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Model estimates of the impact of bioirrigation activity of MARENZELLERIA spp. on the trophic state of the Gulf of Finland ecosystem

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Since the end of the 2000s, a sparcely populated soft bottom area in the deeps of the Eastern Gulf of Finland has been affected by invasive species Marenzelleria spp. The burrow flushing of sediments by Marenzelleria results in deeper penetration of oxygen into the sediments with corresponding redox alterations of nutrient cycling. In oxic conditions, a lager fraction of mineralized phosphates is transformed into particulate form due to formation of iron-humate complexes, thus increasing sediment phosphorus retention and burial. On the contrary, increased oxygen availability reduces nitrogen removal by denitrification, thus leading to larger release of nitrate into the water column. Indeed, as was revealed by long-term observations, the large-scale invasion of Marenzelleria spp. into the Eastern Gulf of Finland was accompanied by significant increase of the N:P ratio (Maximov et al., 2014). For a quantitative assessment of the bioirrigation activity of Marenzelleria spp., sediment parameterizations in SPBEM (St. Petersburg Baltic eutrophication model) have been modified as follows. Intensified burrow flushing is considered as the enlarged water-sediment contact area between water and sediments and described with the coefficient of bioirrigation determined by the abundance of polychaete and radius of their burrows. These parameterizations have been applied for simulation of the Gulf of Finland nutrient dynamics during 2010-2040. Preliminary results of simulations showed that vital activity of invasive Marenzelleria spp. might lead to slowdown or decrease of eutrophication in the Gulf of Finland due to reduction of cyanobacterial blooms