

ABSTRACT

A study on the effects of fish cage aquaculture on water quality was carried out in three Matang mangrove estuaries of the Sangga Besar (SSB), Jaha (SJ) and Sangga Kecil rivers. These estuaries, on a comparative basis, represented high-density, low-density and no aquaculture, respectively. To test the hypothesis that cage aquaculture increases the nutrient concentration of surrounding waters, and consequently increases chlorophyll *a* concentration (phytoplankton biomass), several investigations comprising comparisons of background (non-cage sites) nutrient levels among estuaries and cage and non-cage (control) sites, with consideration for confounding effects by tide (flood/ebb), diel (day/night) and season (wet/dry), were carried out. A nutrient leaching experiment compared the short-term effects (2 hours) of pellet feed and trash fish feed on water nutrient levels. Surface nutrient (ammonia nitrogen, nitrate, nitrite and reactive phosphate) and chlorophyll *a* concentrations, pH and salinity were measured and compared. The mean background $\text{NH}_3\text{-N}$ and PO_4^{3-} concentrations in the SSB were respectively 100% and 25% higher than that in both SJ and SSK. The mean background $\text{NH}_3\text{-N}$ and PO_4^{3-} concentrations at SJ and SSK were similar. Irrespective of locations (cage or non-cage site), higher mean $\text{NO}_3\text{-N}$ and $\text{NO}_2\text{-N}$ levels were observed in SSB and SSK, while a higher mean chlorophyll *a* level was observed in SJ. Significantly higher $\text{NH}_3\text{-N}$ concentrations were observed within the fish farms (SSB: $3.14 \mu\text{mol/L NH}_3\text{-N}$; SJ: $2.88 \mu\text{mol/L NH}_3\text{-N}$) as compared to outside the farm area (SSB: $1.56 \mu\text{mol/L NH}_3\text{-N}$; SJ: $1.44 \mu\text{mol NH}_3\text{-N}$). Seasonal and tidal effects interactions indicated a dilution effect on the nutrient concentrations during ebb tide in the wet season. There were no significant diel effects on the nutrient levels. Pellet and trash fish feeds contributed equally to nutrient enrichment of the water column. Overall, the chlorophyll *a* concentrations in the estuaries were however not consistent with the levels of nutrient concentration. The present study supports the hypothesis that fish cage culture increases nutrient concentrations in the water column. However, the idea that increased concentrations of nutrients cause eutrophication cannot be verified in the short-term study, given the estuarine complexity and dynamics of the study area.