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Spatial-temporal variability of microphytoplankton assemblages including harmful microalgae in a tropical semi-enclosed strait (Johor Strait, Malaysia)

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ABSTRACT

Harmful algal blooms (HABs) were not new to the tropical semi-enclosed Johor Strait, with incident records that could trace back to the 1980s. HAB monitoring in the area, often, is reactive, focusing only on HAB taxa previously causing problems but neglecting potential emerging HABs. To develop datasets on HABs that can better inform and improve management practices, monitoring should expand to sample whole microphytoplankton communities. In this study, microphytoplankton community structure across the Strait was investigated. Abundances of microphytoplankton and a suite of *in situ* water parameters of temperatures, salinity, pH, dissolved oxygen levels, macronutrients, and chlorophyll-*a* contents were collected at ten sites across the Strait at monthly intervals from January 2017 to December 2018. A total of 48 genera (51 taxa) microphytoplankton were identified microscopically. Diatom was the most diverse group (32 genera), followed by dinophyte (15 genera). Bloom-forming species included diatoms *Chaetoceros*, *Coscinodiscus*, *Eucampia*, *Pseudo-nitzschia*, *Rhizosolenia*, *Skeletonema, Thalassiosira*, and dinophytes *Blixaea quinquecornis* and *Scrippsiella*. Diatom taxa that exhibit high *in situ* growth rates were predominant in the low-nutrient marine-influenced environment. Bloom-forming taxa including HAB taxa were found dominant in the environment with high nutrient levels and mesohaline, salinity-stratified conditions. This study provides valuable baseline data that could assist in monitoring and prediction of HABs in the Johor Strait and could be of reference to other similar tropical coastal systems.

1. Introduction

Marine phytoplankton are the primary producers in the ocean that contribute half of the global primary production (Falkowski et al., 1998; Baumert and Petzoldt, 2008). They are distributed in various marine environments spanning the coastal ecosystems to open oceans with vast diversity. Phytoplankton exhibit high growth rates and measurable photosynthetic responses but are extremely sensitive to environmental changes, thus, they are often chosen as environmental indicators to measure and assess the changes in ecological and biogeochemical processes in the marine ecosystems (Paerl et al., 2007). Changes in phytoplankton community composition and its structure have been associated with increments and changes in nutrient availability in the environments (Spatharis et al., 2007). Anthropogenic inputs of nutrients to the marine systems are often accompanied by the shifts in nutrient ratios and caused coastal eutrophication; this drives the phytoplankton community shift from a diverse assemblage to the proliferation of harmful microalgal species, also termed harmful algal blooms (HABs), which are

Abbreviations: HAB, Harmful Algal Bloom; JS, Johor Strait; WJS, Western Johor Strait; EJS, Eastern Johor Strait; mar, Marine-influenced zones; fresh, freshwater-influenced zones.

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