Marine Environmental Research 158 (2020) 104935

Contents lists available at ScienceDirect

Marine Environmental Research

journal homepage: http://www.elsevier.com/locate/marenvrev

Disturbance of mangrove forests causes alterations in estuarine phytoplankton community structure in Malaysian Matang mangrove forests

Fareha Hilaluddin [a], F.M. Yusoff [a,b,c,*], F.M.I. Natrah [a,b,c], P.T. Lim [d]

[a] Laboratory of Marine Biotechnology, Institute of Bioscience, Universiti Putra Malaysia (UPM), 43400, Serdang, Selangor, Malaysia
[b] Department of Aquaculture, Faculty of Agriculture, Universiti Putra Malaysia (UPM), 43400, Serdang, Selangor, Malaysia
[c] International Institute of Aquaculture and Aquatic Sciences (I-AQUAS), Universiti Putra Malaysia (UPM), 43400, Selangor, Malaysia
[d] Bachok Marine Research Station, Institute of Ocean and Earth Sciences, University of Malaya, 16310, Bachok, Kelantan, Malaysia

ARTICLE INFO

Keywords:
Phytoplankton
Diatoms
Biodiversity
Mangrove estuaries
Environmental disturbance

ABSTRACT

To assess the effects of environmental changes on phytoplankton community structure in a mangrove ecosystem, phytoplankton distribution in Matang mangrove, Malaysia was examined. Phytoplankton and water samples, and *in situ* environmental parameters from three estuaries with differing levels of disturbance were examined monthly for one year. Two species, *Cyclotella choctawhatcheeana* and *Skeletonema costatum*, were dominant in the least disturbed and moderately disturbed areas, respectively. *Skeletonema costatum* was also the most dominant in the most disturbed area. Significant differences in phytoplankton density and biodiversity between the least and most disturbed areas were also observed. Principle component 1 (salinity, conductivity, total solids/water transparency and nitrogenous compounds) and PC2 (dissolved oxygen, pH and temperature) explained 60.4% of the total variance. This study illustrated that changes in phytoplankton community structure in Matang mangrove estuaries were significantly correlated with environmental parameters which were in turn influenced by ecosystem disturbance levels as well as seasonal changes.

1. Introduction

The mangrove ecosystem is an essential component and ecological link within coastal habitats. The interaction between mangroves and their adjacent habitats forms a complex system involving numerous biological, chemical, and physical processes (Alfaro-Espinoza and Ullrich, 2015; Balakrishnan et al., 2016; Luo et al., 2018; Grativol et al., 2017; Ward et al., 2016; Yando et al., 2016). Mangrove forests play significant roles in many aspects of ecology, such as providing various goods and ecosystem services to enhance local livelihoods. They provide intrinsic and unique values to human, and are especially important for offering protection from natural disasters such as tsunamis, in addition to providing food and other coastal resources. Mangrove forests also serve to control erosion, which protects coastline from wave damage caused by storms, through their unique geomorphological features (Thornton and Johnstone, 2015; Twilley and Rivera-Monroy, 2005). In addition, mangrove ecosystems provide a natural coastal buffer, due to their ability to reduce tidal flow and to induce sedimentation, and their biological richness and high productivity have been recognized worldwide (Bourgeois et al., 2019; Chen et al., 2018; Horstman et al., 2015; Mazda et al., 2006; Schwarzer et al., 2016). Mangroves contribute significantly to sustainable fishery resources, since they provide shelter and nutrients that enable adjacent estuaries to be suitable mating, spawning and nursing grounds for various aquatic species. A complex interaction between biotic and abiotic components in the mangrove-estuarine ecosystem is important for sustaining high productivity and biological integrity, which is essential in maintaining aquatic ecosystem food webs, through both grazing and detrital food chains (Claudino et al., 2015; Peng et al., 2017).

In addition to the detrital food web in the mangrove ecosystem, phytoplankton forms the initial biological component for carbon fixation in the autotrophic marine food chain that allows energy to be transferred to higher trophic levels (Saifullah et al., 2016; San Martin et al., 2006). Many phytoplankton species form direct or indirect sources of food for marine animals (Alikunhi and Kathiresan, 2012; Arumugam et al., 2016). Physico-chemical parameters, including nutrient load, as well as temperature, light, rainfall, and river runoff, play major roles in determining the abundance and diversity of phytoplankton, which are valuable for biomonitoring mangrove health (Aziz et al., 2012; Hama et al., 2016; Thompson et al., 2008). The freshwater discharge from

* Corresponding author. Laboratory of Marine Biotechnology, Institute of Bioscience, Universiti Putra Malaysia (UPM), 43400, Serdang, Selangor, Malaysia.
E-mail addresses: fatimahyus@gmail.com, fatimamy@upm.edu.my (F.M. Yusoff).

https://doi.org/10.1016/j.marenvres.2020.104935
Received 21 September 2019; Received in revised form 26 January 2020; Accepted 29 February 2020
Available online 5 March 2020