Biodeposits from farmed mussels severely influence the biogeochemistry of sediments by increasing the levels of organic matter (OM). Mitigation of such negative impacts is important for the development of sustainable aquaculture operations. As a step towards developing methods for remediation of coastal sediments affected by mussel farming, the effects of the polychaete, Hediste diversicolor was evaluated experimentally. In a series of field- and laboratory experiments we tested hypotheses about the effects of polychaetes on sediment oxygen consumption, nutrient fluxes and sulphide pools under different polychaete densities and sedimentation regimes. The experimental results support the idea that polychaetes can mitigate negative effects on the benthic environment beneath mussel farms. H. diversicolor oxidized the sediment and generally enhanced the oxygen consumption, and thus the decomposition of OM. The accumulation of pore water sulphides were reduced and fluxes of nutrients across the sediment-water interface increased. Additional calculations suggest that the effects of polychaetes were mainly indirect and driven by increased microbial activity due to the borrowing activity of the polychaetes. Trends of increasing decomposition with increasing polychaete density suggest that the decomposition could be further enhanced by higher densities. Overall, we concluded that H. diversicolor is a potentially strong candidate for remediation of mussel farm sediments. The results show that sediments inhabited by H. diversicolor have high assimilative capacity of OM and oxygen conditions are significantly improved following the addition of polychaetes at naturally occurring densities. However, technological developments are needed in order to allow the approach to be used in practice.