

## Diversity and distribution of seaweeds in the Muttom coastal waters, south-west coast of India

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### ABSTRACT

Seaweeds are found in the coastal region between high and low tide, and in the sub-tidal region up to a depth where 0.01% photosynthetic light is available. Plant pigments, light, exposure, depth, temperature, tides and the characteristics of the shore combine to create different environments that determine the distribution and variety of seaweeds. The present study was conducted at Muttom, formed of different inter-tidal rock shores with rich algal vegetation. During the study period (January to December 2011), a total of 38 species of seaweeds were recorded. Among them, *Ulva fasciata* and *U. lactuca* (green algae); *Sargassum wightii*, *S. duplicata* and *Padina tetrastomatica* (brown algae); *Gracilaria corticata* and *G. pygmaea* (red algae), were present throughout the study period.

### KEY WORDS

Diversity; Muttom; Seaweeds; South West Coast of India.

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### INTRODUCTION

In the vast ocean realm, several forms of life, starting from unicellular to multi-cellular flourish, multiply and disintegrate. It is believed that the first living cell that appeared on the planet Earth emerged from the ocean. In all its forms, Life has developed from the growth of mono-cellular algae (Dhargalkar & Pereira, 2005). It was estimated that about 90% of the species of marine plants are algae and about 40% of the global photosynthesis is contributed from algae (Andersen, 1992).

Seaweeds, known as macroalgae, are among the most important primary producers and act as ecological engineers on rocky coasts of the world's oceans. They are primary producers, shelter, nursery grounds and food sources for marine organisms. Seaweeds are not only of high ecological, but also of great economic importance. Dried thalli are di-

rectly used as human and animal food and also as fertilizer. Extracted seaweed substances are used as stabilizers and stiffeners in food industry, cosmetics, pharmaceutical industry, and biotechnology (Jeeva & Kiruba, 2009; Wiencke & Bischof, 2012). Recent research has pointed to new opportunities, particularly in the field of medicine, associated with bioactive molecules extracted from seaweeds (Baby et al., 2012; Jeeva et al., 2012). Moreover, due to their habitats and biology, seaweeds are relatively easy to observe, manipulate and measure. Therefore, they have been widely used as model organisms for studying biogeographic patterns and testing various ecological theories, both in intertidal and subtidal habitats (Murray & Littler, 1984; Bolton et al., 2004; Prathep, 2005).

India has a vast coastline of more than 7000 km, which harbours a large diversity of marine algal species (Sahoo et al., 2003). The seaweed flora of



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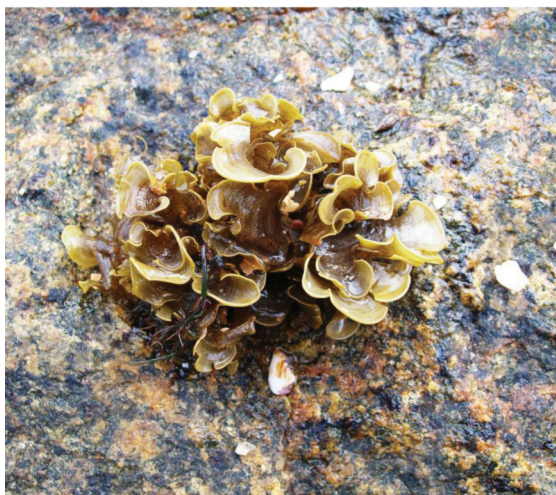
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Figures 1-6. Seaweeds from Muttom coastal waters of southwest coast of India. Fig. 1: *Caulerpa racemosa*. Fig. 2: *Gracilaria fergusonii*. Fig. 3: *Gracilaria pygmaea*. Fig. 4: *Hypnea musciformis*. Fig. 5: *Padina pavonica*. Fig. 6: *Sargassum duplicatum*.



Figure 7. Map showing the study site: Muttom coastal waters, south-west coast of India.

India is highly diversified and comprises mostly of tropical species, but boreal, temperate and subtropical elements have also been reported. 1153 taxa of marine algae, including forms and varieties belonging to 271 genera have been enumerated till date from the Indian waters. Many of the rocky beaches, mudflats, estuaries, coral reefs and lagoons along the Indian coast provide ideal habitats for the growth of seaweeds (Rao & Mantri, 2006); rich seaweed beds occur around Visakhapatnam in the eastern coast, Mahabalipuram, Gulf of Mannar, Tiruchendur, Tuticorin, Kanyakumari and Kerala in the southern coast; Veraval and Gulf of Kutch in the western coast; Andaman and Nicobar Islands and Lakshadweep (Kaliaperumal & Pandian, 1984; Selvaraj & Selvaraj, 1997; Sahoo, 2001; James et al., 2004; Manilal et al., 2009; Christobel & Jeeva, 2009; Paul & Raja, 2011; Jeeva et al., 2012; Satheesh & Wesley, 2012).

Southwest coast of India is a unique marine habitat infested with diverse seaweeds. In recent years, only a few investigations have been carried

out on various applications and uses of macroalgae in Kanyakumari district (Bai et al., 2007; Christobel, 2008; Christobel et al., 2011; Jeeva et al., 2012). However, more studies on various aspects of macroalgae are still needed, especially, on diversity and species richness. Such information could provide a baseline for future more complex ecological studies and coastal management, as well as applied aspects of the uses of seaweed. Therefore, the present study was initiated to explore the richness of seaweeds in Muttom coastal waters of southwest coast of India.

## MATERIALS AND METHODS

The present study was carried out at Muttom coast in southwest coast of India (Fig. 7), in the Arabian Sea. Muttom sports a beautiful and tidy beach with rocky shores showing an astonishing biodiversity. Huge rocks standing at either sides of the beach give it a pristine look. Since the shore is usually no

| No | BOTANICAL NAME                                                                      | PHYLUM      | CLASS            | FAMILY            |
|----|-------------------------------------------------------------------------------------|-------------|------------------|-------------------|
| 1  | <i>Amphiroa anceps</i> (Lamarck) Decaisne                                           | Rhodophyta  | Florideophyceae  | Corallinaceae     |
| 2  | <i>Asparagopsis taxiformis</i> (Delile) Trevisan de Saint-Léon                      | Rhodophyta  | Florideophyceae  | Bonnemaisoniaceae |
| 3  | <i>Caulerpa peltata</i> J.V.Lamouroux                                               | Chlorophyta | Bryopsidophyceae | Caulerpaceae      |
| 4  | <i>Caulerpa racemosa</i> (Forsskål) C. Agardh (Fig. 1)                              | Chlorophyta | Bryopsidophyceae | Caulerpaceae      |
| 5  | <i>Caulerpa scalpelliformis</i> (R. Brown ex Turner) C. Agardh                      | Chlorophyta | Bryopsidophyceae | Caulerpaceae      |
| 6  | <i>Centroceras clavulatum</i> (C. Agardh) Montagne                                  | Rhodophyta  | Florideophyceae  | Ceramiales        |
| 7  | <i>Ceratodictyon variabile</i> (C. Agardh) R. E. Norris                             | Rhodophyta  | Florideophyceae  | Lomentariaceae    |
| 8  | <i>Chaetomorpha antennina</i> (Bory de Saint-Vincent) Kützinger                     | Chlorophyta | Ulvophyceae      | Cladophoraceae    |
| 9  | <i>Chnoospora implexa</i> C. Agardh                                                 | Ochrophyta  | Phaeophyceae     | Scytosiphonaceae  |
| 10 | <i>Chondrophycus ceylanicus</i> (C. Agardh) M.J.Wynne, Serio, Cormaci et G. Furnari | Rhodophyta  | Florideophyceae  | Rhodomelaceae     |
| 11 | <i>Dictyota bartayresiana</i> J. V. Lamouroux                                       | Ochrophyta  | Phaeophyceae     | Dictyotaceae      |
| 12 | <i>Dictyota ciliata</i> C. Agardh                                                   | Ochrophyta  | Phaeophyceae     | Dictyotaceae      |
| 13 | <i>Dictyota dichotoma</i> (Hudson) J. V. Lamouroux                                  | Ochrophyta  | Phaeophyceae     | Dictyotaceae      |
| 14 | <i>Enantiocladia prolifera</i> Falkenberg                                           | Rhodophyta  | Florideophyceae  | Rhodomelaceae     |
| 15 | <i>Gelidiella indica</i> Sreenivasa Rao                                             | Rhodophyta  | Florideophyceae  | Gelidiellaceae    |
| 16 | <i>Gelidium pusillum</i> (Stackhouse) Le Jolis                                      | Rhodophyta  | Florideophyceae  | Gelidiaceae       |
| 17 | <i>Gracilaria corticata</i> (C. Agardh) C. Agardh                                   | Rhodophyta  | Florideophyceae  | Gracilariaceae    |
| 18 | <i>Gracilaria fergusonii</i> C. Agardh (Fig. 2)                                     | Rhodophyta  | Florideophyceae  | Gracilariaceae    |
| 19 | <i>Gracilaria foliifera</i> (Forsskål) Børgesen                                     | Rhodophyta  | Florideophyceae  | Gracilariaceae    |
| 20 | <i>Gracilaria pygmaea</i> Børgesen (Fig. 3)                                         | Rhodophyta  | Florideophyceae  | Gracilariaceae    |
| 21 | <i>Grateloupia lithophila</i> Børgesen                                              | Rhodophyta  | Florideophyceae  | Halymeniaceae     |
| 22 | <i>Hypnea musciformis</i> (Wulfen) J. V. Lamouroux (Fig. 4)                         | Rhodophyta  | Florideophyceae  | Cystocloniaceae   |
| 23 | <i>Hypnea valentiae</i> (Turner) Montagne                                           | Rhodophyta  | Florideophyceae  | Cystocloniaceae   |
| 24 | <i>Laurencia poitei</i> (J. V. Lamouroux) M. A. Howe                                | Rhodophyta  | Florideophyceae  | Rhodomelaceae     |
| 25 | <i>Neurymenia fraxinifolia</i> (Mertens ex Turner) C. Agardh                        | Rhodophyta  | Florideophyceae  | Rhodomelaceae     |
| 26 | <i>Padina pavonica</i> (Linnaeus) Thivv (Fig. 5)                                    | Ochrophyta  | Phaeophyceae     | Dictyotaceae      |
| 27 | <i>Padina tetrastomatica</i> Hauck                                                  | Ochrophyta  | Phaeophyceae     | Dictyotaceae      |
| 28 | <i>Palisada flagellifera</i> (C. Agardh) K.W.Nam                                    | Rhodophyta  | Florideophyceae  | Rhodomelaceae     |
| 29 | <i>Portieria hornemannii</i> (Lyngbye) P. C. Silva                                  | Rhodophyta  | Florideophyceae  | Rhizophyllidaceae |
| 30 | <i>Sargassum duplicatum</i> (C. Agardh) C. Agardh (Fig. 6)                          | Ochrophyta  | Phaeophyceae     | Sargassaceae      |
| 31 | <i>Sargassum linearifolium</i> (Turner) C. Agardh                                   | Ochrophyta  | Phaeophyceae     | Sargassaceae      |
| 32 | <i>Sargassum polycystum</i> C. Agardh                                               | Ochrophyta  | Phaeophyceae     | Sargassaceae      |
| 33 | <i>Sargassum swartzii</i> C. Agardh                                                 | Ochrophyta  | Phaeophyceae     | Sargassaceae      |
| 34 | <i>Sargassum wightii</i> Greville ex C. Agardh                                      | Ochrophyta  | Phaeophyceae     | Sargassaceae      |
| 35 | <i>Trichosolen mucronatus</i> (Børgesen) W. R. Taylor                               | Chlorophyta | Bryopsidophyceae | Bryopsidaceae     |
| 36 | <i>Ulva fasciata</i> S. G. Gray                                                     | Chlorophyta | Ulvophyceae      | Ulvaceae          |
| 37 | <i>Ulva lactuca</i> Linnaeus                                                        | Chlorophyta | Ulvophyceae      | Ulvaceae          |
| 38 | <i>Ulva reticulata</i> Forsskål                                                     | Chlorophyta | Ulvophyceae      | Ulvaceae          |

Table 1. List of species found in the study area with their scientific names, class and family.

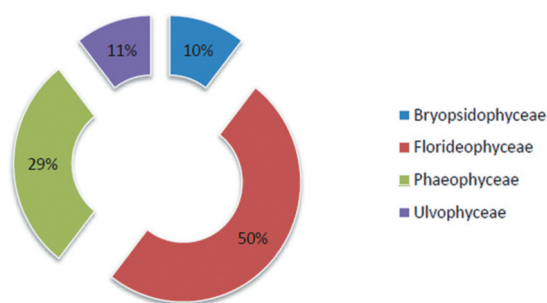


Figure 8. Class-wise distribution percentage of species richness in the study area.

crowded, it is an excellent spot for tourists to enjoy its beauty.

Field surveys were undertaken in the selected sampling stations of the Muttom coast over a period of twelve months from January to December 2011. The algal samples were collected in every season during the study period by detaching a portion from the seaweed bed, keeping it in polythene bags with fresh seawater, transporting to the laboratory and fixing in 4% formaldehyde for further studies. The seaweeds were identified using the taxonomic keys provided by Srinivasan (1969; 1973), and the nomenclature was updated using Appeltans et al. (2012) and Guiry & Guiry (2012).

## RESULTS AND DISCUSSION

Taxonomically, a total of 38 taxa belonging to 3 phyla (Chlorophyta, Ochrophyta and Rhodophyta), 4 classes (Bryopsidaceae, Florideophyceae, Phaeophyceae and Ulvophyceae), 23 genera and 18 families were inventoried in the Muttom coastal waters (Table 1). Among the 18 families, Dictyotaceae, Rhodomelaceae and Sargassaceae were the most richest ones (5 species each), followed by Gracilariaceae (4 species), Caulerpaceae and Ulvaceae (3 species each) and Cystocloniaceae (2 species), whereas the remaining families (Bonnemaisoniaceae, Bryopsidaceae, Ceramiaceae, Cladophoraceae, Corallinaceae, Gelidiaceae, Gelidiellaceae, Halymeniaceae, Lomentariaceae, Rhizophyllidaceae and Scytosiphonaceae) were monospecific.

Of the 38 species, 19 were from the class of Florideophyceae (50%), 11 species from Phaeophyceae (28.9%), while the remaining eight species from Bryopsidophyceae and Ulvophyceae (10% and 11% each) (Fig. 8). Finally, the seaweeds observed in the present study are similar to those reported from the nearby Kudankulam coast (Satheesh & Wesley, 2012); and the very high richness of seaweeds species in Muttom coastal waters may be due to the presence of intertidal rocky reefs.

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