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DISTRIBUTION AND SEASONAL VARIATION OF *ULVA* SPECIES (GREEN SEAWEED) IN THOOTHUKUDI REGION, THE SOUTH EAST COAST OF TAMIL NADU, INDIA

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ABSTRACT

The aim of the present study was to investigate the distribution and seasonal variation of *Ulva* species in Thoothukudi region, the south east coast of Tamil Nadu, India. Thoothukudi region was divided in to four stations namely Manapad, Trichendur, Thoothukudi and Vembar for the collection and identification of seasonal variability of Ulva species. Monthly survey was conducted regularly and the *Ulva* species were enumerated at random using a quadrate ($0.5m^2$). A total of three species of *Ulva* were collected in the study area such as *Ulva fasciata*, *Ulva reticulata* and *Ulva rigida*. The frequency and density were calculated and all the *Ulva* species showed a similar pattern of seasonal variation. Among the seaweeds collected the highest frequency (58.75%) and density (4.97) were observed in *Ulva fasciata* during summer season and the lowest frequency (35.00%) and density (1.51) were recorded in *Ulva reticulata* during post-monsoon season. From the present study, it was concluded that all the *Ulva* species (Chlorophyceae) exhibited the maximum frequency and density during the summer season followed by the declined trend was observed in the successive seasons. During the post-monsoon season the frequency and density of *Ulva* species (Chlorophyceae) was minimum in the selected region of south east coast of Tamil Nadu.

Keywords: Chlorophyceae, *Ulva*, Seasonal variability, Thoothukudi.

INTRODUCTION

No life can be imagined without water. Water is indispensable and one of the most precious of natural resources on our planet. It is generally accepted that life on earth began in the oceans and about 450 million years ago, all plants were marine plants. The next 400 million years witnessed the evolution of the land flora including bryophytes, pteridophytes, gymnosperms and angiosperms. The plant life in the ocean is extremely rich and some exploitation of this resource has taken place over hundred years. Today about 90% of all the species of marine plants belong to one or other of the groups of algae [1, 2].

Many of these algal groups are now represented mainly as seaweeds or benthic marine macro algae that are the groups of plants found attached to the bottom in relatively shallow coastal waters [3]. Seaweeds form one of the important living resources grouped under three classes namely Chlorophyceae (green algae), Phaeophyceae (brown algae) and Rhodophyceae (red algae). There are about 900 species of green seaweeds, 1500 brown seaweeds and 4000 red seaweeds in nature. The greatest variety of red seaweeds is found in subtropical and tropical waters, while brown seaweeds and green seaweeds are more common in cooler and temperate waters respectively [4].

Seaweeds form an important renewable resource in marine environment and have been a part of human civilization from time immemorial. The long history of seaweeds utilization for a variety of purposes has led to the gradual realization that some of their constituents are

more superior and valuable in comparison to their counterparts of land plants. Seaweeds synthesis a wide range of chemicals, some of the chemicals stand the only natural resources [5]. Reports on the uses of seaweeds have been cited as early as 2500 years ago in Chinese literature [6]. Among the seaweeds the green seaweed *Ulva* species forms grayish green mats in the intertidal and subtidal regions which cover the entire rock. In the present study an attempt has been made to investigate the seasonal variability of *Ulva* species collected from Thoothukudi region in the south east coast of Tamil Nadu, India.

MATERIALS AND METHODS

In the present study, the Thoothukudi region in the south east coast of Tamil Nadu, India was selected to analyze the seasonal variability of the important green seaweed *Ulva*. Thoothukudi region extends from Manapad in the south to Vembar in the north. Survey was carried out regularly from July 2013 to June 2014. For the sake of convenience and easy interpretation, the calendar year was divided in to four seasons viz. post-monsoon (January to February), summer (March to June), pre-monsoon (July to September) and monsoon (October to December) seasons. The entire study area was divided in to four stations namely Manapad (S_1), Trichendur (S_2), Thoothukudi (S_3) and Vembar (S_4). The survey of green seaweed *Ulva* species from the intertidal area was carried out during low tide [7].

For the sampling of *Ulva* transect lines, a quadrat ($0.5m^2$) was used. Plant samples were selected at random as per the requirement. This was carried out by selecting sampling points in the area using quadrat. Sampling points were selected in such a manner that every species of the study area has good chance of being selected. The number of quadrats was determined as per the area selected. For this purpose the whole station (For example station S_1) was separated into four segments namely segment A, segment B, segment C and segment D. Quadrats were placed every three meters on four segments. Each segment was 250m long in which 80 quadrats were placed. Monthly 160 quadrats were taken and the number varying according to the tidal height. *Ulva* species present in the quadrats were observed, collected, counted species wise and number of individuals in each species was noted for quantitative assessment of frequency and density. The seasonal variability of *Ulva* species were represented in seasonal wise [8]. For the estimation of frequency and density the following formulae were used.

Frequency: Total number of quadrats in which species occurred / Total number of quadrats studied

Density: Total number of species / Total number of quadrats studied.

RESULTS AND DISCUSSION

Totally there are three species of *Ulva* namely *Ulva fasciata* Delile (Figure 1a), *Ulva reticulata* Forssk (Figure 1b) and *Ulva rigida* C.Ag (Figure 1c) collected from Thoothukudi region and all the species found in the study area were observed throughout the year. Though all the members of *Ulva* showed similar patterns of seasonal distribution, with respect to frequency and density high level of variability was observed between the seasons and stations. Among the four seasons studied, all the taxa of *Ulva* observed during summer with high frequency and density.

A well-marked declining in the frequency and density were recorded in the subsequent seasons of pre-monsoon and monsoon. The post-monsoon season was noted to be poor growth of *Ulva* members which showed the lowest frequency and density in the present study. Among those species which were observed in all the four stations, the species

Ulva fasciata showed the highest frequency (58.75%) and the species *Ulva reticulata* was observed the lowest frequency (43.75%) during summer in Thoothukudi region, while during the post-monsoon season, *Ulva fasciata* was observed to be the highest frequency (48.75%) and *Ulva reticulata* was with the lowest frequency (35.00%). *Ulva rigida* was reported to have the highest frequency during the summer season (51.25%) and the lowest frequency during post-monsoon (42.50%) as shown in Table 1 and Figure 2.

Though the members of *Ulva* showed the similar pattern of seasonal distribution, high level of the variability was observed with respect to density between the seasons and stations. In *Ulva* species, *Ulva fasciata* showed the highest density (4.97) during summer and the lowest density (2.97) during post-monsoon season. *Ulva reticulata* showed the lowest density (1.51) at post-monsoon and the highest density (1.93) at summer season. Followed by the highest density was observed in *Ulva rigida* (3.22) in summer and the lowest density (2.08) during post-monsoon season. From the present study, it was recorded that both frequency and density of all the *Ulva* taxa varied with seasons and stations. All the taxa of *Ulva* showed an uniform pattern of increase in frequency and density during summer followed by decrease in frequency and density in the successive seasons and the rate of increase or decrease varied with taxa and stations (Table 1 and Figure 3).

The similar pattern of distribution was also recorded in *Caulerpa* species from Kanyakumari [9], Tirunelveli region [7], Thoothukudi region [11] *Enteromorpha* species from Kanyakumari region [12], *Ulva* species [13], *Chaetomorpha* species [14] and *Halimeda* species [15] from Tirunelveli region. From the previous reports, It was recorded that seasonal variability of green seaweeds (Chlorophyceae) showed the similar pattern of seasonal distribution that all the chlorophyceae members were observed to have the highest frequency and density during summer season followed by decline trend were observed in the successive seasons (pre-monsoon and monsoon). During the post-monsoon season, it was noted the lowest frequency and density of chlorophyceae

members. The similar results were reported in the present study also. In contrast, it was noted that both frequency and density of all the *Laurencia* (Red seaweed) taxa varied with seasons and stations. All the taxa of *Laurencia* exhibited an uniform pattern of increase in frequency and density during monsoon season followed by decrease in frequency and density in the successive post-monsoon season, during the summer season all the *Laurencia* species were disappeared and the *Laurencia* species reappeared during pre-monsoon season. The rate of increase or decrease in frequency and density varied with taxa and stations [16]. In the concordance of present study with previous studies, it was noted that all the *Ulva* species (green seaweeds) were observed during summer with the highest frequency and density and during post-monsoon season with the lowest frequency and density.

Table 1. Seasonal variability of *Ulva* species (Chlorophyceae) in Thoothukudi region of the south east coast of Tamil Nadu, India

S.No.	Name of the Seaweeds	Post-monsoon		Summer		Pre-monsoon		Monsoon	
		F	D	F	D	F	D	F	D
1	*Ulva fasciata*	48.75	2.97	58.75	4.97	41.25	3.88	37.50	3.35
2	*Ulva reticulata*	35.00	1.51	43.75	1.93	41.25	1.71	38.75	1.61
3	*Ulva rigida*	42.50	2.08	51.25	3.22	47.50	3.01	46.25	2.35

F- Frequency D- Density

Figure 1a.*Ulva fasciata* Delile

Figure 1b.*Ulva reticulata* Forssk

Figure 1c.*Ulva rigida* C.Ag

Figure 2. Seasonal Distribution (Frequency) of *Ulva* species in Thoothukudi Region

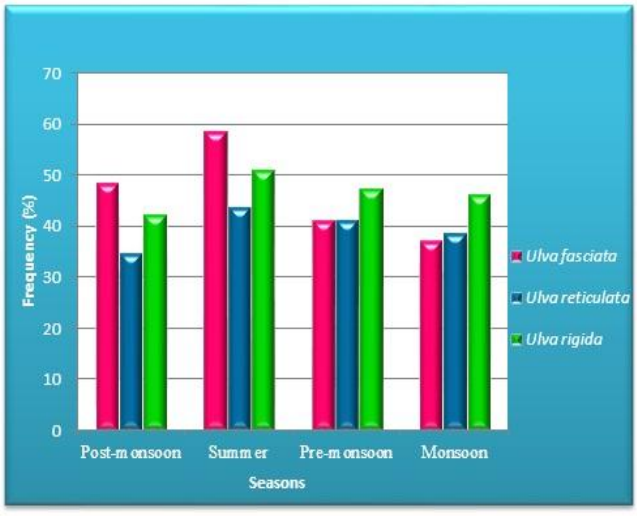
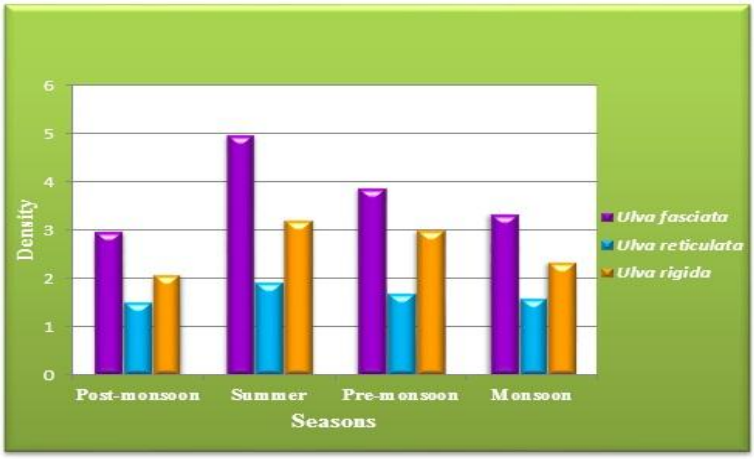


Figure 3. Seasonal Distribution (Density) of *Ulva* species in Thoothukudi Region



CONCLUSION

From the present study, it was concluded that both frequency and density of all the *Ulva* species varied with seasons and stations. All the taxa of *Ulva* exhibited an uniform pattern of increase in frequency and density during summer followed by decrease in frequency and density in the successive seasons such as pre-monsoon and monsoon seasons. During the post-monsoon season, all the *Ulva* species were observed with the lowest frequency and density. And the rate of increase or decrease of frequency and density varied with taxa and stations.

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