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Seaweed Associated Macro Fauna across Seasons in the Rocky Shore Tide Pools of Sindhudurg District, Maharashtra, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Variation in the diversity and abundance of associated macro fauna of two commonly encountered seaweed species viz., *Sargassum sp.* and *Amphiroa sp.* were assessed seasonally. 100 grams wet weights per seaweed species in replicate were sampled from the rocky shore tide pools of Sindhudurg district of Maharashtra, India in 2021.
14 groups of macro fauna were found in association with *Sargassum sp.* and 18 groups with *Amphiroa sp.* In *Sargassum sp.* the highest abundance (individuals/100 grams seaweed) was recorded during Post-monsoon (116.86 ±188.24 SD), Pre-monsoon (339.65 ±347.15 SD) and

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Monsoon (127.14 ±67.14 SD) by *Amphipoda* respectively; while in *Amphiroa sp.* during Post-monsoon Foraminifera (740.74 ±1047.57 SD), Pre-monsoon *H. Copepoda* (87.80 ±3.54 SD) and Monsoon Bivalvia (55.69 ±33.19 SD). Highest biomass (mg/100 grams seaweed) in *Sargassum sp.* during Post-monsoon (241.51 ±429.26 SD) and Monsoon (359.76 ±356.90 SD) by *Gastropoda* respectively, during Pre-monsoon *Amphipoda* (214.55 ±191.77 SD); while in *Amphiroa sp.* during Post-monsoon Polychaeta (752.50 ±680.09 SD), during Pre-monsoon *Gastropoda* (452.68 ±457.97 SD) and during Monsoon Bivalvia (662.85 ±221.60 SD).

Diversity indices in both the seaweeds during Monsoon, showed high evenness and Shannon diversity; higher dominance is seen during Pre-monsoon in *Sargassum sp.* and during Post-monsoon in *Amphiroa sp.*

ANOVA and Kriskal-Wallis test showed significant variance in the abundance of *Turbellaria*, *Ophiuroidea*, *Amphipoda*, *Isopoda*, *Decapoda*, *Tanaidacea*, *Copepoda*, *Bivalvia*, *Cnidaria*, and Eggs. Spearman's correlation test showed significant correlations between the environmental parameters that are pH, dissolved oxygen, conductivity, total dissolved solids, salinity, turbidity, water and air temperature and tide pool depth with the macro faunal abundance of *Copepoda*, *Turbellaria*, *Ophiuroidea*, *Tanaidacea*, *Isopoda* and *Decapoda*.

Majority of macro fauna stays in association with seaweeds, as it provides food and shelter to them. Since *Sargassum sp.* and *Amphiroa sp.* were significantly available, it was selected for sampling. Study reveals both the seaweeds supports diversity of macro fauna which vary seasonally.

Keywords: Seasonal variation; seaweeds; fauna; seaweed; habitat; tidepools; species.

1. INTRODUCTION

Tide pools on the coastal rocky flats forms a unique habitat. A gradual process of tide pool formation takes several years which initiates by wearing and tearing of rock flats due to the heavy rotating rocks driven by the tidal forces. Tide pools on the rocky flats can be present on all the tidal zones and found in different size and shapes which is characterised by assessing the dominant algal groups rather than their height on the shores, in contrast to the communities on the emergent substrata [1]. Diversity of flora and fauna found in the tide pools varies from invertebrates to fishes [2]; this macro and meio fauna remains in association with seaweeds as it provides shelter (get protection from harsh ocean waves and predators) and nutrition [3] for the omnivores and provides foraging sites for filter feeders, detritus feeders, scavengers [4] and the invertebrate consumers which predate on associated epifauna [5]. Other than this many species of gastropods lay their eggs on seaweeds; some polychaetes and spider crab species grow seaweeds on their tubes and carapaces [4]. Therefore in the aquatic ecosystem along with benthic and pelagic, phytal biotope also forms important habitat [6]. The fauna associated with seaweed provides habitat complexity, benefit the flow of energy through biogeochemical cycles [7].

The diversity and abundance of the associated fauna is dependent on the contents of nutrients in the seaweeds which can be vary with light, temperature, salinity and geographical distribution [5] and also the morphology of seaweeds (Texture, Structure, colour and contour), its sediment retaining capacities and inter and intra specific relations [8].

The literature on seaweed associated fauna is vast for temperate countries as compared to India [8]. Studies in the rocky intertidal coasts in India by marine ecologists was very few and was restricted to the algal zonation and composition without reference to associated fauna which is getting attention after 70's [9] in that they provided important information on the ecology of seaweed associated fauna [4,10,11,12,6] but in scarce [13].

At the study location there were total 18 species of seaweeds were encountered, from them *Sargassum sp.* (Class – *Phaeophyceae*, Family – *Sargassaceae*) and *Amphiroa sp.* (Class – *Florideophyceae*, Family – *Amphiroideae*) were commonly available in the tide pool habitat, therefore it is selected and sampled to find out the diversity and seasonal variation of macro faunal communities associated with it and to see its correlation within communities and with the environmental parameters.

2. STUDY AREA, MATERIALS AND METHODS

2.1 Study Area

Sindhudurg in Maharashtra state is the southern coastal district with the coastline length of 121

Kms. lies between the latitude 15°40’00’’ and 16°30’00’’ N and longitude 73°20’00’’ and 73°55’00’’E on the central west coast of India. It has a stretch of sandy and rocky shores and well formed tide pools on the various rocky shores. These tide pools are mainly formed of laterite and basalt rocks.

Seasonal sampling was carried out during low tides form the mid littoral zone pools; January-February (Post-monsoon), April-May (Pre-monsoon), August-September (Monsoon) at the five locations of Sindhudurg district viz., Tambaldeg, Kunkeshwar, Malvan, Bhogve and Redi from north to south during the year 2021 (Fig. 1).

2.2 Materials and Methods

The two seaweed species viz. *Sargassum sp.*and *Amphiroa sp.* each approximately 100 grams were sampled in replicate to minimise the error due to possible patchy distribution and immideately preserved in 10 percent formaldehyde-rose bengol solution in the polythene zip lock bags and vigorously shaked to dislodge the clinging fauna. In laboratory the seaweed is washed by keeping it in the 500 µm mesh size sieve. Macro fauna was carefully sorted out by keeping the seaweed in a white enamel trey. Sorted out fauna transffered in the seperate small vials with 10 percent formaldehyde solution. Further microscopic analysis were carried out where the macro fauna were analysed under Nikon SMZ 445 Stereo microscope and Labomed LX 500 LED binocular microscope. Identification manuals, books and keys [14,15,16,17,18,19,20] were used for the identification. Water quality parameters were analysed on field using Hanna HI 9829 multi parameter probe. Paleontological statistics (PAST) version 4.11 statistical software is used for the data analysis.

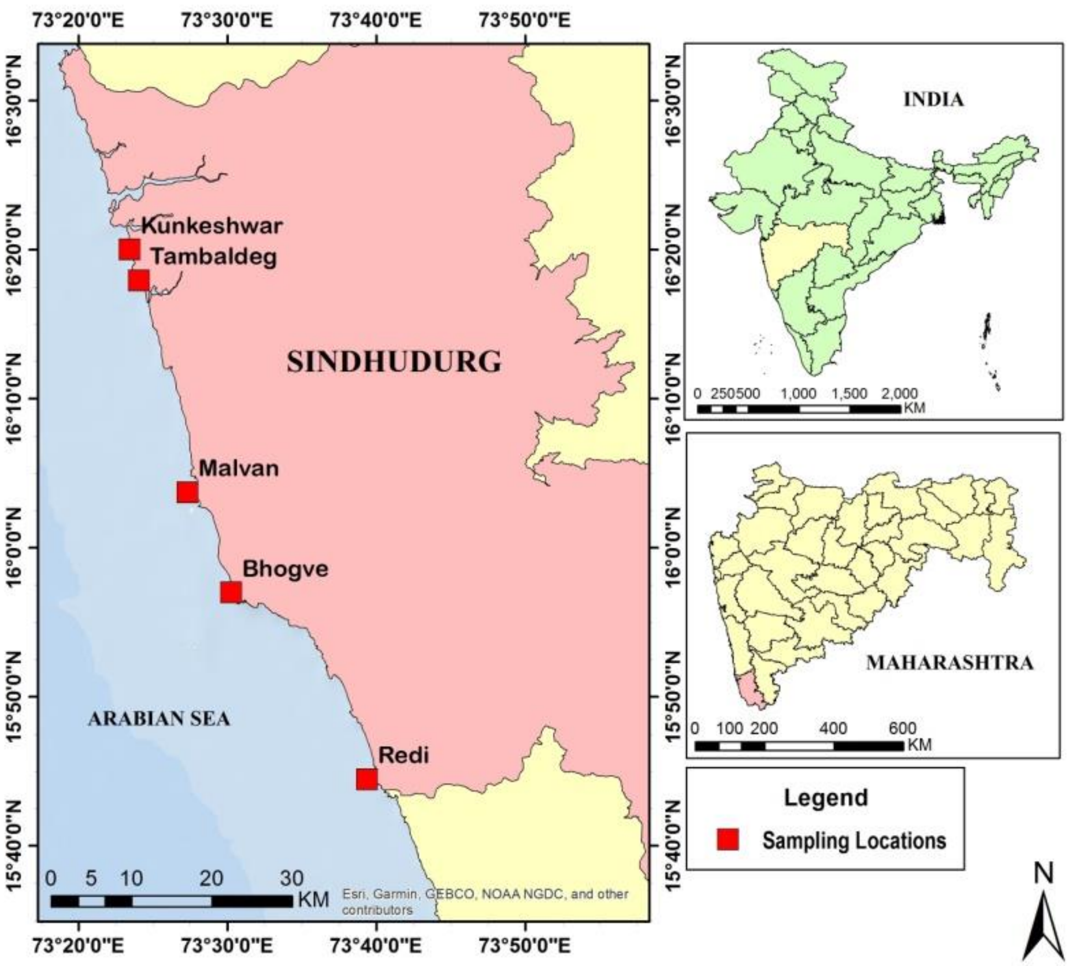

Fig. 1. Study Area

3. RESULTS

Total 20 macro faunal groups were encountered and the temporal variation in abundance and biomass is showed in Tables 1 - 4. Seasonal variation in the water parameters are showed in Table 5.

Amphipoda, H. *Copepoda*, Foraminifera and Polychaeta were the abundant macro fauna during study. The *Sargassum sp.* had abundance of *Amphipoda* and were found during all seasons; while in *Amphiroa sp.* Foraminifera, Harpacticoid *Copepoda* and Bivalvia were abundant during Post-monsoon, Pre-monsoon and Monsoon respectively (Table 1).

Gastropoda, *Amphipoda*, Polychaeta, Decapoda, Bivalvia and Cirripedia showed high biomass during study. Highest biomass in *Sargassum sp.* is showed by *Gastropoda* during Post-monsoon and Monsoon respectively, by *Amphipoda* during Pre-monsoon; while in *Amphiroa sp.* Highest biomass is showed by Polychaeta, *Gastropoda* and Bivalvia during Post-monsoon, Pre-monsoon and Monsoon respectively (Table 2).

Diversity indices revealed in *Sargassum sp.* higher diversity is seen during Monsoon followed by Post-monsoon and Pre-monsoon; species found evenly distributed during Monsoon and dominance is seen during Pre-monsoon. While in *Amphiroa sp.* higher diversity is seen during Monsoon followed by Pre-monsoon and Post-monsoon; species found evenly distributed during Monsoon and dominance is seen in Post-monsoon (Table 6).

ANOVA showed significant variance in the abundance of *Turbellaria* (p = 0.027) and *Ophiuroidea* (p = 0.010); while Kruskal-Wallis test showed it for *Amphipoda* (p = 0.041), *Isopoda* (p = 0.022), Decapoda (p = 0.008), Tanaidacea (p = 0.007), *Turbellaria* (p = 0.020) and *Ophiuroidea* (p = 0.022) between the seaweed species. For the variance between the seasons ANOVA and Kruskal-Wallis test showed variance in the abundance of Decapoda (p = 0.037) and (p = 0.018), *Copepoda* (p = 0.000) and (p = 0.0001), Bivalvia (p = 0.006) and (p = 0.022); and Cnidaria (p = 0.043) and (p = 0.023) respectively; while only Kruskal-Wallis test showed it for *Ophiuroidea* (p = 0.026) and Eggs (p = 0.009) (Table 7).

Correlation in the environmental parameters and macro faunal abundance showed increasing conductivity, TDS, salinity and water temperature favours *Copepoda* abundance; turbidity and air temperature favours *Turbellaria* and *Ophiuroidea* respectively; while increasing dissolved oxygen and tide pool depth results in decreasing *Turbellaria* and *Isopoda* abundance respectively in *Sargassum sp.* Similarly, increasing dissolved oxygen, conductivity, TDS, salinity and water temperature found favouring *copepoda* abundance and increasing water temperature also found beneficial to abundance of Tanaidacea in *Amphiroa sp.*

Table 1. Seasonal change in the abundance of the dominant macro fauna in decreasing order (lower limit is 50 ind/100 gm seaweed)

Sr. No.	Season	Abundance	
		Sargassum sp.	***Amphiroa sp.***
1	Post-monsoon	*Amphipoda* > H. *Copepoda*	Foraminifera > Polychaeta > H. *Copepoda*
2	Pre-monsoon	*Amphipoda* > H. *Copepoda*	H. *Copepoda*
3	Monsoon	*Amphipoda*	Bivalvia

Table 2. Seasonal change in the biomass of the dominant macro fauna in decreasing order (lower limit is 100 mg/100 gm seaweed)

Sr. No.	Macro fauna	Biomass	
		Sargassum sp.	***Amphiroa sp.***
1	Post-monsoon	*Gastropoda* > *Amphipoda* > Polychaeta	Polychaeta > Bivalvia
2	Pre-monsoon	*Amphipoda* > *Gastropoda* > Polychaeta > Decapoda	*Gastropoda* > Polychaeta > Decapoda
3	Monsoon	*Gastropoda* > Bivalvia > *Amphipoda* > Polychaeta > Cirripedia	Bivalvia > *Gastropoda* > Polychaeta > Decapoda

Table 3. Temporal changes in the abundance of macro fauna associated with seaweed (Individuals/100 grams seaweed) (±SD = Standard deviation)

Macro Fauna		***Sargassum sp.***			***Amphiroa sp.***	
Season	**Post-M**	**Pre-M**	**M**	**Post-M**	**Pre-M**	**M**
Amphipoda	116.86 ±188.24	339.65 ±347.15	127.14 ±67.14	17.50 ±18.14	16.12 ±20.16	45.58 ±41.83
Isopoda	7.35 ±9.17	25.08 ±28.33	0.00	0.83 ±1.18	0.00	0.00
Decapoda	0.20 ±0.40	2.67 ±2.80	3.41 ±2.30	1.67 ±2.36	5.95 ±5.71	17.57 ±8.68
H. Copepoda	62.60 ±6.77	89.80 ±6.14	16.00 ±15.00	68.33 ±7.32	87.80 ±3.54	9.00 ±6.00
Tanaidacea	0.00	0.00	0.00	1.33 ±1.89	8.84 ±4.61	0.00
Cirripedia	0.00	0.00	91.43 ±91.43	0.00	0.00	0.00
Pycnogonida	0.00	0.00	2.86 ±2.86	0.00	0.00	0.00
Hexapoda	0.00	0.00	0.00	0.00	0.00	0.37 ±0.37
Gastropoda	11.12 ±16.97	1.58 ±1.13	3.09 ±0.24	3.78 ±4.43	8.71 ±6.33	13.36 ±10.39
Bivalvia	0.30 ±0.59	1.12 ±0.90	18.73 ±9.84	16.28 ±15.70	3.31 ±4.17	55.69 ±33.19
Polychaeta	14.56 ±11.83	43.64 ±28.23	12.70 ±1.59	102.22 ±90.49	29.06 ±22.32	39.72 ±15.28
Sipunculida	0.00	0.00	2.86±2.86	0.00	0.84 ±1.03	0.37 ±0.37
Cnidaria	0.40 ±0.80	0.99 ±0.96	53.01 ±44.13	27.78 ±36.95	3.40 ±4.12	28.45 ±20.30
Phoronida	0.00	0.00	0.00	0.00	0.00	4.44 ±4.44
Turbellaria	0.15 ±0.30	1.72 ±2.19	7.70 ±6.59	10.11 ±7.15	4.82 ±5.11	9.93 ±1.18
Ophiuroidea	0.44 ±0.89	0.67 ±0.97	1.67 ±1.67	0.00	6.14 ±3.09	10.72 ±5.53
Echinoidea	0.00	0.00	0.00	0.00	0.00	0.37 ±0.37
Egg	0.00	0.00	2.78 ±2.78	0.00	0.00	0.74 ±0.74
Tintinnid	0.00	0.00	0.00	0.00	0.00	0.37 ±0.37
Foraminifera	0.00	0.00	0.00	740.74 ±1047.57	0.00	0.00

Table 4. Temporal changes in the biomass of macro fauna associated with seaweed (mg /100 grams seaweed) (±SD = Standard deviation)

Macro Fauna	***Sargassum sp.***			***Amphiroa sp.***		
Season	**Post-M**	**Pre-M**	**M**	**Post-M**	**Pre-M**	**M**
Amphipoda	209.90 ±392.05	214.55 ±191.77	221.11 ±78.89	24.44 ±32.24	23.45 ±38.84	62.11 ±60.86
Isopoda	22.41 ±32.38	6.73 ±6.87	0.00	0.83 ±1.18	0.00	0.00
Decapoda	0.40 ±0.80	163.13 ±217.26	50.63 ±35.08	15.00 ±21.21	123.62 ±199.38	140.53 ±85.72
H. Copepoda	0.24 ±0.03	0.34 ±0.03	0.06 ±0.06	0.26 ±0.03	0.34 ±0.01	0.03 ±0.02
Tanaidacea	0.00	0.00	0.00	0.22 ±0.31	5.60 ±4.93	0.00
Cirripedia	0.00	0.00	150.00 ±150.00	0.00	0.00	0.00
Pycnogonida	0.00	0.00	1.43 ±1.43	0.00	0.00	0.00
Hexapoda	0.00	0.00	0.00	0.00	0.00	0.37 ±0.37
Gastropoda	241.51 ±429.26	197.45 ±195.00	359.76 ±356.90	27.11 ±21.06	452.68 ±457.97	502.61 ±441.13
Bivalvia	0.15 ±0.30	0.62 ±0.32	226.98 ±115.87	125.00 ±104.16	28.28 ±48.64	662.85 ±221.60
Polychaeta	130.12 ±230.01	190.21 ±98.44	203.33 ±96.67	752.50 ±680.09	162.74 ±131.18	296.11 ±26.11
Sipunculid	0.00	0.00	17.14 ±17.14	0.00	5.16 ±7.13	4.07 ±4.07
Cnidaria	0.018 ±0.037	0.00	0.19 ±0.17	0.40 ±0.57	0.02 ±0.04	0.22 ±0.18
Phoronid	0.00	0.00	0.00	0.00	0.00	4.44 ±4.44
Turbellaria	0.15 ±0.30	0.52 ±0.70	21.03 ±13.25	26.11 ±19.07	3.92 ±5.39	36.71 ±10.79
Ophiuroidea	0.30 ±0.59	0.29 ±0.36	3.33 ±3.33	0.00	9.73 ±9.76	49.91 ±35.09
Echinoidea	0.00	0.00	0.00	0.00	0.00	1.11 ±1.11
Egg	0.00	0.00	1.67 ±1.67	0.00	0.00	0.74 ±0.74
Tintinnid	0.00	0.00	0.00	0.00	0.00	0.37 ±0.37
Foraminifera	0.00	0.00	0.00	19.33 ±27.34	0.00	0.00

Table 5. Temporal changes in the environmental parameters

Seaweed sp.	*Sargassum sp.*			*Amphiroa sp.*		
Parameters / Seasons	**Post-M**	**Pre-M**	**M**	**Post-M**	**Pre-M**	**M**
pH	7.79 ±0.69	8.17 ±0.09	7.81 ±0.13	7.56 ±0.74	8.25 ±0.17	7.8 ±0.12
Dissolved Oxygen (ppm)	5.94 ±0.16	5.40 ±1.69	4.74 ±0.33	5.96 ±0.06	6.80 ±0.47	4.80 ±0.27
Conductivity (Ms/cm)	49.33 ±0.25	53.97 ±0.42	49.02 ±1.37	48.91 ±0.57	53.98 ±0.13	48.34 ±0.69
Total Dissolve Solids (ppt)	24.67 ±0.12	26.99 ±0.21	24.51 ±0.68	24.46 ±0.29	26.99 ±0.06	24.17 ±0.34
Salinity (psu)	32.07 ±0.18	35.44 ±0.29	31.90 ±1.00	31.65 ±0.52	35.39 ±0.15	31.44 ±0.54
Turbidity (fnu)	2.30 ±0.94	5.06 ±4.35	7.40 ±3.30	2.10 ±1.50	4.57 ±1.44	4.85 ±1.16
Water temperature (°C)	30.38 ±0.38	31.76 ±0.69	29.06 ±0.19	31.07 ±0.50	32.99 ±1.44	28.09 ±1.16
Air temperature (°C)	31.43 ±1.70	31.24 ±1.14	32.29 ±1.01	31.80 ±1.30	32.73 ±0.56	29.30 ±4.00
Avg Tide pool depth (inches)	17.24 ±6.51	17.93 ±5.30	22.54 ±3.61	13.24 ±1.59	23.32 ±2.09	21.72 ±4.42

Table 6. Temporal changes in the diversity indices of seaweed associated macro fauna

Seaweed	*Sargassum sp.*			*Amphiroa sp.*		
Season	**Post-M**	**Pre-M**	**M**	**Post-M**	**Pre-M**	**M**
Taxa S	10	10	13	11	11	15
Individuals	210	501	337	985	169	229
Dominance_D	0.39	0.49	0.24	0.58	0.29	0.15
Shannon H	1.21	1.04	1.77	0.97	1.70	2.13
Evenness e^H/S	0.33	0.28	0.45	0.24	0.50	0.56

Table 7. Variance in the abundance of macro fauna between the seaweeds and seasons

Fauna	Between Seaweeds		Between seasons	
	p - Value			
	ANOVA	Kruskal -Wallis	ANOVA	Kruskal -Wallis
Amphipoda	0.055	0.041	0.649	0.351
Isopoda	0.510	0.022	-	0.202
Decapoda	0.081	0.008	0.037	0.018
Copepoda	0.998	0.792	0.000	0.0001
Tanaidacea	-	0.007	-	0.157
Cirripedia	-	0.361	-	0.105
Pycnogonid	-	0.361	-	0.105
Hexapoda	-	0.273	-	0.105
Gastropod	0.613	0.247	0.796	0.593
Bivalvia	0.112	0.070	0.006	0.022
Polychaeta	0.204	0.235	0.777	0.779
Sipunculida	0.977	0.260	-	0.119
Cnidaria	0.596	0.194	0.043	0.023
Phoronida	-	0.273	-	0.105
Turbellaria	0.027	0.020	0.263	0.225
Ophiuroidea	0.010	0.022	0.054	0.026
Echinoidea	-	0.273	-	0.105
Eggs	0.556	0.947	-	0.009
Tintinnid	-	0.273	-	0.105
Foraminifera	-	0.273	-	0.417

Note: Variation is significant when $p < 0.05$; (-) represents ANOVA failed due to very less faunal abundance

Table 8. Correlation between environmental parameters and abundance of macro fauna (Test is performed for each seaweed species separately)

Environmetal Prameters	*Sargassum sp.*			*Amphiroa sp.*		
	Fauna	***R***	***p***	**Fauna**	***R***	***p***
DO	*Turbellaria*	-0.712	0.009	*Copepoda*	0.854	0.002
Cond.	*Copepoda*	0.758	0.004	*Copepoda*	0.854	0.002
TDS	*Copepoda*	0.758	0.004	*Copepoda*	0.854	0.002
Salinity	*Copepoda*	0.758	0.004	*Copepoda*	0.854	0.002
Turbidity	*Turbellaria*	0.689	0.013			
Water T	*Copepoda*	0.625	0.030	*Copepoda*	0.695	0.026
Water T		-	-	Tanaidacea	0.716	0.020
Air T	*Ophiuroidea*	0.619	0.032		-	-
Pool depth	*Isopoda*	-0.636	0.026		-	-

Note: Spearman's Correlation test is applied and, correlation is significant when p < 0.05; R = Correlation coefficient
Only significant correlations were presented in the table and (-) represents no correlation

Table 9. Correlation between environmental parameters and abundance of macro fauna (Test is performed for each season separately)

Environmetal Prameters	Post-monsoon			Pre-monsoon			Monsoon		
	Species	***R***	***p***	**Species**	***R***	***p***	**Species**	***R***	***p***
pH	*Copepoda*	-0.856	0.019		-	-		-	-
Turbidity	*Copepoda*	0.856	0.019	Decapoda	-0.648	0.043		-	-
Water temperature		-	-	Decapoda	-0.660	0.038		-	-
Water temperature		-	-	*Copepoda*	-0.665	0.036		-	-
Air temperature	*Copepoda*	0.932	0.005	*Isopoda*	-0.772	0.009		-	-
Pool depth		-	-	*Isopoda*	-0.797	0.006		-	-

Note: Spearman's Correlation test is applied and, correlation is significant when p < 0.05; R = Correlation coefficient
Only significant correlations were presented in the table and (-) represents no correlation

Increasing turbidity and air temperature found favouring the *copepoda* abundance but increasing pH was found not favouring the *copepoda* during Post-monsoon; Increasing turbidity and water temperature results in decreasing Decapoda abundance, increasing water temperature also found affecting *copepoda* abundance and, increasing air temperature and pool depth results in decreasing *Isopoda* abundance during Pre-monsoon (Tables 8 and 9).

4. DISCUSSION

During the study period, both *Sargassum sp.* and *Amphiroa sp.* showed diversity of associated macro fauna; but *Amphiroa sp.* showed more diversity than *Sargassum sp.* during all seasons (Table 6). The *Sargassum sp.* recorded highest total abundance during Pre-monsoon (506.93 ±418.82 SD) wherein the *Amphipoda* (67.00%) contributed the most; The highest total biomass (1256.49 ±870.30 SD) was contributed by *Gastropoda* (28.63%). Similarly, in *Amphiroa sp.* highest total abundance was recorded during Post-monsoon (990.57 ±1233.17 SD) in which Foraminifera (74.79%) contributed; while Bivalvia (37.62%) contributed to the highest total biomass (1761.98 ±892.43).

Cirripedia and Pycnogonida were specific to *Sargassum sp.* and only observed during Monsoon; similarly Hexapoda, Phoronida, Echnoidea and Tintinnid were specific *to Amphiroa sp*. and only observed during Monsoon; Tanaidacea is observed during Post-monsoon and Pre-monsoon while Foraminifera was reported during Post-monsoon. Abundance of *Amphipoda* in *Sargassum sp.* maybe attributed to the lanceolate fronds and bushy structure that suits them as habitat; while with *Amphiroa sp.* association of Bivalvia, Polychaeta and Foraminifera is probably associated to the dense coarse structure and high sediment retention capacity [6] however their abundance was specific to the season; Bivalvia were highly abundant during Monsoon while Polychaeta and Foraminifera during Post-monsoon. *Gastropoda* and Polychaeta recorded high biomass in both the seaweeds; the biomass of *Amphipoda* was high in *Sargassum sp.* while Bivalvia showed high biomass in *Amphiroa sp*. The increasing abundance from Post-monsoon to Pre-monsoon of certain species viz., *Amphipoda*, *Isopoda*, Harpacticoid *Copepoda* and Polychaeta in *Sargassum sp.* probably due to the sand ‘cut’ phenomenon and steady hydrographical conditions during this season [21].

Copepoda abundance seen affecting most with the environmental parameters and majorly seen positively significant with it; except water temperatures during Pre-monsoon and pH during Post-monsoon where it showed significant negative correlation; most significant negative correlations were seen in this season may be due to little high values of the parameters.

There are various aspects by which macro fauna forms association with the seaweeds, several seaweed properties like thallus structure, thallus chemistry, nutritional properties of seaweeds determine the habitat selection by macro fauna in this dynamic environment. More study with respect to community composition and structure is required to understand the mechanism that accelerates the dynamics of marine communities [3].

5. CONCLUSION

High abundance is shown by *Amphipoda* during all the seasons which was specific to *Sargassum sp. Copepoda* showed more significant correlations with environmental parameters. Based on the indices, the study reveals both *Sargassum sp.* and *Amphiroa sp.* support diversity of macro fauna which vary seasonally.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

CONFERENCE DISCLAIMER

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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