Harmful Algae 107 (2021) 102077

Contents lists available at ScienceDirect

Harmful Algae

journal homepage: www.elsevier.com/locate/hal

Original Article

Diverse harmful microalgal community assemblages in the Johor Strait and the environmental effects on its community dynamics

Kieng Soon Hii [a], Monaliza Mohd-Din [a,b], Zhaohe Luo [c], Suh Nih Tan [a,1], Zhen Fei Lim [a], Li Keat Lee [a], Sandric Chee Yew Leong [d], Sing Tung Teng [e], Haifeng Gu [c], Xiuyun Cao [f], Po Teen Lim [*,a], Chui Pin Leaw [a,*]

[a] Bachok Marine Research Station, Institute of Ocean and Earth Sciences, University of Malaya, 16310 Bachok, Kelantan, Malaysia
[b] Department of Biosciences, Faculty of Science, Universiti Teknologi Malaysia, 81310 Skudai, Johor, Malaysia
[c] Third Institute of Oceanography, Ministry of Natural Resources, Xiamen, 361005, China
[d] Tropical Marine Science Institute, National University of Singapore, 18 Kent Ridge Road, S2S Building, Singapore, 119227 Singapore
[e] Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia
[f] Institute of Hydrobiologia, Chinese Academic of Science, Wuhan, China

ARTICLE INFO

Keywords:
Diatom
Dinoflagellate
Environmental DNA
HAB taxa
Haptophyte
Raphidophyte
Seasonality

ABSTRACT

Coastal ecosystems are often subjected to anthropogenic disturbances that lead to water quality deterioration and an increase in harmful algal bloom (HAB) events. Using the next-generation molecular tool of 18S rDNA metabarcoding, we examined the community assemblages of HAB species in the Johor Strait, Malaysia between May 2018 and September 2019, covering 19 stations across the strait. The molecular operational taxonomic units (OTUs) of HAB taxa retrieved from the dataset ($n = 194$) revealed a much higher number of HAB taxa (26 OTUs) than before, with 12 taxa belong to new records in the strait. As revealed in the findings of this study, the diversity and community structure of HAB taxa varied significantly over time and space. The most common and abundant HAB taxa in the strait (frequency of occurrence >70%) comprised *Heterosigma akashiwo, Fibrocapsa japonica, Pseudo-nitzschia pungens, Dinophysis* spp., *Gymnodinium catenatum, Alexandrium leei*, and *A. tamiyavanichii*. Also, our results demonstrated that the HAB community assemblages in the strait were dependent on the interplay of environmental variables that influence by the monsoonal effects. Different HAB taxa, constitute various functional types, occupied and prevailed in different environmental niches across space and time, leading to diverse community assemblages and population density. This study adds to the current understandings of HAB dynamics and provides a robust overview of temporal-spatial changes in HAB community assemblages along the environmental gradients in a tropical eutrophic coastal ecosystem.

1. Introduction

Harmful algal blooms (HABs) in coastal marine ecosystems are dreadful events that caused tremendous impacts on public and marine ecosystem health, as well as the economy of the affected coastal countries including Malaysia (Lim et al., 2012; Yñiguez et al., 2020). These impacts encompass poisoning syndromes in human due to intoxication of algal toxin-contaminated seafood, massive mortality of aquatic life, and ecosystem deterioration. Among the poisoning syndromes, paralytic shellfish poisoning (PSP) is the most impactful event in the Southeast Asian region, with the cases mainly attributed to the toxic marine dinoflagellates *Pyrodinium bahamense, Alexandrium minutum*, and *A. tamiyavanichii* (Usup et al., 2002, 2012; Hii et al., 2016; Lim et al., 2020; Yñiquez et al., 2020). Other types of harmful microalgae such as *Margalefidinium polykrikoides, Noctilluca scintillans, Karlodinium australe*, and *Chattonella* species have been associated with massive red tides and caused fish mortality in aquaculture sites, leading to innumerable losses to the fish breeders (Lim et al., 2014a; Yñiquez et al., 2020).

The Johor Strait, also known as the Tebrau Strait, is a narrow passage waterway that separates the southern Malaysia Peninsula and the neighboring country Singapore (Fig. 1). The strait is bisected by the Johor-Singapore causeway into the Eastern Johor Strait (EJS) and the

* Corresponding author.
E-mail addresses: ptlim@um.edu.my (P.T. Lim), cpleaw@um.edu.my (C.P. Leaw).
[1] Present address: China-ASEAN College of Marine Sciences, Xiamen University Malaysia 43900 Sepang, Selangor, Malaysia

https://doi.org/10.1016/j.hal.2021.102077
Received 5 February 2021; Received in revised form 15 June 2021; Accepted 27 June 2021
Available online 12 July 2021