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Distribution and Diversity of Macroalgae from Selected Stations in The South West Coast of Kanyakumari, Tamil Nadu

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ABSTRACT

Marine ecosystems are the largest of Earth's aquatic ecosystems and are distinguished by waters that have salt content in contrast to freshwater ecosystems, which have a lower salt content. Marine environment which includes oceans, seas, coastal backwaters, estuaries and bays covers 70.8% of earth surface. It is a wealthy resource of biological and chemical diversity. The present study was explored to enumerate the seaweed resources around five selected stations (Kurumpanai, Manavalakurichi, Muttom, Kovalam and Leepuram) of the Kanyakumari coastal region, of Tamil Nadu, during the period from July 2018 to May 2019. A total of 46 algal species were collected from the selected coasts, among which 12 species belonged to Chlorophyceae, 14 species belonged to Phaeophyceae and 20 species belonged to Rhodophyceae. Among the five coasts surveyed for seaweed resources, rich vegetation of macroalgae was found at Muttom coast (35 species), followed by 30 species of macroalgae from Kovalam coast. Lower number of macroalgal species were collected from Leepuram (15 species), Manavalakurichi (10 species) and Kurumpanai (7 species). Among the three groups of algae collected, red algae dominated over green and brown algae at four stations - Manavalakurichi, Muttom, Kovalam and Leepuram - except Kurumpanai.

Keywords : Macroalgae, Kanyakumari coast, Diversity

Introduction

Marine ecosystems are the largest of earth's aquatic ecosystems and are distinguished by waters that have salt content. These systems contrast with freshwater ecosystems, which have a lower salt content (Oceanic Institute, 2018). Marine environment which includes oceans, seas, coastal backwaters, estuaries and bays covers 70.8% of earth surface. It is a wealthy resource of biological and chemical diversity (Minth *et al*., 2005). The major groups of marine organisms are macroalgae (seaweeds), soft corals, fungus, sponges, bryozoans, tunicates, annelids, holothurians, molluscs and echinoderms. Among the marine organisms, the macroalgae occupy important place as a source of food, industrial raw materials, in therapeutic and botanical applications for centuries (Barrow, 2007). The coastal region of Kanyakumari district is rich in algal flora before Tsunami. Now the diversity and distribution of macroalgae in this region of Kanyakumari district have come down (Krishnamurthy, 2006). Some stations of coastal line of Kanyakumari district have rich algal vegetation which are beneath the water level or exposed during low tide.

Macroalgae

Macroalgae are ecologically important primary producers (Harley *et al*., 2012) and are with varied biodiversity (Christie *et al*., 2009). They are the main primary producers and form the base of the food chain in the oceans (Figueiredo and Creed 2009). They play a key role in coastal biodiversity (Barot *et al*., 2015) and provide ecosystem goods and services to human like food, medicine and protection of coastal ecosystem from storm (Ronnback *et al*., 2007). They are also autotrophic and photosynthetic beings, so their habitat is limited to a certain depth, which is usually a maximum of 60 m, always within the intertidal zone, and its growth is usually vertical, looking for sunlight (Zhao *et al*., 2016). Quantification of nutritional aspects of edible seaweeds include polysaccharides (Celluloses, Hemicelluloses, Xylans, Carrageenans and Alginates), minerals (Calcium, Potassium, Magnesium, Sodium, Copper, Iron, Iodine and Zinc), Poly Unsaturated Fatty Acids (PUFA), vitamins (A, B, C and E), proteins (Biliproteins) and other major compounds (Alginic acid, Fucoidan, Laminarin, Mannitol, Porphyran, Floridoside, Pentoses and Xylose) (MacArtain *et al*., 2007).Seasonal changes on the diversity and abundance of intertidal macroalgae at four Southern districts of Tamil Nadu, India studied by Shahayarraj and Singh 2016 and reported that 435 specimens were collected from Tamil Nadu coast during April 2010- March 2011.

Materials and methods

Description of the study area

Kanyakumari is a coastal town in the state of Tamil Nadu on India's southern tip.It is a most popular tourist place in Tamil Nadu. Kanyakumari coast is a rocky area. The rocky areas are exposed to tide and these rocks are covered by macroalgae. The selected study area include five stations of kanyakumari coasts namely Kurumpanai, Manavalakurichi, Muttom, Kovalam and Leepuram.

Field studies

Period of Study

The study was conducted for a period of twelve months from July 2018 to June 2019 at the five stations namely Kurumpani, Manavalakurichi, Muttom, Kovalam and Leepuram of Kanyakumari District, Tamil Nadu. Depending on the climatic conditions prevailing in the study area, the period was divided into four seasons viz:Southwest monsoon (July to September 2018), Northeast monsoon (October to December 2018), Postmonsoon (January and February 2019), and Premonsoon (March to May 2019).

Distribution of macro algae

The distribution and diversity of macroalgae were analysed by constructing 16 quadrates of 0.25 m^2 randomly. The macroalgae collected are brought to the laboratory in polythene bags and were identified by referring the keys given by Anantharaman (2002) and Kathiresan (2000) and confirmed by Botanical Survey of India, Howrah. The season-wise occurrence of individual species of macro algae occurring during the 12 months study period was also recorded.

Results

Seasonal occurrence of marine macroalgae

Species and generic composition of marine macroalgae belonging to three groups recorded from five stations are presented in Table -9. The list of species of marine macro algae collected from the five stations are given in Table -10. A total of 46 algal species were collected in the selected coasts of Kanyakumari district. Among that 12 species belongs to Chlorophyceae, 14 species belonged to Phaeophyceae and 20 species belongs to Rhodophyceae.

Among the five coasts, rich vegetation was found in Muttom coast (35 species). Next to that more number i.e. 30 species of macroalgae were collected from Kovalam coast. Less number of macroalgal species were found in Leepuram (15 species), Manavalakurichi (10 species) and Kurumpanai (7species). From the three groups of macroalgae, red algae dominated over green and brown algae in all the four stations except Kurumpanai.

The common macro algae found in all the five localities were *Ulva fasciata*, *Chaetomorpha antennina* of Chlorophyceae. *Sargassum wightii* of Phaeophyceae, *Gracilaria corticata,Hypnea musciformis* of Rhodophyceae. Some species of macroalgae were rarely reported at five localities. They include *Ulva flexuosa*, *Ulva rigida*, *Ulva reticulata*, *Caulerpa scalpelliformis*, *Bryopsis plumose*, *Halimedia opuntia* of Chlorophyceae, *Dictyota fasciola*, *Padina tetrastromatica*, *Padina boryana*, *Dictyota dichotama*, *Lobophora variegata*, *Stoechospermum marginatum*, *Padina boergesenii*, *colpomenia sinuosa*, *Chnoospora implexa*, *Chnoospora minima*, *Sargassum ilicifolium*, *Turbinaria ornata*, *Turbinaria turbinata* of Phaeophyceae. *Cheilosporum spectabile*, *Gracilaria debilis*, *Gracilaria gracilis*, *Gracilaria edulis*, *Gracilaria verrucosa*, *Hypnea valentiae*, *Polysiphonia lanosa*, *Halymenia floresii*, *Palmaria palmata*, *Sarconema filiforme*, *Meristotheca papulosa*, *Scinaia hatei*, *Enantiocladia prolifera*, of Rhodophyceae. Among the total macroalgae identified 6 species were reported as rare. They are *Ulva reticulata, Chnoospora implexa*, *Scinaia hatei, Gracilaria debilis*, *Gracilaria verrucosa, Spyrida hypnoides* (plate. 1).

The seasonal occurrences of macroalgae is given in table-11. It revealed that a maximum of 31 species of macroalgae were reported from muttom coast during south west monsoon and it was followed by 24 species in Kovalam coast. Kurumpanai, Manavalakurichi and Leepuram have minimum number of algal species. Among the macroalgae species *Ulva fasciata*, *Valoniopsis pachynema*, *Chaetomorpha antennina* of Chlorophyceae and *Sargassum wightii* of Phaeophyceae and *Gracilaria corticata*, *Gracilaria fergusonii*, *Hypnea musciformis* of Rhodophyceae were present throughout the study period.

Table 9

Species and Generic Composition (Number) of Different Groups of Algae in Stations I-V from July 2018 to May 2019

Stations	Chlorophyceae		Phaeophyceae		Rhodophyceae	
	Genera	Species	Genera	Species	Genera	Species
Kurumpanai (I)	3	4	1	1	2	2
Manavalakurichi (II)	2	4	1	1	4	5

Muttom (III)	4	10	5	9	10	16
Kovalam (IV)	6	10	4	5	11	15
Leepuram (V)	4	5	4	5	5	5

Table 10
Seasonal Occurrence of Marine Macroalgae Recorded from five coast – July 2018 to May 2019

S. No	Botanical name of the seaweeds	South west monsoon (July to Sep 2018					North - east monsoon (Oct to Dec 2018)					Post - monsoon (Jan to Feb 2019					Pre - monsoon (March to May 2019				
		I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V
	Division : Chlorophyta **Class : Chlorophyceae** **Order : Ulvales** **Family : Ulvaceae**																				
1	***Ulva flexuosa* Wulfen**	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	***Ulva fasciata* Delile.**	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	-
3	***Ulva rigida* C.Agardh**	-	-	-	-	-	-	-	+	-	-	-	-	+	+	-	-	-	-	-	-
4	***Ulva reticulata* Forsskal.**	-	-	+	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
5	***Ulva prolifera* O.F.Muell**	+	+	+	+	-	-	+	+	-	-	-	-	-	-	-	+	+	+	+	-
	Order : Siphonales **Family : Caulerpaceae**																				
6	***Caulerpa racemosa* (Forssk.) J.Agardh**	-	-	+	+	+	+	-	+	+	+	-	-	-	-	-	-	-	+	+	-
7	***Caulerpa scalpelliformis* (R. Brown ex Turner) C.Agardh.**	-	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
8	***Caulerpa chemnitzia* J.V.Lamouroux.**	-	-	+	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-
	Family : Halimedaceae.																				
9	***Halimeda opuntia* (Linnaeus) J.V.Lamouroux**	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Family : Valoniaceae																				
10	***Valoniopsis pachynema* (G. Martens) Boergesen.**	-	-	+	+	+	-	-	+	+	+	-	-	-	+	+	-	-	-	+	-
	Order : Cladophorales **Family : Cladophoraceae**																				

11	***Chaetomorpha antennina* (Bory) Kuetzing.**	+	+	+	+	+	-	+	+	+	-	-	-	+	-	-	-	-	+	-	-
	Family : Bryopsidaceae																				
12	***Bryopsis plumosa* (Hudson) C. Agardh.**	-	-	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
	Division : Phaeophyta **Class : Phaeophyceae** **Order : Dictyotales** **Family : Dictyotaceae**																				
13	***Dictyota fasciola* (Roth) J. V. Lamouroux**	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	***Padina boryana* Thivy.**	-	-	-	-	-	-	-	+	-	-	-	-	+	-	-	-	-	-	-	-
15	***Padina tetrastromatica* Hauck.**	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	***Dictyota dichotama* (Hudson) J. V. Lamouroux**	-	-	+	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-
17	***Lobophora variegata* (J.V. Lamouroux)**	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	***Stoechosspermum marginatum* (C. Agardh) Kutzing.**	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
19	***Padina boergesenii* Allender Kraft.**	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
	Family : Scytosiphonaceae																				
20	***Calpomenia sinuosa* (Mertens ex Roth Derbes & Solier.**	-	-	-	+	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
	Family : Chnoosporaceae																				
21	***Chnoospora implexa* J.Agardh.**	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	***Chnoospora minima* (Hering) Papenf (Brown).**	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Order :Fucales **Family : Sargassaceae**																				
23	***Sargassum ilicifolium* (Turner) C.Agardh.**	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
24	***Sargassum wightii* Greville ex J .Agardh.**	-	-	+	+	+	-	-	+	+	+	+	+	+	+	+	-	-	+	-	+

25	***Turbinaria ornata* (Turner) J.Agardh.**	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	***Turbinaria turbinata* (Linnaeus) Kuntze.**	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Division : Rhodophyta **Class : Rhodophyceae** **Sub class : Florideophyceae** **Order : Corallinales** **Family : Corallinaceae**																				
27	***Cheilosporum spectabile* Harvey ex Grunow**	-	-	-	+	-	-	-	-	-	-	-	-	-	+	-	-	-	-	+	-
	Order : Gigartinales **Family : Gracilariaceae**																				
28	***Gracilaria edulis* (S.G.Gmelin) P.C.Silva**	-	-	+	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
29	***Gracilaria debilis* (Forsskal) Borgesen .**	-	-	-	+	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-
30	***Gracilaria corticata* (J.Agardh).**	+	+	+	+	-	+	+	+	+	-	+	+	+	+	+	+	-	+	+	-
31	***Gracilaria fergusonii* J.Agardh .**	-	-	+	+	-	-	+	+	+	-	-	-	+	-	-	-	-	+	+	-
32	***Gracilaria gracilis* (Stack house)Steentoft, L.M. Irvine&Farnham**	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
33	***Gracilaria verrucosa* (Hudson) Papenf.**	-	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
	Family : Cystocloniaceae																				
34	***Hypnea musciformis* (Wulfen) J.V.Lamouroux.**	+	+	+	+	+	-	+	+	+	+	-	+	+	+	-	-	+	+	-	-
35	***Hypnea valentiae* (Turner) Montagne.**	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Family : Rhodomelaceae																				
36	***Enantiocladia prolifera* Falken berg.**	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
37	***Laurencia obtusa* (Hudson) J.V.Lamouroux.**	-	-	+	+	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-
38	***Polysiphonia lanosa* (Linnaeus) Tandy**	-	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Family : Halymeniaceae																				

39	***Halymenia floresii* (Clemente) C.Agardh.**	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Family : Lithophyllaceae																				
40	***Amphiroa anceps* (Lamarck) Decaisne.**	-	-	+	+	+	-	-	-	+	+	-	-	-	+	-	-	-	+	+	+
	Family : Palmariaceae																				
41	***Palmaria palmata* (Linnaeus) F. Weter & D. Mohr.**	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Family : Solieriaceae																				
42	***Sarconema filiforme* (Sonder) Kylin.**	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
43	***Gelidium micropterum* Kuetz.**	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
44	***Meristotheca papulosa* (Montagne) J. Agardh**	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Family : Scinaiaceae																				
45	***Scinaia hatei* Borgesen**	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Family : Spyridiaceae																				
46	***Spyridia hypnoides* (Bory) Papenf.**	-	+	+	+	+	-	+	+	+	-	-	+	+	-	-	-	-	-	-	-

Site – I Kurumpanai **Site-IV Kovalam**
Site-II Manavalakurichi **Site-V Leepuram**
Site-III Muttom

Table 11

Seasonal Occurrence of Different Groups of Marine Macroalgae (Number of species) from July 2018 to 2019 Station I to V

Station	**No of species**			
	Southwest monsoon	**Northeast monsoon**	**Post monsoon**	**Pre monsoon**
Kurumpanai	5	3	3	3
Manavalakurichi	8	7	5	3
Muttom	32	18	10	9
Kovalam	24	18	8	8
Leepuram	13	8	3	2

Plate: 1

Macroalgae identified in the study areas

***Ulva flexuosa* wulfen.**

***Ulva fasciata* Delile**

***Ulva rigida* C.Agardh**

***Ulva reticulata* Forsskal.**

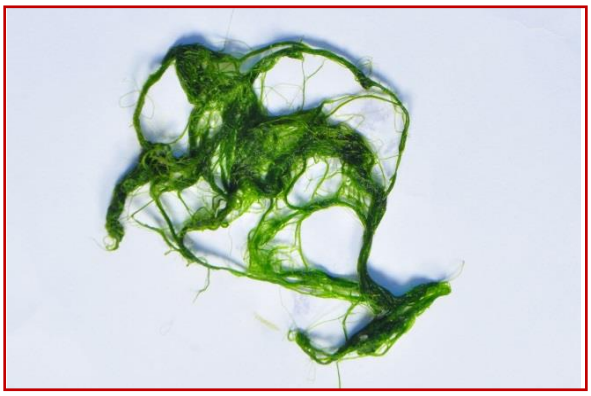
***Caulerpa racemosa* (Forssk.) J.Agardh.**

***Caulerpa scalpelliformis* (R. Brown ex Turner) C.Agardh.**

***Caulerpa chemnitzia* J.V.Lamouroux.**

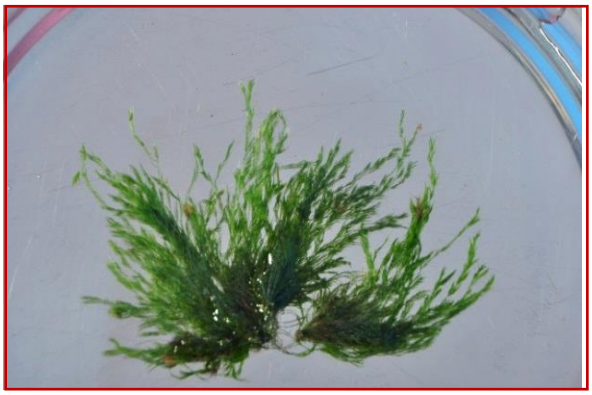
***Halimedia opuntia*(Linnaeus)J.V.Lamouroux**

***Valoniopsis pachynema* G.Martens Boergesen**



***Ulva prolifera* O.F.Muell.**

***Chaetomorpha antennina* Bory Kutzing**



***Bryopsis plumosa* Hudson C.Agardh**

***Dictyota fasciola* (Roth) J.V. Lamouroux**

***Padina boergesenii* Allender Kraft**

Padina tetrastromatica **Hauck**

Dictyota dichotama **Hudson J.V.Lamouroux**

Lobophora variegata **(J.V. Lamouroux)**

Stoechosspermum marginatum
C. Agardh Kutzing

Padina boergesenii **Allender Kraft**

Chnoospora implexa **J.Agardh**

Calpomenia sinuosa **Mertens**

Sargassum ilicifolium **Turner C.Agardhex Roth Derbes & Solier**

Sargassum wightii **Greville ex.J.Agardh**

Padina boryana Thivy

Turbinaria ornata **Turner J.Agardh**

Turbinaria turbinata **(Linnaeus) Kuntze**

Gracilaria edulis **(S.G.Gmelin) P.C.Silva.**

Cheilosporum spectabile **Harvey ex Grunow**

Gelidium micropterum **Kuetz.**

Gracilaria debilis **(Forsskal) Borgesen**

Gracilaria corticata **J.Agardh**
Steentoft, L.M.Irvine & Farnham

Gracilaria gracilis **(Stack house)**

Gracilaria fergusonii **J.Agardh**

Hypnea musciformis **Wulfen J.V.Lamouroux**

Hypnea valentiae **(Turner) Montagne.**

Spyridia hypnoides **(Bory) Papenf.**

Enantiocladia prolifera Falkenberg.

Laurenciaobtusa(Hudson)J.V.Lamouroux.

Amphiroa anceps Lamarck Decaisne

***Polysiphonia lanosa* Linnaeus Tandy**

***Chnoospora minima* (Hering) Papenf.**

***Scinaia hatei* Borgesen**

***Meristotheca papulosa* (Montagne) J.Agardh**

Halymenia floresii (Clemente) C.Agardh

***Gracilaria verrucosa* (Hudson) Papenf.**

***Palmaria palmata* Linnaeus F.Weter&D.Mohr**

Population Density and Abundance

In this study, diversity index of all the identified 46 macroalgae were analyzed to investigate population density in all five stations. In the class Chlorophycae *Ulva fasciata Delile* showed high population density value i.e. 1.12.Similarly in Phaeophycaeae, population density was high(0.81) for *Sargassum wightii Greville ex J.Agardh*.It indicated more availability of that species.Among the red algae, the population density was high(1) for *Gracillaria corticata J.Agardh*. Population density analysis also revealed the abundance of macroalgae in the study areas. In the present study *Ulva fasciata Delile* showed high abundance i.e. 1.38 among the chlorophyceae members. *Sargassum wightii* Greville ex J.Agardh of Phaeophyceae, showed maximum abundance i.e. 1.3. Gracilaria corticata J.Agardh showed high abundance in population i. e. 1.45 among the members of Rhodophycae (Table-12).

Table 12 Population density and abundance of seaweed from Kanyakumari collected in different season

S. No	Species Name	Number of individual species (n)	Pi=n/N	log Pi	Pi log Pi	Total number of unit in which species occurred	Total number of units	Studied frequency % (f)	Frequency class to which species belong	Density (D)	Abundance
1	*Ulva flexuosa* wulfen.	2	0.01	2	0.02	2	16	12.5	A	0.12	1
2	*Ulva fasciata* Delile.	18	0.09	1.04	0.09	13	16	81.25	E	1.12	1.38
3	*Ulva rigida* C.Agardh.	4	0.02	1.69	0.03	3	16	18.75	A	0.25	1.33
4	*Ulva reticulata* Forsskal.	2	0.01	2	0.02	2	16	12.5	A	0.12	1
5	*Ulva prolifera* O.F.Muell	9	0.04	1.39	0.05	7	16	43.75	C	0.56	1.28
6	*Caulerpa racemosa* (Forssk.) J.Agardh.	2	0.01	2	0.02	2	16	12.5	A	0.12	1
7	*Caulerpa scalpelliformis* (R.Brown ex Turner) C.Agardh.	3	0.01	2	0.02	3	16	18.75	A	0.18	1
8	*Caulerpa chemnitzia* J.V.Lamouroux.	10	0.05	1.3	0.06	8	16	50	C	0.62	1.25
9	*Halimedia discoidea* Decaisne	1	0.005	2.3	0.01	1	16	6.25	A	0.06	1
10	*Valoniopsis pachynema* (G. Martens) Borgesen.	9	0.04	1.39	0.05	7	16	43.75	C	0.56	1.28
11	*Chaetomorpha antennina* (Bory) Kutzing.	10	0.05	1.3	0.06	9	16	56.25	C	0.62	1.11
12	*Bryopsis plumosa* (Hudson) C. Agardh.	2	0.01	2	0.02	2	16	6.25	A	0.12	1
13	*Dictyota fasciola* (Roth) J. V. Lamouroux	1	0.005	2.3	0.01	1	16	6.25	A	0.06	1

14	*Padina boryana* Thivy.	2	0.01	2	0.02	2	16	6.25	A	0.12	1
15	*Padina tetrastromatica* Hauck.	1	0.005	2.3	0.01	1	16	6.25	A	0.06	1
16	*Dictyota dichotama* (Hudson) J. V. Lamouroux	3	0.01	2	0.02	3	16	12.5	A	0.18	1
17	*Lobophora variegata* (J.V. Lamouroux)	1	0.005	2.3	0.01	1	16	6.25	A	0.06	1
18	*Stoechosspermum marginatum* (C. Agardh) Kutzing.	1	0.005	2.3	0.01	1	16	6.25	A	0.06	1
19	*Padina boergesenii* Allender Kraft.	1	0.005	2.3	0.01	1	16	6.25	A	0.06	1
20	*Calpomenia sinuosa* (Mertens ex Roth Derbes & Solier.	3	0.01	2	0.02	3	16	12.5	A	0.18	1
21	*Chnoospora implexa* J.Agardh.	1	0.005	2.3	0.01	1	16	6.25	A	0.06	1
22	*Chnoospora minima* (Hering) Papenf.	1	0.005	2.3	0.01	1	16	6.25	A	0.06	1
23	*Sargassum ilicifolium* (Turner) C.Agardh.	2	0.01	2	0.02	2	16	6.25	A	0.12	1
24	*Sargassum wightii* Greville ex J . Agardh.	13	0.06	1.22	0.07	10	16	62.5	D	0.81	1.3
25	*Turbinaria ornata* (Turner) J.Agardh.	1	0.005	2.3	0.01	1	16	6.25	A	0.06	1
26	*Turbinaria turbinata* (Linnaeus) Kuntze.	1	0.005	2.3	0.01	1	16	6.25	A	0.06	1
27	*Cheilosporum spectabile* Harvey ex Grunow.	3	0.01	2	0.02	3	16	12.5	A	0.18	1
28	*Gracilaria edulis* (S.G.Gmelin) P.C.Silva.	2	0.01	2	0.02	2	16	6.25	A	0.12	1
29	*Gracilaria debilis* (Forsskal) Borgesen 1932.	3	0.01	2	0.02	3	16	12.5	A	0.18	1
30	*Gracilaria corticata* (J.Agardh).	16	0.08	1.09	0.08	11	16	68.75	D	1	1.45
31	*Gracilaria fergusonii* J.Agardh 1901.	2	0.01	2	0.02	2	16	6.25	A	0.12	1

32	*Gracilaria gracilis* (Stack house)Steentoft, L.M. Irvine&Farnham	8	0.04	1.39	0.05	7	16	25	B	0.5	1.14
33	*Gracilaria verrucosa* (Hudson) Papenf.	2	0.01	2	0.02	2	16	6.25	A	0.12	1
34	*Hypnea musciformis* (Wulfen) J.V.Lamouroux.	14	0.07	1.15	0.08	11	16	50	C	0.87	1.27
35	*Hypnea valentiae* (Turner) Montagne..	2	0.01	2	0.02	2	16	6.25	A	0.12	1
36	*Polysiphonia lanosa* (Linnaeus) Tandy	4	0.02	1.69	0.03	4	16	12.5	A	0.25	1
37	*Enantiocladia prolifera* Falkenberg.	2	0.01	2	0.02	2	16	6.25	A	0.12	1
38	*Laurencia obtusa* (Hudson) J.V.Lamouroux.	1	0.005	2.3	0.01	1	16	6.25	A	0.06	1
39	*Halymenia floresii* (Clemente) C.Agardh.	1	0.005	2.3	0.01	1	16	6.25	A	0.06	1
40	*Amphiroa anceps* (Lamarck) Decaisne.	9	0.04	1.39	0.05	5	16	31.25	B	0.56	1.8
41	*Palmaria palmata* (Linnaeus) F. Weter & D. Mohr.	1	0.005	2.3	0.01	1	16	6.25	A	0.06	1
42	*Sarconema filiforme* (Sonder) Kylin.	1	0.005	2.3	0.01	1	16	6.25	A	0.06	1
43	*Gelidium micropterum* Kuetz.	1	0.005	2.3	0.01	1	16	6.25	A	0.06	1
44	*Meristotheca papulosa* (Montagne) J.Agardh	1	0.005	2.3	0.01	1	16	6.25	A	0.06	1
45	*Scinaia hatei* Borgesen	4	0.02	1.69	0.03	4	16	12.5	A	0.25	1
46	*Spyridia hypnoides* (Bory) Papenf.	9	0.04	1.39	0.05	8	16	31.25	B	0.56	1.12

Discussion

In recent times, seaweeds are noteworthy resources of our nature due to the fact of their distribution, diversity and wide range of utilization in the broad spectrum of science. They render the socio-economic rewards to the coastal communities in the term of commercial aquaculture (Mantri *et al*., 2020).

The present study reported, a total of 35 species of macroalgae from Muttom, 30 species from Kovalam and less number of macroalgal species i.e.15,10,7 found in Leelapram, Manavalakurichi and Kurumpanai respectively. Similar findings were reported by Christobel 2012 in her thesis.The maximum number of seaweed observed at Muttom coastal waters may be due to the presence of intertidal rocky reefs reported by Domettila *et al*.,2013. The red algae dominated in all the stations except Kurumpanai (station-1).Similar finding was observed by Sahayaraj *et al*., 2014, who studied the distribution and diversity of marine macroalgae at four southern districts of Tamil nadu. It indicates that the presence of the rocky coasts is essential for the attachment of macroalgae .The above findings also confirmed by the studies of Paul and Raja 2011. The macroalgae species viz; *Ulva fasciata* of Chlorophyceae, *Sargassum wightii* of Phaeophyceae, *Gracilaria corticata* of Rhodophyceae were dominant throughout this study period.It was similar to the findings by Satheesh and Wesley 2012. Reviews on the seasonal studies of marine macroalgae along the East and West coast of India and other islands were found that *Caulerpa scalpelliformis*, *Caulerpa veravalensis*, *Caulerpa crassa* and *Sargassum wightii* were recorded throughout the year in Tamil Nadu(Sahayaraj *et al*., 2014).

Comparative study of observation

In the present study the number of macroalgae collected from different stations of Kanyakumari coastal areas was found to be varied from the previous studies. In the earlier observations by Shahayaraj *et al*., 2014, macroalgae collected from different station of Kanyakumari coastal areas were three (3) in Manavalakurichi, seven (7) in Muttom, eighteen (18) in Leepuram. Domettila *et al*., 2013 reported 38 species in muttom coastal areas.

Compared to the earlier observations, the macroalgae species were declined from 38 to 31 in Muttom coastal areas. Similarly, it was decreased in Leepuram station18 to 13species. Increased number of macroalgae was obserbed in Manavalakurichi coastal areas i.e. 3 to 8 species.

Satheesh and Wesley (2012) noted that the macroalgae are under threat in developing countries, where they are being disturbed by a variety of human activities. Gradual disappearance of marine algae along Visakhapatnam coast by disturbances created by discharge of effluents, environmental factors, tidal waves and cyclones was reported by Krishnamurty *et al*., 2015. Due to rapid anthropogenic activities like industrialization and urbanization etc. attributes the changes of seaweed flora that could be evident in Ennore, Pulicat lake and in covelong (Santhiya *et al*., 2010).

Population density and abundance

Diversity and distribution of seaweeds in selected reefs and island in gulf of kachchh studied by Roy *et al*., 2015 and reported that the value of density and frequency for Chlorophyceae, Phaeophyceae and Rhodophyceae varied in four sites.The density of Chlorophyta (D=0.32/m2 in chhad D=0.26/m2 in Narara) and Rhodophyta (D=0.30/m2 in chhad,D=0.30/m2 in Narara) were comparatively higher than Phaeophyta in the surveyed area. In the present study *Ulva fasciata Delile* of Chlorophyceae have highest density (1.12) and followed by *Gracillaria corticata* of Rhodophyyceae(1) then *Sargassum wightii* from Phacophyceae (0.81).This results were confirmed by Dave *et al*., 2019.

Conclusion

The alteration in the algal vegetation of the Kanyakumari coastal areas is evident in the current examination of macroalgae variety. In order to prevent the extinction of macroalgal taxa, manmade activity must be recognised and reduced, in addition to devastation such as flooding. Future systematic and constant biomonitoring of this coast will benefit the conservation of marine macroalgal species for which the results of the current study can be a baseline record of important information.

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