

Sedimentary characteristics of a shelf reef exposed to fish farm operations, Kepulauan Seribu, Indonesia

Abstract

Emissions of organic matter from fish farming operations affect the sea water and the sea floor. An increased concentration may lead to an environmental impact, that is, to a deterioration of physico-chemical sediment conditions. This deterioration may affect the benthic faunal and floral communities as well as the fish of the fish farm itself.

A case study in Seribu Islands, Java Sea, Indonesia investigates the sediment characteristics in proximity to coastal aquaculture in a tropical reef environment by focussing on grain size data and porosity as well as the related parameters of density and permeability. The prevailing hydrodynamic situation is that of a microtidal system with measured current flow velocities of max. 0.33 m/s near the fish farm.

In similar studies around the world, an anthropogenic influence by fish farming was shown to alter sediment characteristics locally in the vicinity of the outfall source. Statistical analysis in this study aims at assessing if alterations can be distinguished. Two separate pools of data (hot spot vs. reference) are statistically compared and denoted some differences. A further testing addressing changes with distance from the site of impact, however, did not detect any trend. A possible change of sediment properties by organic matter input from fish farming is discussed.

Carbonate particles, widely varying in shape and density, show a hydraulic behaviour significantly different compared to quartzose material. Morphodynamic studies of sediment motion, however, refer conventionally to quartz spheres. Settling velocity experiments have been carried out to establish a conversion factor, with which an initiation of particle motion of reefal carbonaceous material may be approximated. It is shown that under the observed flow conditions near the fish farm, sediment movement may take place.

Hence, the investigated sediment characteristics of reefal sediments exposed to fish farming operations show very little impact by fish farm outfall. This may be attributed to the amount of outfall settling on the sea bed, to an efficient microbial processing and to sediment exchange allowing current removal of fish farm outfall.

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