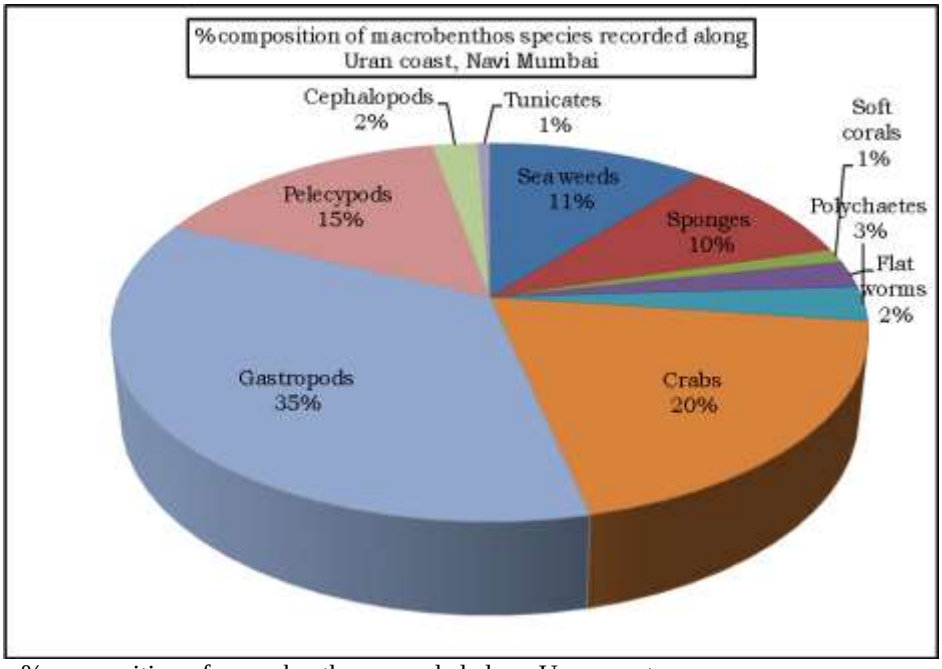

Fig. 2: Average % composition of macrobenthos recorded along Uran coast.

Table 2: Checklist of benthic macrophytes recorded along Uran coast, Navi Mumbai collected during June 2013 to May 2015

Class	Order	Family		Scientific Name
Division: Charophyta				
Charophyceae	Charales	Characeae	1	*Chara baltica* (A. Bruzelius,1824)
Division: Chlorophyta				
Ulvophyceae	Cladophorales	Cladophoraceae	2	*Cladophora rupestris* (L.) Kutzing 1843)
		Valoniaceae	3	*Valonia aegagropila* (C. Agardh, 1823)
	Ulotrichales	Gomonticeae	4	*Monostroma nitidium* (Wittrock,1866)
	Ulvales	Ulvaceae	5	*Ulva fasciata* (Delile, 1813)
			6	*Ulva lactuca* (Linnaeus, 1753)
			7	*Enteromorpha intestinalis* (L.) Nees, 1820
			8	*Enteromorpha linza* (L.) J. Agardh, 1883
Division: Cyanobacteria				
Cyanophyceae	Oscillatoriales	Oscillatoriaceae	9	*Lyngbya confervoides* (C. Agardh ex Gomont, 1893)
			10	*Lyngbya majuscule* (Harvey ex Gomont, 1892)
Division: Ochrophyta				
Phaeophyceae	Ectocarapales	Scytosiphonaceae	11	*Colpomenia sinuosa* (Derbes & Solier, 1851)
	Sphacelariales	Sphacelariaceae	12	*Sphacelaria tribuloides* (Meneghini, 1840)
Division: Rhodophyta				
Florideophyceae	Corallinales	Corallinaceae	13	*Amphiroa tribuloides* (Meneghini, 1840)
	Nemaliales	Galaxauraceae	14	*Galaxaura oblongata* (J. V. Lamouroux, 1816)
	Gelidiales	Gelidiaceae	15	*Gelidium pusillum* (Stackhouse) Le Jolis, 1863
		Gelidiellaceae	16	*Gelidiella acerosa* (Fosskal) Feldmann & G. Hamel, 1934
	Gracilariales	Gracilariaceae	17	*Gracilaria verrucosa* (Hudson) Papenfuss, 1950
	Halymeniales	Halymeniaceae	18	*Grateloupia filicina* (C. Agardh, 1822)
	Ceramiales	Rhodomelaceae	19	*Acanthophora specifera* (M.Vahl) Borgesen,1910
05	13	15		19

Table 3: Checklist of benthic macrofauna recorded along Uran coast, Navi Mumbai collected during June 2013 to May 2015

Class	Order	Family		Scientific Name
Sponges				
Calcarea	Leucosolenida	Leucosoleniidae	20	*Leucosolenia complicate* (Montagu,1818)
			21	*Leucosolenia variabilis (Haeckel, 1870)*
Demospongiae	Axinellida	Axinellidae	22	*Axinella damicornis* (Esper, 1794)
			23	*Axinella verrucosa* (Esper, 1794)
	Halichondrida	Halichondriidae	24	*Axinyssa ambrosia* (de Laubenfels, 1936)
			25	*Halichondria bowerbanki* (Burton, 1930)
			26	*Halichondria panacea* (Pallas, 1766)
			27	*Hymeniacidon heliophila* (Parker, 1910)
			28	*Hymeniacidon perleve* (Montagu, 1814)
	Haplosclerida	Haliclonidae	29	*Haliclona permollis* (Bowerbank,1866)
	Hadromerida	Hemiasterellidae	30	*Paratimea constellate* (Topsent, 1893)
		Suberitidae	31	*Protosuberitis epiphytum* (Lamarck, 1815)
	Poecilosclerida	Hymedesmiidae	32	*Kirkaptrickia borealis* (Koltun, 1970)
		Microcionidae	33	*Clathria parthena* (de Laubenfels,1930)
	Homosclerophorida	Plakinidae	34	*Plakina monolopha* (Schulze,1880)
Hexactinellida	Hexactinosida	Aphrocallistidae	35	*Aphrocallistes Beatrix* (Gray, 1858)
Coelenterates (Soft corals)				
Anthozoa	Alcyonacea	Nephtheidae	36	Dendronephthya klunzingeri (Studer,1888)
			37	*Dendronephthya hemprichi* (Klunzinger,1877)
Flat worms				
Rhabditophora	Polycladida	Leptoplanidae	38	*Leptoplana tremellaris* (Muller OF, 1773)
		Notoplanidae	39	*Notoplana australis* (Schmarda, 1859)
		Pericelidae	40	*Pericelis hymanae* (Poulter, 1974)
		Stylochoplanidae	41	*Stylochoplana maculata* (Quatrefage, 1845)
Polychaetes				
Polychaeta	Amphinomida	Amphinomidae	42	*Hermodice carunculata* (Pallas, 1766)
	Phyllodocida	Nereididae	43	*Perinereis cultrifera* (Grube, 1840)
			44	*Perinereis nuntiavallata* (Grube, 1857)
		Polynoidae	45	*Enipo gracilis* (Verrill, 1874)

	Terebellida	Terebellidae	46	*Neoamphitrite groenlandica* (Malmgren,1866)
Brachyuran crabs				
Malacostraca	Decapoda	Grapsidae	47	*Goniopsis cruentata* (Latreille, 1803)
			48	*Grapsus albolineatus* (Lamarck, 1818)
			49	*Metopograpsus frontalis* (Miers, 1880)
			50	*Metopograpsus messor* (Forskål,1775)
			51	*Metopograpsus oceanicus* (H. & Jacquinot,1846)

Table 3: Continued

Class	Order	Family		Scientific Name
		Leucosiidae	52	*Persephona mediterranea* (Herbst, 1794)
			53	*Tokoyo eburnea* (Alcock, 1896)
		Matutidae	54	*Matuta lunaris*(Forskal, 1775)
		Menippidae	55	*Myomenippe hardwickii* (Gray, 1831)
		Ocypodidae	56	*Uca annulipes* (H. Milne Edwards, 1837)
			57	*Uca dussumieri* (H. Milne Edwards, 1852)
		Oziidae	58	*Epixanthus frontalis* (H. Milne Edwards, 1834)
			59	*Ozius* rugulosus (Stimpson,1858)
		Polybiidae	60	*Liocarcinus pusillus* (Leach, 1815)
		Porcellanidae	61	*Petrolisthes galathinus* (Bosc,1802)
		Portunidae	62	*Charybdis acuta* (A. Milne-Edwards, 1869)
			63	*Charybdis feriatus* (Linnaeus, 1758)
			64	*Charybdis japonica* (A. Milne-Edwards, 1861)
			65	*Charybdis lucifera* (Fabricius, 1798)
			66	*Charybdis orientalis* (Dana, 1852)
			67	*Charybdis truncata* (Fabricius, 1798)
			68	*Portunus pelagicus* (Linnaeus, 1758)
			69	*Portunus sanguinolentus* (Herbst, 1783)
			70	*Scylla serrata* (Forskål, 1775)
		Sesarmidae	71	*Aratus pisonii* (H. Milne Edwards,1837)
			72	*Metasesarma obesum* (Dana, 1851)
		Xanthidae	73	*Leptodius exaratus* (H. Milne Edwards, 1834)
			74	*Leptodius sanguineus* (H. Milne Edwards, 1834)
			75	*Paractaea monody* (Guinot, 1969)
			76	*Xantho incisus* (H. Milne Edwards, 1834)
			77	*Xantho poressa* (Olivi, 1792)
Anomuran crabs				
Malacostraca	Decapoda	Diogenidae	78	*Clibanarius senegalensis* (Chevreux & Bouvier, 1892)
			79	*Clibanarius taeniatus* (H. Milnne Edwards, 1848)
Gastropods				
Gastropoda	Archaeo-gastropoda	Fissurellidae	80	*Diodora gibberula* (Lamarck, 1822)
		Nacellidae	81	*Cellana radiata* (Born, 1778)
		Trochidae	82	*Trochus radiates* (Gmelin, 1791)
			83	*Trochus tentorium* (Gmelin,1791)
			84	*Umbonium vestiarium* (Linnaeus, 1758)
			85	*Trochus stellatus* (Gmelin, 1791)
			86	*Trochus maculates* (Linnaeus, 1758)

Table 3: Continued

Class	Order	Family		Scientific Name
			87	*Clanculus guineensis* (Gmelin, 1791)
		Turbinidae	88	*Astraea stellata* (Gmlin, 1791)
			89	*Astraea semicostata* (Kiener, 1850)
	Caeno-gastropoda	Cerithiidae	90	*Clypeomorus bifasciatus* (Sowerby II, 1855)
			91	*Clypeomorus moniliferus* (Kiener, 1841)
		Potamididae	92	*Telescopium telescopium* (Linnaeus, 1758)
			93	*Potamides cingulatus* (Gmelin, 1791)
	Chitonida	Ischnochitonidae	94	*Ischnochiton australis* (G.B. Sowerby II, 1833)
	Cyclo-neritimorpha	Neritidae	95	*Nerita undata* (Linnaeus, 1758)
			96	*Nerita albicilla* (Linnaeus, 1758)
			97	*Nerita crepidularia* (Lamarck, 1816)
			98	*Nerita oryzarum* (Recluz, 1841)
			99	*Nerita costata* (Gmelin, 1791)
			100	*Nerita chamaeleon* (Linnaeus, 1758)
			101	*Nerita aterrima* (Gmelin, 1791)
			102	*Neritina* pulligera (Linnaeus, 1758)
			103	*Neritina punctulata* (Lamarck, 1816)
	Littori-nimorpha	Bursidae	104	*Bursa tuberculata* (Broderip,1833)
			105	*Bursa granularis* (Roding, 1798)

			106	*Bursa spinosa* (Schumacher, 1817)
			107	*Bursa lissostoma* (E. A. Smith, 1914)
		Cypraeidae	108	*Erosaria lamarckii* (J.E. Gray, 1825)
			109	*Luria lurida* (Linnaeus, 1758)
			110	*Cypraea tigris* (Linnaeus, 1758)
		Ficidae	111	*Ficus gracilis* (G. B. Sowerby I,1825)
		Naticidae	112	*Natica didyma* (Röding, 1798)
			113	*Natica rufa* (Born, 1778)
		Rostellariidae	114	*Tibia curta* (G. B. Sowerby II, 1842)
		Tonnidae	115	*Tonna dolium* (Linnaeus, 1758)
	Neo-gastropoda	Buccinidae	116	*Cantharus* spiralis (Gray, 1839)
		Clavatulidae	117	*Makiyamaia arthopleura* (Kilburn, 1983)
		Columbellidae	118	*Parvanachis obesa* (C. B. Adams, 1845)
		Conidae	119	*Conus ambiguus* (Reeve, 1844)
			120	*Conus circumactus* (Iredale, 1929)
		Mangeliidae	121	*Propebela harpularia* (Couthouy, 1838)

Table 3: Continued

Class	Order	Family		Scientific Name
		Muricidae	122	*Drupa konkanensis* (Melvill, 1893)
			123	*Indothais blanfordi* (Melvill, 1893)
			124	*Murex brunneus* (Link, 1807)
			125	*Murex bundharmai* (Houart, 1992)
			126	*Purpura bufo* (Lamarck, 1822)
			127	*Stramonita floridana* (Conrad, 1837)
			128	*Thais carinifera* (Lamarck, 1822)
			129	*Thais sacellum* (Gmelin, 1791)
			130	*Thais gradata* (Jonas, 1846)
			131	*Vasula deltoidea* (Lamarck, 1822)
		Nassariidae	132	*Nassarius vibex* (Say, 1822)
		Onchidiidae	133	*Onchidium damelii* (Semper, 1882)
		Volemidae	134	*Hemifusus pugilinus* (Born, 1778)
			135	*Hemifusus cochlidium* (Linnaeus, 1758)
		Chromodorididae	136	*Mexichromis mariei* (Crosse, 1872)
		Lottiidae	137	*Lottia septiformis* (Quoy & Gaimard, 1834)
			138	*Lottia tenuisculpta* (Sasaki & Okutani,1994)
			139	*Acmaea subrugosa* (d'Orbigny, 1846)
Pelecypods				
Pelecypoda	Arcoida	Arcidae	140	*Arca granosa* (Linnaeus, 1758)
			141	*Barbatia barbata* (Linnaeus, 1758)
			142	*Barbatia foliata* (Forsskål in Niebuhr,1775)
			143	*Barbatia virescens* (Reeve, 1844)
			144	*Barbatia obliquata* (Wood, 1828)
	Ostreoida	Ostreidae	145	*Crassostrea virginica* (Gmelin, 1791)
			146	*Saccostrea scyphophilla* (Peron & Lesueur, 1807)
			147	*Saccostrea glomerata* (Gould, 1850)
	Pectinoida	Pectinidae	148	*Volachlamys tranquebaria* (Gmelin, 1791)
			149	*Volachlamys singaporina* (Sowerby II, 1842)
	Pectinoida	Placunidae	150	*Placuna placenta* (Linnaeus, 1758)
	Veneroida	Corbiculidae	151	*Villorita cyprinoides* (Gray, 1825)
		Psammobiidae	152	*Hiatula diphos* (Linnaeus, 1771)
		Trapezidae	153	*Trapezium sublaevigatum* (Lamarck, 1819)
		Veneridae	154	*Callista chione (Linnaeus,* 1758)
			155	*Chamelea gallina (Linnaeus,* 1758)
			156	*Dosinia caerulea (Reeve,* 1850)
			157	*Dosinia exoleta (Linnaeus,* 1758)

Table 3: Continued

Class	Order	Family		Scientific Name
			158	*Gafrarium divaricatum* (Gmelin, 1791)
			159	*Katelysia japonica* (Gmelin, 1791)
			160	*Meretrix casta* (Gmelin, 1791)
			161	*Meretrix meretrix* (Linnaeus, 1758)
			162	*Meretrix lamarckii* (Deshayes, 1853)
			163	*Paphia rhomboides* (Pennant, 1777)
			164	*Pitar hebraeus* (Lamarck, 1818)
			165	*Protapes gallus* (Gmelin, 1791)
Cephalopods				
Cephalopoda	Myopsida	Loliginidae	166	*Loligo vulgaris* (Lamarck, 1798)
	Octopoda	Octopodidae	167	*Eledone cirrhosa* (Lamarck, 1798)
			168	*Octopus vulgaris* (Cuvier, 1797)

	Sepiida	Sepiidae	169	*Sepia officinalis* (Linnaeus, 1758)
Tunicates				
Ascidiacea	Aplouso-branchia	Euherdmaniidae	170	*Euherdmania claviformis* (Ritter, 1903)
12	31	68		151

Species composition:

- *Seaweeds:*

A total of 19 species of seaweeds representing 16 genera, 15 families and 13 orders were recorded. Of these, 7 species belongs each to Chlorophyta and Rhodophyta, 2 each to Cyanobacteria and Ochrophyta and 1 to Charophyta. Varied diversity of seaweeds belonging to Charophyta, Chlorophyta, Cyanobacteria, Ochrophyta and Rhodophyta is recorded from three sites. Of the recorded species, 36.84% belongs each to Chlorophyta and Rhodophyta, 10.53% each to Cyanobacteria and Ochrophyta, and 5.26% to Charophyta.

- *Sponges:*

16 species of sponges representing 12 genera, 10 families and 8 orders were recorded. Of the recorded species, 13 species belongs to class Demospongiae, 2 to Calcarea and 1 to Hexactinellida. The percentage distribution (by order) of sponges showed that the Order Halichondrida had the highest species composition (31.25%), followed by Leucosolenida, Axinellida, Hadromerida, and Poecilosclerida each with 12.5%. Orders Haplosclerida, Homosclerophorida and Hexactinosida had a composition of 6.25% species in each.

- *Gastropods:*

Total 60 species of gastropods belonging to 38 genera, 25 families and 8 orders were recorded. In present study, gastropods belonging to order Archaeogastropoda, Caenogastropoda, Chitonida, Cycloneritimorpha, Littorinimorpha, Neogastropoda, Nudibranchia and Patellogastropoda were recorded. Number of species of gastropods distributed in each family reveals that 10 species belongs to family Muricidae, 9 species to Neritidae, 6 species to Trochidae and 4 species to Bursidae. Families Cypraeidae and Lottiidae were represented by 3 species each. 2 species each were reported from families Turbinidae, Cerithidae, Potamididae, Naticidae, Conidae and Volemidae whereas 1 species each is contributed by remaining 13 families.

- *Bivalves:*

26 species of bivalves belonging to 18 genera, 8 families and 4 orders were recorded. In present study, bivalves belonging to families Arcidae, Ostreidae, Pectinidae, Placunidae, Corbiculidae, Psammobiidae, Trapezidae and Veneridae were recorded. Number of species of bivalves distributed in each family reveals that 12 species belongs to family Veneridae, 5 species to Arcidae, 3 species to Ostreidae and 2 species to Pectinidae. One species each were reported from families Placunidae, Corbiculidae, Psammobiidae and Trapezidae.

- *Crabs:*

Total 33 species of crabs belonging to 21 genera and 12 families under the order Decapoda in the class Malacostraca were recorded. Brachyuran crabs belonging to family Grapsidae, Leucosiidae, Matutidae, Menippidae, Ocypodidae, Oziidae, Polybiidae, Porcellanidae, Portunidae, Sesarmidae and Xanthidae were recorded. Family Portunidae contribute 9 species while 5 species were belonging each to families Grapsidae and Xanthidae. 2 species were belonging each to families Leucosiidae, Ocypodidae, Oziidae and Sesarmidae where as rest of the families including Matutidae, Menippidae, Polybiidae and Porcellanidae contributed only one species each. 2 species of anomuran crabs belonging to family Diogenidae were also recorded.

- *Other macrobenthos:*

5 species of polychaetes, 4 species of flat worms, 2 species of soft corals and 1 species of tunicates were also recorded.

Measuring species richness and diversity in various habitats is a useful tool for conservation and action planning of the marine and coastal biodiversity [6, 24, 30]. Ganesh and Raman [18] stated that several factors, e.g. locality, depth, distance from the shore, river proximity and local oceanographic features appeared important for determining benthos distribution patterns.

Results of the present study are in agreement with the work of Varadharajan et al., [53] along the south east coast of India, Lozano-Cortes et al., [27] from Malaga Bay, Colombian Pacific, Susan et al., [49] in Minicoy Island, Lakshadweep, India, Behera and Nayak [5] of Bahuda estuary, Odisha, east coast of India, Geetha and Bijoy [19] in Cochin Estuary, India, Mahapatro et al., [28] of the Chilika Lake, east coast of India and Balachandar et al., [3] from Puducherry coast, southeast coast of India.

The Uran coast acts as a sink receiving large daily volume of domestic and industrial wastes and effluents from Asia's largest industrialized zone namely Thane Belapur industrial area, Navi Mumbai Municipal Corporation and effluents from Jawaharlal Nehru Port [32]. Maritime activities of JNP and local dredging

activities have promoted the changes in physico-chemical parameters, and inorganic nutrients in the seawater surrounding the Jawaharlal Nehru Port [31]. Anthropogenic impact of these activities has affected the water quality and diversity of macrobenthos from coastline of Uran [33, 34, 35].

The present study provides a comprehensive checklist of benthic macrophytes and macrofauna from coastline of Uran. Results of the study can be used as the baseline for future research. It will further helpful to develop the management strategy for the conservation of coastal marine ecosystem.

Conclusion:

Results of the present study showed that intertidal region of Uran coast is fertile and provides a suitable habitat for diverse and wide range of organisms. Findings of the study also reflect the biological characteristics of the macrobenthos in the intertidal and shallow subtidal region. Gastropods, crabs, pelecypods, seaweeds and sponges are dominant taxa recorded during the study. The study was an initial step toward understanding the macrobenthic community dynamics of Uran coast and long-term monitoring studies are recommended to evaluate the impacts of human activities on the local marine communities. The comprehensive checklist of macrobenthos provided can be used as the baseline for future research and to develop the management strategy for the conservation of coastal marine ecosystem.

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