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The effects of thermal effluent on marine diatoms and bacteria

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ABSTRACT. In this study, the effects of thermal effluent on the abundance and diversity of microbes (diatoms and bacteria) are investigated. The abundance of diatoms ($5.3 – 16 \times 10^5$ cells l^{-1}) and bacteria (110 – 2500 cfu ml^{-1}) showed reduction near the thermal effluent outfall (–56 and –96%, respectively). However, the effects of thermal effluent are limited to < 200 m from the outfall.

ABSTRAK. Di dalam kajian ini, kesan efluen panas pada kelimpahan dan kepelbagaian mikrob (diatom dan bakteria) diselidiki. Kelimpahan diatom ($5.3 – 16 \times 10^5$ cells l^{-1}) dan bakteria (110 – 2500 cfu ml^{-1}) menunjukkan penurunan berdekatan dengan punca efluen panas ini (–56 dan –96% masing-masing). Bagaimanapun, kesan efluen panas terhad pada < 200 m dari puncanya.

(near-field, diversity, power station, Port Dickson)

INTRODUCTION

The earliest investigations on the effects of thermal discharges on aquatic life was done in 1957 [1]. Thermal effluent from a power plant includes heated water, antifouling biocides and leached metals [2] has been shown to affect aquatic life [3,4]. One method of evaluating the effect of thermal pollution is to monitor the kinds and numbers of organisms living in the environment [5,6].

The Tuanku Ja'afar Power Station (TJPS) is located at the coastal town of Port Dickson, Malaysia, and its thermal effluent is discharged directly into the sea. In Malaysia, there are few biological studies on the effects of thermal effluent [7]. In this study, carried out in 1996, sampling was done in the immediate thermal discharge area [2].

I used the synecological method where the disturbed site is compared with control sites [8]. I sampled along a transect projecting away from the outfall until ambient temperature was obtained. The marine microbes examined are the diatoms and bacteria. Diatoms are often used as indicators of environmental change [9]. Diatoms have a rapid doubling time and respond quickly to changes in environmental conditions. As a result, diatom assemblages can provide a model to illustrate the effects of environmental change or ecosystem stress [10,11].

METHODS

There were five sampling stations (Stn 1 until Stn 5) along a transect projecting from the TJPS outfall (Figure 1). The farthest station (Stn 5) was located 240 m from the outfall. Sampling was carried out during low tides, and both *in-situ* measurements and samples were taken at 1 m depth. Samplings were also done in the thermal outfall of the Sultan Salahuddin Abdul Aziz Power Station (SSAAPS) located at Kapar, Selangor and a control site at Batu 10, Port Dickson (Batu 10). *In-situ* temperature measurements of seawater was carried out with a thermocouple (Fluke 51K/J, USA) and dissolved oxygen (DO) was measured with a DO membrane electrode (YSI, USA).

I used the Zobell 2216E medium [12] to isolate for marine bacteria, and identification was done to generic level [13]. Seawater samples for diatom analyses were preserved with Lugol's Iodine, and observed using an inverted microscope (Olympus CK2, Japan). The diatoms were identified based on taxonomic descriptions available [14,15]. Diversity indices are useful in monitoring changes and detecting shifts in water quality [6], hence the Shannon-Weiner Diversity Index, $H = -\sum p_i \log p_I$, (H) [16] was calculated