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Temporal variation of phytoplankton growth and grazing loss in the west coast of Peninsular Malaysia

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Abstract Phytoplankton growth (μ) and grazing loss (g) rates were measured monthly by the Landry-Hassett dilution method over a 2-year period at both estuarine (Klang) and coastal water (Port Dickson) systems along the Straits of Malacca. Chlorophyll *a* (Chl *a*) concentration ranged from 0.20 to 4.47 μg L^{-1} at Klang except on two occasions when Chl *a* spiked above 10 μg L^{-1}. In contrast, Chl *a* concentrations were relatively stable at Port Dickson (0.14 to 2.76 μg L^{-1}). From the rate measurements, μ was higher (t=2.01, df=43, p<0.05) at Klang (0.30 to 2.26 day^{-1}) than at Port Dickson (0.18 to 1.66 day^{-1}), but g was not significantly different (p>0.80). g ranged from 0.30 to 1.50 and 0.21 to 1.51 day^{-1} at Klang and Port Dickson, respectively. In this study, grazing loss was coupled to phytoplankton growth, and the ratio of g/μ or grazing pressure which estimates the proportion of primary production grazed was 50 % at Klang and lower than at Port Dickson (68 %; t=2.213, df=36, p<0.05). We found that the higher growth rates in a eutrophic system, i.e., Klang, were not matched by higher grazing loss, and this may have implications for the biogeochemical cycling in coastal waters.

Keywords Phytoplankton growth rate · Grazing loss rate · Grazing pressure · Tropical waters · Straits of Malacca

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Introduction

Marine phytoplankton accounts for nearly half of the global primary production (Field et al. 1998) and plays an essential role in marine food webs (Falkowski et al. 1998). The fate of phytoplankton production follows either the classical or microbial pathways (Calbet and Landry 2004; Schmoker et al. 2013). In the classical pathway, phytoplankton production is transferred to higher level via grazing and subsequently affects fishery yield (Mann 1993), whereas in the microbial pathway, phytoplankton production is coupled to bacterial consumption via the dissolved organic matter pool (Azam et al. 1983; del Giorgio et al. 1997; Cole 1999). Although the microbial pathway is relatively well-studied in the coastal waters of Peninsular Malaysia (Lee and Bong 2008; Lee et al. 2009; Bong and Lee 2011; Lee and Bong 2012), the classical pathway remains poorly characterized.

Grazing loss is an important process in the classical pathway as the fate of phytoplankton production not grazed is either through horizontal export into adjacent waters or sinking (Cloern et al. 1985; Turner 2002;

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