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Original Research Article

# MACROPHYTIC ALGAE OF THE BRACKISH WATERS OF KODUNGALLUR, KERALA, INDIA: INDICATORS OF SALINITY AND CLIMATIC STRESS.

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**Abstract:** The macrophytic algae Enteromorpha intestinal is, *Chaetomorpha linum, Cladophora fascicularis, Gracillariopsis lemaneiformis, Calaglossa clavulatum and Hypnea musciformis* were found in the estuarine station during the monsoon and postmonsoon seasons only. The increase in this macrophytic green alga suggests that the Azhicode Estuary is under the strain from anthropogenic interference and is undergoing eutrophication. The red algae Gracilariopsislemaneiformis and Centroceros clavulatum occurred around the pneumatophores of Aviccenia officinalis. Disappearance of these species during summer when the salinity was high (>20ppt) attributes to their status as ecological indicators.

**Key Words**: Macrophytic algae, Eutrophication

**Introduction*:*** The macrophytic marine algae in Kerala are restricted to places in Thiruvananthapuram, Kollam, Kozhikode, Kannur and Kasargode districts (Sulekha[1], 2004). Nair[2] (2005) has reported that Thrissur district has not been fully or partly surveyed for its marine and freshwater algae and there is no compilation on the algal floral content of the area, though there is fairly exhaustive data available on the algal species of the southern districts of Kerala. The present study attempts to analyse the macrophytic algal community of the backwaters of the Kodungallur region. Barik[3] *et al* (2019) focuses on the health assessment of Chilika, a shallow lagoon present in east coast of India. Hempel[4] *et al* (2008) has studied the epiphytic microbial community on the macrophytes of brakish and fresh water.

The ecology, distribution and seasonal succession of the littoral algae of the west coast of India were studied by Misra[5] (1956). Diversity of marine and brackish water algae along the South Indian coast has been studied by Krishnamurthy[6], 1985; Rao[7], 1987; Kaliaperumal[8]*et al.*, 1987; Chennubhotla and Kaliaperumal[9], 1987 and Kaliaperumal and

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Kalimuthu[10], 1987;Muthukannu[11] (1983); Krishnamurthy[12] (2000) Kaliaperumal[13]*et al.* (2001) Mukhopadhyay and Pal[14] (2002);Chennubhotla[15]*et al.* (1988). Sindhu and Panikkar[16] (1995) Asha[17]*et al*. (2002), Kaladharan[18] (2005) Nair[19] *et al.*, 1982.

According to Sulekha[1] (2004), the pattern of distribution of marine algae on Indian coasts depends on the atmospheric and seawater temperature, monsoon patterns, total rainfall, tidal range, substrate availability and topography of the shores. Janes[20] *et al* (2017) have studied the functional traits of marine macrophytesin predicting primary production.

In Kerala, the macrophytic marine algae are confined to places in Thiruvananthapuram, Kollam, Kozhikode, Kannur and Kasargode districts. The steep shores of the west coast of India, confines the inter-tidal vegetation to a narrow stripe, near to the low water level. Consequently the algal vegetation of Kerala is neither qualitatively high nor rich in biodiversity. Nair[2] (2005), in his biodiversity documentation, has recorded just five species of the macrophytic algae belonging to three genera from Thrissur district; hence this work endeavours to make a note of the few algal macrophytes occurring in the study area.

**Materials and Method:** The macrophytic algae were handpicked from the granite embankments, stones and wooden poles of the Chinese nets and from the sandy soils of the canals. They were preserved in 5% formaldehyde.

**Results and Discussion:** The macrophytic algae showed striking seasonal distribution. During the monsoon and post monsoon periods when the salinity was low these algae occurred abundantly in the estuarine region (Station 10).The salinity variations in time and space in the various stations selected for the study is depicted in Fig.1. Only six genera of macro algae viz. *Enteromorpha intestinalis*, *Chaetomorpha linum*, *Cladophora fascicularis*, *Gracillariopsis lenaneiformis*, *Calaglossa clavulatum* and *Hypneamusciform is* where encountered. These were found in the estuarine station only during the monsoon and postmonsoon seasons. These algae disintegrated when the salinity of the region increased with the onset of summer and are absent during the premonsoon season.

*Enteromorpha intestinalis*, *Chaetomorpha linum* and *Cladophora fascicularis* were seen to occur on the granite embankments, while the red algae were profuse on the sandy banks of the estuary. The salinity range during this period was 7‰ to 18‰. The abundance in algal diversity during post monsoon period when the salinity decreases was reported by Muthukannu[11] (1983) from Pichavaram mangroves.

*Enteromorpha linza* and *Cladophora* sp., along with other algal members, have been reported by Nair *et al.* (1982) from Ashtamudi Estuary occurring in a salinity range of 10-35%. Occurrence of *Enteromorpha intestinalis* and *Chaetomorpha linum* has been reported from the largest brackish lagoon in Asia, the Chilika Lake (Sahu and Adhikary[20], 1999; Rath and Adhikary[21], 2005). According to McAvoy and Klug[22] (2005), high nutrient and low salinity have a positive impact on *Enteromorpha intestinalis.*

Waite and Mitchell[23] (1972) and Hernandez[24]*et al.* (1997) consider *Enteromorpha intestinalis* as a major bloom forming genus of opportunistic macro algae in nutrient rich estuaries worldwide. These algae are euryhaline (Edward[25]*et al.*, 1987) and eurythermal (Fong and Zedler[26], 1993). According to Cohen and Fong[27] (2004) they are tolerant to a variety of conditions associated with eutrophication. During the present study these algae were found only near the estuarine region. The increase in this macrophytic green alga suggests that the Azhicode Estuary is under the strain from anthropogenic interference and is undergoing eutrophication. Webber *et al.* (2005) are of the view that increase in *Enteromorpha* suggest that the water body is experiencing stress from a wide range of activities. Jokhan and Prakash[28] (2008) opine that *E. intestinalis* can be used as an indicator of extensive nitrate pollution in the coastal environment. The man made sea wall seems to have provided this opportunistic alga a

suitable substratum, which otherwise is not available.

According to Misra[5] (1956) the richest algal flora occurs on the rocky surfaces in the intra littoral zone. Since the Azhikode estuarine region does not have any rock formation, the lack of suitable substratum can be the reason for lack of diversity of algae. The loose, unsteady soil is unfavourable for the growth of many macroalgae. *Ulva* and *Enteromorpha* were seen as early colonizers by Valsalakumar[29] (2002) and Jokhan and Prakash (2008), so it will be interesting to study the succession of algae on the sea-wall in future.

Liua[30] et *al* (2018) studied the nutrient bio extraction and microalgae growth inhibition using submerged macrophyte*Myriophyllum spicatum* in a low salinity area of East China Sea. In the present study, the red algae *Gracilariopsis lemaneiformis* and *Centroceros clavulatum* occurred around the pneumatophores of *Aviccenia officinalis*. These species disappeared during summer when the salinity was high (>20ppt). It can be presumed that these algae are indicators of salinity.Brock and Vierssen[31] (1992) have studied the relation between climatic change and hydrophyte dominated communities in inland wet land ecosystems. The macrophytic algae *Enteromorpha intestinalis*, *Chaetomorpha linum*, *Gracilariopsis lemaneiformis*, *Centroceros clavulatum* and *Cladophora fascicularis* are reported for the first time from the Azhikode area.The results of the present study indicate that the taxonomic structure of the algal community changes in response to alteration in the seasons and hydrographic parameters, especially salinity and nutrient load. Further studies in the post flood scenario are envisaged to find out the distribution and role of macrophytic algae in the ecological health assessment of such unique water bodies.

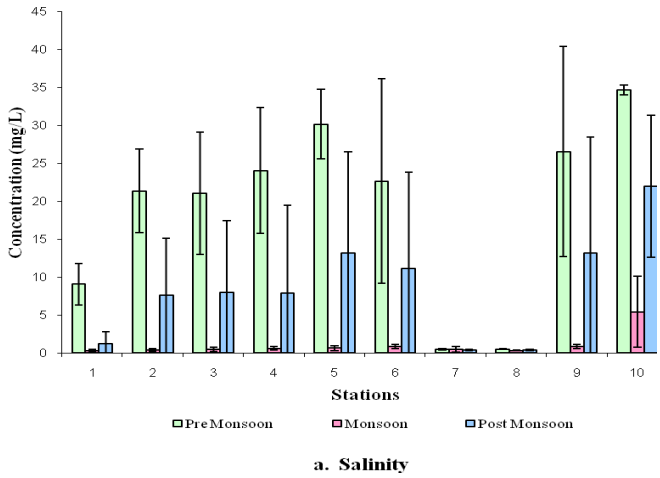


Fig: 1 Seasonal Variation of Salinity in the Selected Sites of the Brackish Waters of Kodungallur

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