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RESEARCH ARTICLE

SEAWEED DIVERSITY OF TUTICORIN COASTAL WATERS ALONG SOUTH EAST COAST OF INDIA

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ABSTRACT

Seaweeds are considered as ecologically and biologically important component in the marine ecosystems. Seaweeds make a substantial contribution to marine primary production and provide habitat for near shore benthic communities. Present status of seaweed diversity and temporal variation in their abundance along Tuticorin coastal waters were investigated. Fortnightly seaweed sampling was conducted for the period of five months from July 2014 to November 2014. Seaweed showed significant variation in its abundance and ranged from minimum 248 numbers of seaweed during September month to 953 numbers during November. In total 86 seaweed species belonging to 14 orders, 22 family and 36 genera were recorded. Rhodophyceae represented as dominant seaweed phylum with 32 species belonging to 7 order, 11 family and 18 genera followed by Chlorophyceae (27 species belonging to 3 order, 7 family and10 genera) and Phaeophyceae (27 species belonging to 4 order, 4 family and 8 genera). *Caulerpa* and *Ulva*were were dominant genera along the Tuticorin coast followed by *Gracilaria, Sargassum* and *Padina*. Temporal variability in various diversity indices were calculated by using PRIMER v6 software. The calculated value ranges of biodiversity indices were: Shannon–Wiener diversity (H') ranged from 3.91 to 4.38, Margalef's species richness ('d') was from 11.32 to 15.18, Pielou's evenness (J') was in the range of 0.9727 to 0.9858 and the Bray-Curtis similarity found maximum between July and August (89.92%) followed by August and November (88.11%). Higher values for biodiversity indices indicated healthy nature of seaweed ecosystem along Tuticorin coastal waters. Present research report can provide basic information for commercial exploitation of seaweed resources along Tuticorin coastal waters.

INTRODUCTION

Seaweeds resources are among the most productive life supporting coastal ecosystems. They also considered as ecologically important component in the marine ecosystems as they contribute substantially to marine primary production and provide habitat for near-shore benthic communities (Mann, 1973). The assemblage, distribution and abundance of Indian seaweeds has been extensively studied by Krishnamurthy and Joshi (1970); Chauhan *et al*. (1990); Kaliaperumal and Kalimuthu (1997) Sahayaraj *et al*. (2014). According to Silva *et al*. (1996) and Sahoo (2001) rich seaweed beds known to occur around Visakhapatnam in the northeast coast, Mahabalipuram, Gulf of Mannar, Tiruchendur, Tuticorin and Kerala in the southern coast; Veraval and Gulf of Kutch in the northwest coast; Andaman and Nicobar Islands and Lakshadweep. A total 841 species of marine algae have been recorded from different parts of the Indian coast including Andaman-Nicobar and Lakshadweep Islands (Oza and Zaidi, 2001). Of the total number of seaweed species recorded from the Indian coast, the maximum number of species belongs to the Rhodophyta (422) followed by the Chlorophyta (217) and finally the Phaeophyta (191). The resource potential from sub-tidal regions of Tamil Nadu was estimated about 75,373 tons wet weight (Kaliaperumal and Kalimuthu, 1997). Increasing concern on destruction of seaweed resources due to anthropogenic and climatic disturbances makes it necessary to study their diversity and species richness. Therefore, in present investigation an attempt has been made to assess distribution and abundance of seaweed diversity along Tuticorin coastal waters.

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MATERIALS AND METHODS

Present investigation was conducted for 5 months (July 2014 to November 2014) to study seaweed diversity of Tuticorin coastal waters along south east coast of India. Seaweed samples were collected fortnightly at low-tide from 2 sampling points [Hare Island (Light House Island) and Tharuvaikulam]. The substratum of study area consisted of either sand, silt, rocks covered with mud or coral stones. Seaweed was collected by handpicking and steel grappling hook. After sorting and counting, seaweed samples were identified up to species level and representative samples were preserved in 5% formalin (Kaliaperumal *et al*., 1995; Krishnamurthy and Joshi,

1970; Mary *et al*., 2012; Algaebase). Total numbers were calculated from fortnightly seaweed abundance data on monthly basis and used as input for the calculation of biodiversity indices such as Shannon–Wiener diversity (H'), Margalef's species richness ('d'), Pielou's evenness (J') and Bray-Curtis similarity (PRIMER 6v).

RESULTS

Significant variations in distribution and abundance of seaweed diversity were observed during the present study. As many as 2857 number of seaweed were collected from the study area, comprising 86 seaweed species belonging to 14 order, 22 family and 36 genera (Table 1). Abundance of seaweed varied from minimum of 248 numbers during September to 953 numbers during November. Among the different month studied species diversity was high in November and less in September. Rhodophyceae represented as dominant seaweed phylum with 32 species belonging to 7 order, 11 family and 18 genera followed by Chlorophyceae (27 species belonging to 3 order, 7 family and 10 genera) and Phaeophyceae (27 species belonging to 4 order, 4 family and 8 genera). *Caulerpa* and *Ulva*were were dominant genera along the Tuticorin coast followed by *Gracilaria, Sargassum* and *Padina*.

The diversity seaweed was found to be high along Tuticorin coastal waters. The Shannon- Wiener diversity index (H') varied from 3.91 to 4.38. While the minimum value was recorded during September, the maximum value was recorded during November. The minimum value (11.32) of Margalef richness index ('d') was also recorded during the September. However the maximum value (15.18) was recorded during the November. The minimum value of Pielou's evenness index (J') was 0.97 recorded during October and the maximum value of 0.985 during July (Table 2). Bray-Curtis similarity found maximum between July and August (89.92%) followed by August and November (88.11%). Higher values for biodiversity indices indicated healthy nature of seaweed ecosystems along Tuticorin coastal waters.

While comparing abundance of seaweed diversity based on months, dendrogram showed that August and September form a separate cluster; whereas, July and August formed one cluster at 91% of similarity (Fig. 1). In the species dominance plot, curve for seaweed diversity lies on lower side and rises gradually due to less individual species dominance. In the dominance plot, November curve lies on lower side and rises slowly with higher number of species and less species dominance than the other curves. As lower diversity was found during the September, the curve for this season was found at the top (Fig. 2).

Table 1. Checklist of seaweed diversity along Tuticorin coastal waters

Phylum	Order	Family	Scientific name
Chlorophyta	Bryopsidales	Caulerpaceae	*Caulerpa corynephora*
			Caulerpa crassifolia
			Caulerpa cupressoides
			Caulerpa peltata
			Caulerpa racemosa
			Caulerpa sertularioides
			Caulerpa taxifolia
			Caulerpa verticillata
		Codiaceae	*Codium elongatum*
			Codium geppiorum
			Codium tomentosum
		Halimedaceae	*Halimeda macroloba*
			Halimeda tuna
		Udoteaceae	*Udotea indica*
	Cladophorales	Cladophoraceae	*Chaetomorpha antennina*
			Chaetomorpha crassa
			Chaetomorpha melagonium
			Cladophora albida
			Cladophora glomerata
			Cladophoropsis herpestica
		Valoniaceae	*Valoniopsis pachynema*
	Ulvales	Ulvaceae	*Enteromorpha compressa*
			Enteromorpha intestinalis
			Ulva compressa
			Ulva fasciata
			Ulva lactuca
			Ulva reticulata
Phaeophyta	Dictyotales	Dictyotaceae	*Dictyota ciliata*
			Dictyota dichotoma
			Dictyopteris woodwardii
			Padina boergesenii
			Padina gymnospora
			Padina pavonica
			Padina tetrastromatica
			Spatoglossum asperum
			Stoechospermum marginatum
	Ectocarpales	Scytosiphonaceae	*Rosenvingea intricata*

Continue…….

	Fucales	Sargassaceae	*Sargassum caryophyllum*
			Sargassum cervicorne
			Sargassum cinereum
			Sargassum cristaefolium
			Sargassum duplicatum
			Sargassum gracile
			Sargassum ilicifolium
			Sargassum oligocystum
			Sargassum plagiophyllum
			Sargassum polycystum
			Sargassum swartzii
			Sargassum tennerimum
			Sargassum vulgare
			Sargassum wightii
			Turbinaria conoides
			Turbinaria ornata
	Scytosiphonales	Scytosiphonaceae	*Colpomenia sinuosa*
Rhodophyta	Ceramiales	Ceramiaceae	*Ceramium ciliatum*
			Ceramium flaccidum
		Rhodomelaceae	*Acanthophora delilei*
			Acanthophora spicifera
			Laurencia papilosa
			Laurencia pedicularioides
			Polysiphonia variegata
	Corallinales	Corallinaceae	*Amphiroa anceps*
			Jania adherens
			Jania capillacea
			Jania tenella
	Gigartinales	Cystocloniaceae	*Calliblepharis fimbriata*
			Hypnea musciformis
			Hypnea valentiae
		Solieriaceae	*Kappaphycus alvarezii*
			Sarconema filiforme
			Solieria robusta
	Gracilariales	Gracilariaceae	*Gracilaria corticata*
			Gracilaria debilis
			Gracilaria edulis
			Gracilaria fergusonii
			Gracilaria pygmaea
			Gracilaria rostrata
			Gracilaria salicornia
			Gracilaria verrucosa
	Halymeniales	Halymeniaceae	*Corynomorpha prismatica*
			Halymenia floresia
			Halymenia porphyroides
	Nemaliales	Scinaiaceae	*Scinaia furcellata*
	Rhodymeniales	Champiaceae	*Champia indica*
		Lomentariaceae	*Lomentaria articulata*
		Rhodymeniaceae	*Rhodymenia palmata*

Table 2 Diversity indices for Seaweed species in Tuticorin coastal waters

Indices	July	August	September	October	November
S	76	79	54	73	86
N	187.72	212.83	107.84	168.76	269.97
D	14.32	14.55	11.32	14.03	15.18
J’	0.9858	0.9821	0.9807	0.9727	0.98
H’ (logE)	4.26	4.29	3.91	4.17	4.38

S-Number of species,
N-Number of individuals,
D-Margalef richness index,
J’-Pielou’s evenness index and
H’(logE)- Shannon Wiener diversity index.

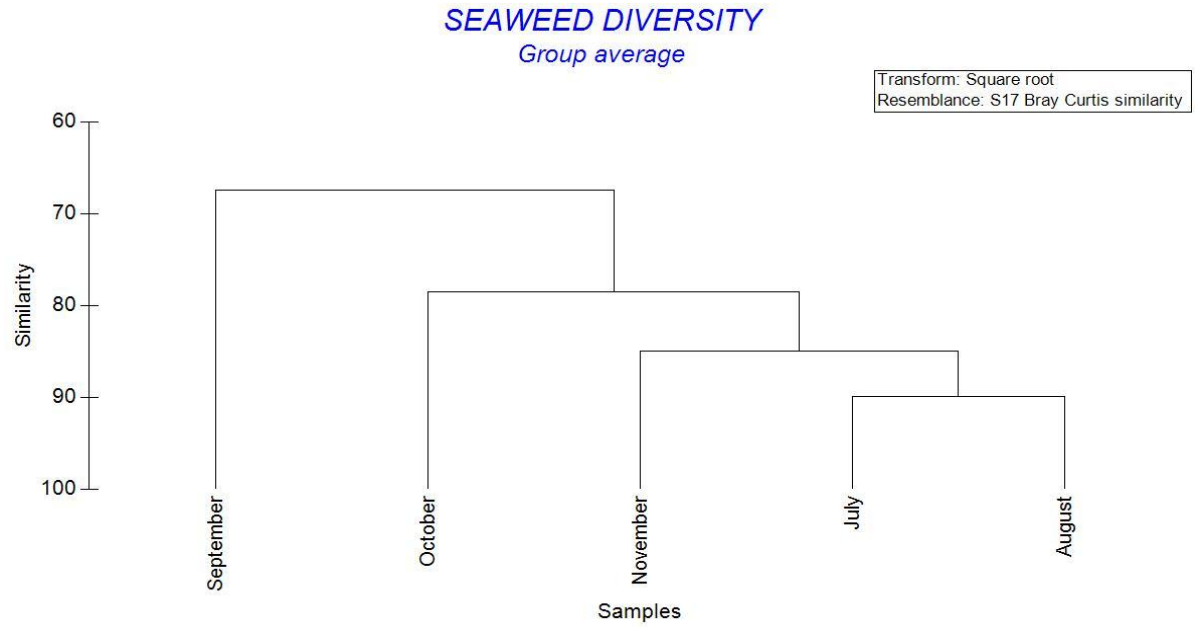

Fig. 1. Dendrogrom showing similarities between months based on the composition of Seaweed species collected along Tuticorin Coastal Waters

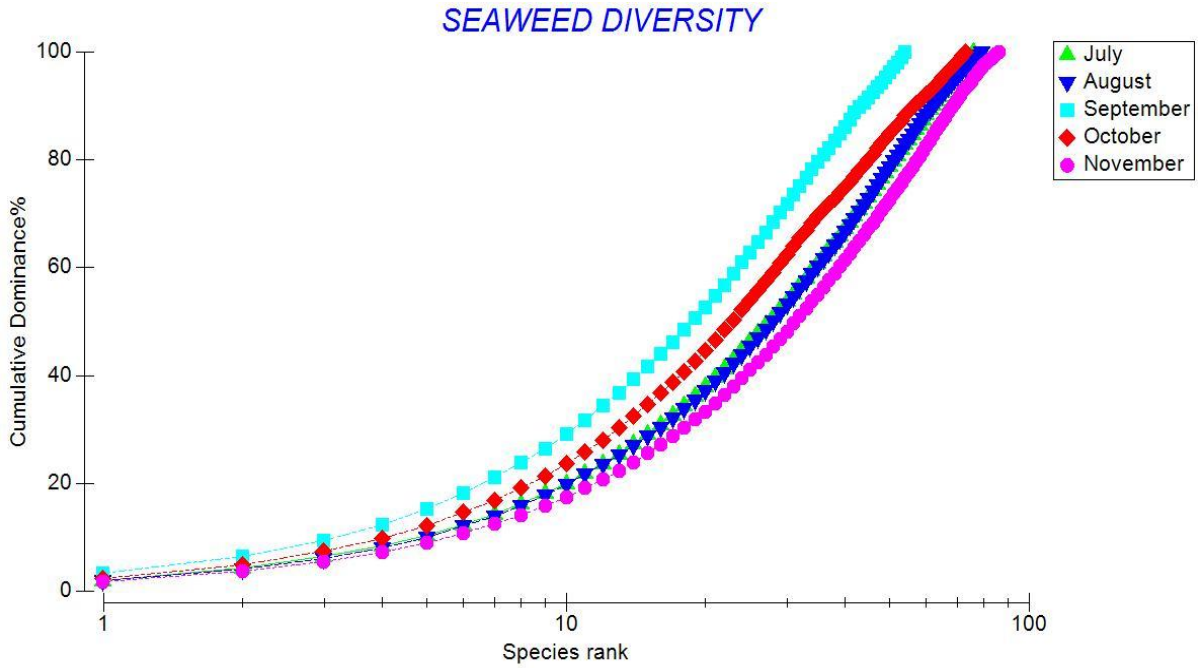

Fig. 2. Dominance plot among different months along Tuticorin Coastal Waters

DISCUSSION

Tuticorin coast of Tamil Nadu is a unique marine habitat characterized by high seaweed biodiversity. In total 2857 seaweed specimens were collected from Hare Island (Light House Island) and Tharuvaikulam located along Tuticorin coastal waters. Results of the present study indicated the occurrence of 86 seaweed species belonging to 14 order, 22 family and 36 genera in the study area. The seaweed flora observed in the present study showed higher species richness compared to Chennubhotla *et al*. (1991); Sathianeson and Samuel (2012); Domettila *et al*. (2013) and Sahayaraj *et al*. (2014) in and around the Gulf of Mannar; however less species observed in present study, when compared to Mary *et al*. (2013). Recorded species during present investigation belonged to 3 phylum; Rhodophyceae (32 species 7 order, 11 family and 18 genera), Chlorophyceae (27 species belonging to 3 order, 7 family and10 genera) and Phaeophyceae (27 species belonging to 4 order, 4 family and 8 genera). The dominance of red algae

over green and brown algae during present study indicated presence of rocky and coralline substrate essential for the attachment, similar observation in 4 districts of southern Tamil Nadu by Sahayaraj *et al*. (2014) and in Orissa coast by Rath and Adhikary (2006). Comparing the results from floral surveys made around the Tamil Nadu coast, the total number of species reported in present study was satisfactory. Sahayaraj *et al*. (2014) recorded 57 seaweed species from the southern Tamil Nadu. Mary *et al*. (2013) identified 90 seaweed species from the Hare Island in Gulf of Mannar. Sathianeson and Samuel (2012) recorded 32 seaweed species from the Kudankulam region of Gulf of Mannar. Similarly, Domettila *et al*. (2013) attributed 38 seaweed species from Muttom coastal waters. Analysis of data undertaken with conventional tools like Shannon – Wiener diversity (H'), Margalef's species richness ('d'), Pielou's evenness (J') and Bray-Curtis similarity, clearly revealed the healthy nature of the seaweed ecosystems and species estimation showed that the sample size of the present study was quit adequate and the effort taken to the list all the species was also quite sufficient.

Conclusion

The higher diversity value observed in present investigation clearly showed the healthy nature of the seaweed ecosystems along Tuticorin coastal waters. The data generated through the present research report can provide base-line information for commercial exploitation of seaweed resources along Tuticorin coastal waters.

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