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# *Rhodovulum sulfidophilum*, a phototrophic bacterium, grown in palm oil mill effluent improves the larval survival of marble goby *Oxyeleotris marmorata* (Bleeker)

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## Abstract

Survival of marble goby larvae fed either *Rhodovulum sulfidophilum*, a phototrophic bacterium cultured from palm oil mill effluent (pPB), or microalgae (*Nannochloropsis* sp.) was evaluated at two salinities. Larvae directly fed pPB had survival of 0–29% at 5 g $L^{-1}$ salinity and 0–19% at 10 g $L^{-1}$ salinity, whereas larvae directly fed microalgae suffered complete mortality after 20 days of culture at both salinities. However, larvae indirectly fed pPB or microalgae, i.e. via rotifers (Days 1–30) and *Artemia* nauplii (Days 21–30) cultured solely from pPB or microalgae, showed improved survival of 35–55% or 44–49% at 5 g $L^{-1}$ salinity respectively. In all experiments, fish larvae reared at 5 g $L^{-1}$ salinity showed significantly higher ($P < 0.01$) mean survival than those reared at 10 g $L^{-1}$ salinity. The survival of larvae fed the bacterial-based diet was higher compared with microalgal diet used in previous studies. The pPB had higher total polyunsaturated fatty acids and docosahexaenoic acid (DHA) than the microalgae, which had very high eicosapentaenoic acid (EPA). Larvae with very high ratios of DHA/EPA (>11) or/and ARA (arachidonic acid)/EPA (>5), attributable to their given diet, however suffered the highest mortality.

**Keywords:** palm oil mill effluent, phototrophic bacteria, microalgae, marble goby, survival, fatty acid profile

## Introduction

The marble goby or sand goby (*Oxyeleotris marmorata*) is a valuable freshwater food fish held in high value due to its lean, 'boneless' flesh and pleasant taste. It is cultured in Southeast Asia, particularly in Malaysia, Thailand, Singapore, Indonesia and Vietnam and is exported to markets in Japan, China, Taiwan and Hong Kong. The present production of marble goby is 684 tonnes for Southeast Asia (Food & Agriculture Organization (FAO) 2010). The extensive and intensive culture of the marble goby is limited by the short supply of larvae, which are obtained mainly from the wild. To date, this industry has not successfully established a stable rearing technique in the hatchery. The problems related to marble goby culture include high mortality of larvae, its passive feeding behaviour, preference for live feed and slow growth rate (Hoa & Yi 2007). The lack of knowledge of suitable live feed has hindered the process of establishing a standard protocol for mass production of marble goby larvae.

Although the marble goby is a freshwater species, its larvae can survive in saline water to as high as 30 g $L^{-1}$ salinity (Senoo, Sow & Mukai 2008). Nonetheless, high salinities (>20 g $L^{-1}$ salinity) gave higher larval mortalities as compared with lower salinities, with the best survival at 10 g $L^{-1}$ (Senoo *et al.* 2008). It is unexpected that larvae reared in freshwater suffered high mortality of up to 100%, which was attributed to poor