Human-induced environmental change affecting macrobenthic communities in the Segara Anakan Lagoon, Java, Indonesia

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Abstract

The Segara Anakan Lagoon is the last large mangrove-fringed estuarine system in Java, Indonesia. It is affected by deforestation, high riverine sediment input, overfishing and effluents from households and industry including Indonesia´s largest oil refinery. We investigated the influence of mangrove vegetation, food quality, abiotic water and sediment properties, and organic pollutants on macrobenthic invertebrates.
Benthic species richness was high compared to other Indo-West Pacific mangroves. However, diversity indices were low to medium and an increasing dominance of opportunistic species was recorded over a period of five years. A high spatio-temporal variation of macrobenthic density and community composition was mainly related to pore water salinity and sediment $\delta^{13}C_{org}$, $\delta^{15}N$ and C_{org}/N. The distribution of facultatively leaf-eating crabs was related to tree, seedling and undergrowth density, but the occurrence of single crab and tree species was not correlated. Experiments revealed that these crabs preferentially feed on leaves with a high amount and/or freshness of nitrogenous compounds (amino acids, hexosamines, total nitrogen, $\delta^{15}N$).
Changes in vegetation and sediment organic matter appear to be important controls of macrobenthic community composition promoting opportunistic species in Segara Anakan. Most of the organic contaminants in water, sediment and biota were polycyclic aromatic compounds. Their concentration in water and sediment reached toxic levels close to the oil refinery. Polycyclic aromatic hydrocarbons (PAHs) mainly consisted of alkylated PAHs which are more abundant in crude oil and more persistent in the environment than the better-known parent PAHs. A total of 51 organic contaminants were recorded in five abundant benthic invertebrates. The gastropod *Telescopium telescopium* and the bivalve *Polymesoda erosa* stored highest number of contaminants suggesting their suitability as bioindicators for coastal pollution. Uptake and biomagnification of as yet hardly investigated organic contaminants and their impact on benthic biodiversity will be the subject of future studies.

Keywords
environmental change, macrobenthic diversity, food quality, industrial pollution, time series investigation