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Studies on the Distribution of Seaweed Resources in Kanniyakumari Coast, Tamil Nadu, India

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ABSTRACT

The present study is focused on the distribution of seaweeds from two stations of Kanyakumari coast.Present study focuses seaweed diversity and temporal variation in their abundance alongKanyakumaricoastal waters were investigated. Sampling was conducted for a period of one year from January2019 to December 2020. Total 106 seaweed species belonging to 20 orders, 27 family and 48 genera were recorded. Rhodophyta represented as dominant seaweed phylum with 53 species belonging to 11 order, 13 family and 28 genera followed by Chlorophyt (32 species belonging to 4 order, 9 family and11 genera) and Phaeophyta (21 species belonging to 5 order, 5 family and 9 genera). *Caulerpa and Chaetomorpha* were dominant genera along the Kanyakumari coast followed by *Gracilaria, Sargassum*and *Padina*. Presentreport can aprovide basic information for commercial exploitation and conservation of seaweed resources along coastal

Keywords; Seaweeds Chlorophyta,Phaeophyta,Rhodophyta

INTRODUCTION

Marine macroalgae, or the term seaweeds, are plant-like organisms that generally live attached to rock or other hard substrata in coastal areas. The classification into divisions is based on various properties such as pigmentation, chemical nature of photosynthetic storage product, the organization of photosynthetic membranes, and other morphological features. Traditionally, they belong to four different groups, empirically distinguished since the mid-nineteenth century on the basis of color: blue-green algae (phylum: Cyanophyta, up to 1500 species), red algae (phylum: Rhodophyta, about 6000 species), brown algae (phylum: Ochrophyta, classes: Phaeophyceae, about 1750 species) and green algae (phylum: Chlorophyta, classes: Bryopsidophyceae, Chlorophyceae, Dasycladophyceae, Prasinophy- ceae, and Ulvophyceae, about 1200 species). However, each of these groups has microscop-ics, if not unicellular, represantatives. All seaweeds at some stage in their life cycles are unicellular, as spores or zygotes, and may be temporarily planktonic. The blue-green algae are widesperead on temperate rocky and sandy shores and have occasionally been acknowledged in seaweed floras. Seaweeds are found growing throughouth the world oceans and seas none is found to be poisonous (Bold and Wyne, 1985; Guiry, 2009; Lobban and Harrison, 2000). Why seaweed is important? Most people don't realize how important marine macroalgae are, both ecologically and commercially. In fact, seaweeds are crucial primary producer in oceanic aquatic food webs. They are rich both in minerals and essential trace elements, and raw materials for the pharmaceutical and cosmetics industry (Chapman, 1970). Seaweed is a very versatile product widely used for food in

direct human consumption. Its classified taxonomically as algae and they represent a food group that is not normally ingested in unprocessed form to any great extent in Western societies. Humankind is no strangers to the use of algae as a food source.

Seaweeds are gaining considerable importance in recent times due to the fact of their cosmopolitan distribution, renewable nature, and wide range of applications (Barbier et.,al2019). Harvests from wild populations coupled with simple cultivation technologies largely evolved in Asian countries which has made it a preferred biomass for emerging commodity goods. Seaweeds also render socio-economic advantages to the maritime rural population in the form of commercial aquaculture. In total, 291 seaweed species are commercially used worldwide across 43 countries (Tiwari et.,al 20150). Commercial harvesting of seaweeds has reached new milestone with 31.2 million tonnes year^{-1} production (95% accounts to farming) with a market worth US$ 11.7 billion (FAO.2018). Seaweeds, or marine algae, refer to three taxonomic groups that have different pigment composition: Chlorophyta (green algae), Rhodophyta (red algae), and Chrophyta (brown algae). These groups are non-monophyletic having complex evolutionary life history strategies. The prevalence of cell wall matrix (sulphated polysaccharides) in their tissue makes this resource economically important. Its industrial utility essentially cuts across these high molecular weight polysaccharides also known as phycocolloids and their use as phycosupplement in nutraceutical market.

India has reported the highest number of seaweed taxa compared to all the other nations bordering the Indian Ocean (Sahoo et., al 2001).Biodiversity in a broad sense includes variation among life forms on this planet and is essential for human survival, as it sustains the health of the ecosystem, provides biological resources, besides representing culture and identity. Biodiversity essentially enriches the productivity of an ecosystem where every taxa, even the smallest, has an important role to play. The myriad array of species ensures the natural sustainability and health of an ecosystem. Biodiversity exploration studies have given critical attention in recent times to the steep decline in species, primarily due to the fact of anthropogenic-induced changes. The extinction rate currently is as high as 27,000 taxa per year (Maddison et.,al 2014). Global changes, including human-induced climate change, pollution, overexploitation of natural resources, destruction of natural habitats, and invasive species are the main reasons for biodiversity loss worldwide.

The Southeast Indian State of Tamil Nadu's coastline is 1076 km long with 13 coastal districts and 15 major ports and harbours. The convergence of the Bay of Bengal, Arabian Sea, and the Indian Ocean at India's southern tip is the unique feature of this coast. Distinct variations are seen in the nature of substratum in the intertidal and sub-tidal regions. The climate change,human activity and global warming will have considerable adverse impacts over the natural resources of Tamil Nadu. Tamil Nadu is famous for itsseaweeds diversity.The study is carried out to accesses the basic status of seaweeds diversity occurring and two station of Kanyakumari.

MATERIALS AND METHODS

The present study area, the Kanayakumari coastal of Tamil Nadu includes. Two station namely,Station -1 (Kanyakumari: Lat 8° 04'N; Long 77° 05'E) - Station -2 (Vattakottai: Lat 8° 12'N; Long 77° 56'E).Collection and Documentation of seaweeds Regular field visits were undertaken from January 2019 to December 2019 once in every 15 days at each station to record the various seaweed resources. Five sampling points were fixed with an interval of 200m in each station. Seaweed collections were made only on the low tidal and sub tidal regions (up to 1m depth) by hand

picking. The collected materials were washed thoroughly with marine water in the field itself to remove the epiphytes and sediment particles. Then the samples were packed separately in polythene bags in wet conditions and brought to the laboratory and thoroughly washed in distilled water to remove the salt on the surface of the thallic. They were stored in 5% formalin-seawater solution.Taxonomic identification by using taxonomic keys (Dawes and Mcintoshet.,al1981)

RESULTS

A total number of 106 species of seaweeds belonging to Chlorophyceae, Phaeophyceae and Rhodophyceae were identified and recorded in two stations of Kanyakumari coast(Table.1)Total 11 genera and 32 species were recorded in chlorophyceae,9 genera and 20 species were reported in Phaeophyceae and 30 genera and 54 species were identified in Rhodophyceae.In kanyakumari,a total of 78 seaweeds species were found. Of which, 19 species belong to Chlorophyceae, followed by 45 Rhodophyceae and 14 Phaeophyceae in Vattakotai (Fig-9,10). They belongs to 9 family,4order,11 genus were recorded in chlophyceae,5 family, 5 order, 9 genus were identified inPhaeophceae and 10 order 9 family, 23 genus and 45 species recoded in Rhodophyta(Fig-11)The seasonal diversity of Kanyakumari revealed that species diversity was equal during post monsoon and summer, in other words, 64 seaweed species were recorded in the two seasons. In post monsoon, the Chlorophyceae was 15, followed by 36 species under Rhodophyceae and 11 under Phaeophyceae. During post monsoon, the genus diversity was the highest with 67 under Rhodophyceae, followed by Chlorophyceae. During summer, the genus diversity was the highest for Rhodophyceae. During post monsoon and summer, the species diversity was found maximum under Rhodophyceae while the maximum genus diversity was found under Rhodophyceae. During pre-monsoon, 69 seaweeds were found; of which, 17 species belong to Chlorophyceae and 57 species belong to Rhodophyceae, followed by 13 species of Phaeophyceae.(Fig-5)

Table.1-List of seaweed occurring at two stations of Kanyakumari coast in the south east coast of Tamil Nadu

S.No.	Name of the Seaweeds	S1	S2
1	*Enteromorpha compressa (L.) Nees*	+	-
2	*Enteromorpha flexuosa (Wulfen) J. Ag.*	+	-
3	*Enteromorpha linza (L.) J. Ag.*	-	+
4	*Ulva fasciata Delile*	+	+
5	*Ulva lactuca L.*	-	+
6	*Ulva reticulata Forssk.*	-	+
7	*Chaetomorpha antennina (Bony) Kutzing*	+	+
8	*Chaetomorpha litorea Harvey*	-	+
9	*Chaetomorpha media (C. Ag.) Kuetzing*	+	+
10	*Chaetomorpha tortuosa Kuetzing*	-	+
11	*Chaetomorpha crasassa Kuetzing*	-	+
12	*Cladophora vagabunda (L.) Van den Hoek*	+	+
13	*Cladophora fasicularis. Kutzing*	+	+
14	*Boodelea composita (Harvy)Brand.*	+	+
15	*Codium arabicum Kuetzing*	-	+
16	*Halimeda macroloba Decaisne*	-	+
17	*Halimeda tuna (Ell. et. Sol.) Lamour*	-	+
18	*Caulerpa chemnitzia (Esper) Web v Bosse*	-	+
19	*Caulerpa crassifolia (C. Ag.) J. Ag.*	-	+

20	*Caulerpa latevirens Montagne*	-	+
21	*Caulerpa parvula Svedelius*	-	+
22	*Caulerpa microphysa Feldman*	+	+
23	*Caulerpa maricana*	+	+
24	*Caulerpa peltata Lamour*	+	+
25	*Caulerpa racemosa (Forssk.) Web. v. Bosse*	+	+
26	*Caulerpa scalpelliformis (R. Br.) Web. v.*	+	+
27	*Caulerpa taxifolia (Vahl.) C. Ag.*	+	+
28	*Caulerpa microphysa Feldman*	+	+
29	*Caulerpa maxicana Kutzing*	+	+
30	*Bryopsis plumosa (Huds.) C. Ag.*	+	+
31	*Cladophoropsis zollingeri (Kuetz.) Boergs.*	-	+
32	*Valoniopsis pachynema (Martens) Boergs*	+	+
33	*Dictyota bartayresiana Lamouroux*	+	+
34	*Dictyota dichotoma (Huds.) Lamouroux*	+	-
35	*Dictyota divaricata Lamouroux*	+	-
36	*Dictyota pinnutifida Kutzing*	+	+
37	*Stoechospermum marginatum (C. Ag.) Kutzing*	-	-
38	*Hormophysa cuneiformis*	-	+
39	*Padina boergesenii Allender & Kraft*	+	+
40	*Padina pavonica (L.) Thivy ex Taylor*	+	+
41	*Padina tetrastromatica Hauck*	+	+
42	*Lobophora varigataLamourex*	-	+
43	*Spatoglossum asperum J. Ag.*	-	+
44	*Spatoglossum variable Figari*	+	+
45	*Chnoospora implexa J. Ag*	+	-
46	*Colpomenia sinuosa (Mertens ex Roth) Derb. et Sol.*	+	+
47	*Rosenvingea intricata (J. Ag.) Boergesen*	+	-
48	*Sargassum duplicatum C.Ag*	+	+
49	*Sargassum linearifolium (Turner) C.Ag.*	+	+
50	*Sargassum ilicifolium (Turn.) J. Ag.*	-	+
51	*Sargassum tenerriumJ.Agarth*	-	+
52	*Sargassum wighti Grevile*	+	+
53	*Cryptonemia coriacea Schmitz*	+	+
54	*Cryptonemia lomation (Bertoloni) J. Ag.*	-	+
55	*Liagora ceranoides Lamouroux*	+	+
56	*Gelidium micropterum Kuetz. A.*	-	+
57	*Gelidium pusillum (Stackhouse) Le Jolis*	+	+
58	*Gelidiella acerosa (Forssk.) Feldm. & Hamel*	+	-
59	*Corynomorpha prismatica (J. Ag.) J. Ag*	-	+
60	*Grateloupia filicina (Wulf.) J. Ag.*	+	+
61	*Halymenia floresia (Clem.) C. Ag.*	+	+
62	*Amphiroa anceps (Lamarck) Decaisne*	+	-
63	*Amphiroa foliacea Lamouroux*	+	-
64	*Amphiroa fragilissima (L.) Lamouroux*	+	-
65	*Amphiroa rigida Lamouroux*	+	+
66	*Cheilosporum spectabile (Harvey) Weber van Bosse*	+	+
67	*Jania rubens (L.) Lamouroux*	+	+
68	*Portieria hornemannii (Lyngbye) Silva*	+	+
69	*Gracilaria corticata J. Ag.*	+	+
70	*Gracilaria crassa (Harvey) J. Ag.*	+	+
71	*Gracilaria cylindrica Boergesen*	+	-
72	*Gracilaria edulis (Gmelin) Silva*	+	+

73	*Gracilaria fergusonii J. Ag.*	+	+
74	*Gracilaria foliifera (Forsskal) Boergesen*	+	+
75	*Gracilaria kanyakumariensis Umamaheswara Rao*	-	+
76	*Gracilaria verrucosa (Hudson) Papenfus*	+	-
77	*Ahnfeltiopsis densa (J. Ag.) Silva et Decew*	+	+
78	*Sarconema scinaioides Boergesen*	+	+
79	*Solieria robusta (Grev.) Kylin*	+	+
80	*Coralina berteroi*	+	+
81	*Jania ruben*	+	+
82	*Hypnea flagelliformis Greville ex J. Ag.*	+	+
83	*Hypnea musciformis (Wulf.) Lamouroux*	+	-
84	*Hypnea valentiae (Turner) Montagne*	+	+
85	*Rhodeminia sonderi Silva*	+	+
86	*Botrycladia leptopoda (J.Agardh) Kylin*	-	+
87	*Gelidiopsis variabilis (Grev.) Schmitz*	+	-
88	*Champia indica Boergesen*	-	-
89	*Champia compressa Harvey*	+	+
90	*Champia glomerata Harvey*	-	+
91	*Champia parvula (Agardh) Harvey*	+	-
92	*Ceramium procumbens Setchell et Gardner*	+	+
93	*Centroceras clavulatum (C. Ag.) Montagne*	+	+
94	*Spyridia hypnoides (Bory) Papenfuss*	+	+
95	*Spyridia filamentosa Harvey*	+	+
96	*Griffithsia corallinoides (Linnaeus) Trevisan*	+	+
97	*Dictyurus purpurascens Bory*	-	+
98	*Enantiocladia prolifera (Greville) Falkenberg*	+	+
99	*Neurymenia fraxinifolia (Mertens) J. Ag.*	+	+
100	*Acanthophora muscoides (L.) Bory*	+	+
101	*Acanthophora spicifera (Vahl.) Boergesen*	+	+
102	*Laurencia flagellifera J. Ag.*	+	+
103	*Laurencia obtusa (Hudson) Lamouroux*	+	+
104	*Laurencia papillosa (Forsskal) Greville*	+	+
105	*Laurencia poiteaui (Lamouroux) Howe*	+	-
106	*Laurencia pedicullariodes Harvey*	+	+

1

2

3

4 5 6

7 8 9

Fig.1-9- Seaweeds from two station at Kanyakumari coast,Tamil Nadu,India.

1.Chetomorphacrasa2.Chetomorpha antennia3.Caulerpa laetevirens 4.Lobora varigata 5.Stoechospermaum marginatum 6.Hormophysa cuneiformis 7. padina pavonica 8.Gracilaria filicina 9.Laurencia obusta

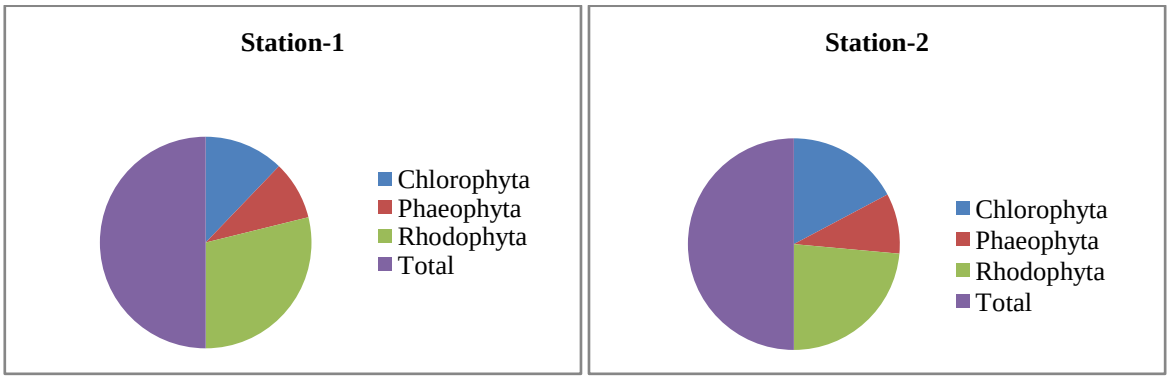

Fig.9,10-Diversity of total number of seaweeds belonging to different classes at two stations at Kanyakumari coast

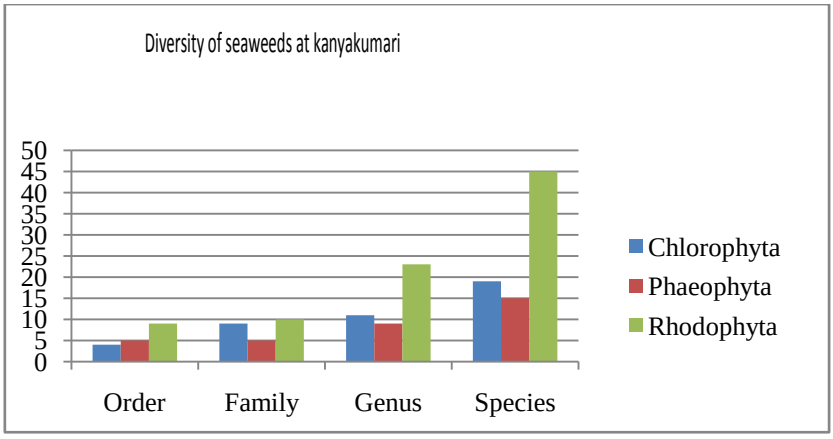

Fig.11-Seaweeds distribution belonging to Order,Family,Genus and Species

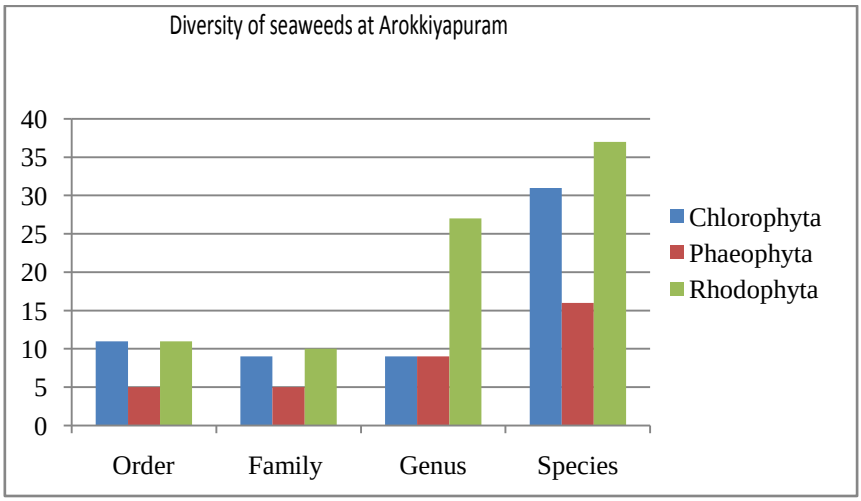

Fig.12-Seaweeds distribution belonging to Order,Family,Genus and Species

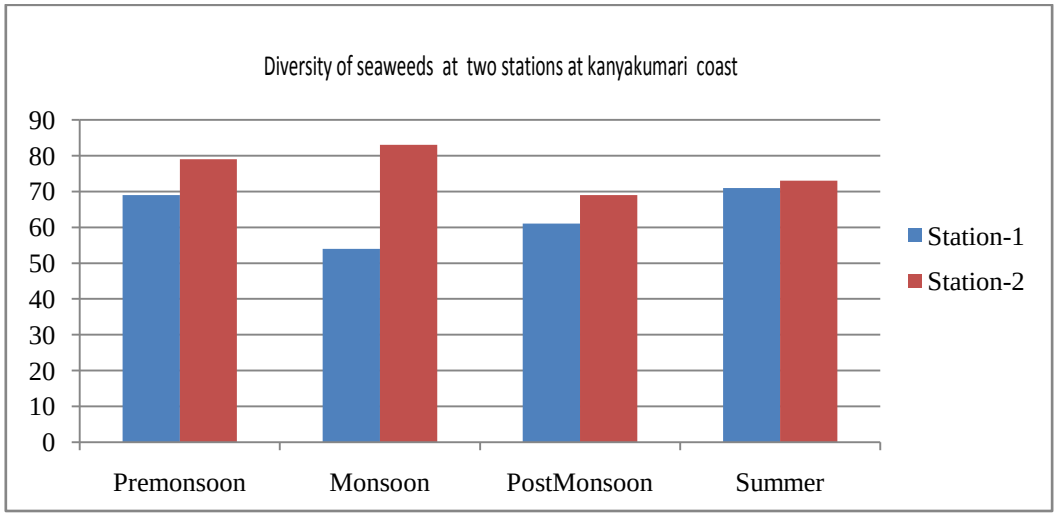

Fig.13 -Seasonal Distribution of seaweeds at two stations at Kanyakumari coast

AtVattakotai, totally 87 seaweeds were recorded which included 30 Chlorophyceae, 16 Phaeophyceae and 41 Rhodophyceae.They belongs to 9 family ,11 order and 9 genus were notified in chlorophyceae,5 order,5 family,9 genus were recorded in phaeophyceae and 11 order,10 family,27 genus and 37 species of Rhodophyta were recorded.(Fig-12)The seasonal survey at Vattakottai showed that post monsoon and summer had higher seaweed diversity than pre-monsoon and monsoon. The seaweed diversity was 73 species during summer and 69 during post monsoon. The seaweed diversity of pre-monsoon was 79 species and 83 in monsoon. In post monsoon, Rhodophyceae was dominated with 37 species, and with the highest genus diversity.. The summer survey recorded totally 85 seaweed species, of which 39 species were Rhodophyceae with the highest genus diversity of 37, followed by 9 species of Phaeophyceae and 5 species of Chlorophyceae. The survey of pre-monsoon and monsoon recorded with 79 species and 83 species respectively with maximum red and brown seaweeds during monsoon season.(Fig-13)

DISSCUTION

In the present investigation the numberof seaweeds collected from different stations ofKanyakumari coast was found to be variedfrom the previous reports. The number of seaweeds inKanyakumari station was 33 (Nair et al., 1993)and 95 (Edwin et al., 2004). Stella et al. (1997)reported 86 seaweed species in aVaattakottaiand a total of 67 seaweed species were reportedfrom Vattakottai (Edwin et al., 2004).Compared to the earlier observations theseaweed species were declined from 95 to 78 in Kanyakumari, species increased 86 to 87 in Vattakottai.Recently Edwin et al. (2004) reportedthe total number of 94 seaweed species in which22 species of Chlorophyceae, 17 species ofPhaeophyceae and 55 species of Rhodophyceaewere observed in Kanyakumari coastal area.Was observed from the survey that Kanyakumari was dominated with Rhodophceae and Vattakotai dominated with Rhodophyceae during monsoon and summer. The monsoon season was dominated with Phaeophyceae atVattakottai , but this was not found at Kanyakumari,during Post-monsoon season. The two coastal areas were dominated with industrially important seaweeds, such as *Gracilaria*,which is utilized seaweed for agar production and *Sargassum,* which are exploited for alginates production.The variation of seaweeds diversity in various seasons may be due to variation of nutrients supply, salinity and temperature, light availability and a wave action during different seasons (Lobban and Harrison, 1994; Nybakken, 2001). The seasonal variation, succession and vegetation patterns of seaweed diversity may be due to the variation of intensity of light, rainfall, and salinity and nutrients supply. Seaweed diversity and distribution along the Indian coast have been reported by many researchers (Untawale et al., 1989; Kalimuthu et al., 1995; Jayachandran and Ramaswamy, 1997; Stella et al., 1997; Selvaraj and Selvaraj, 1997; Mohammed et al., 1999; Kerkar, 2004; Rath and Adhikary, 2006; Satheesh and Wesley, 2012; Roy et al., 2015).Current work is the survey record of seaweeds diversity at Kanyakumari andVattakottai. The baseline data on seaweed diversity of the two coastal areas will be useful for future monitoring and conservation of seaweed resources.

CONCLUSION

At two stations, the maximum seaweed diversity was recorded during summer and post monsoon in comparison with monsoon and pre-monsoon. Seaweed growth was abundant during post monsoon and summer the seaweed diversity was higher at Kanyakumari in comparison to Vattakottaifor four seasons. Total number of seaweeds recorded was 87 for Kanyakumari and 78 in

Vattakottai. Totally 61 seaweed species were recorded during post monsoon and summer 71 at Kanyakumar which was higher than in remaining two seasons and also higher than Vattakottai Red seaweeds were dominant during post monsoon and summer seasons at both stations. The maximum number of 45 species under Rhodophyceae was found during summer at Kanyakumari , followed by 37 red seaweeds at Vattakottai during post monsoon.

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