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Sustainable Aquaculture for a Secure Future

Title: Ten-year simulations of organic matter concentrations in tropical aquaculture ponds using the multiple pool modeling approach

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Abstract: The accumulation rate of organic matter has been used to develop guidelines on sediment management in tropical aquaculture ponds. However, there is conflicting evidence as to the rate of sediment organic matter accumulation and whether steady state concentrations are achieved in the short term (<10 years) in aquaculture ponds. A simulation study using the multiple pool modeling approach (Multi-G model) was conducted to determine the long-term dynamics of sediment organic matter and to establish whether steady state concentrations could be achieved in tropical aquaculture ponds. The Multi-G model, which recognizes the existence of different organic matter pools, each with its own decay rate constant was run as a sub-model of an integrated aquaculture–agriculture system (IAAS) model. The simulation study was conducted for representative management scenarios for new integrated ponds receiving artificial feed, chicken manure, or a combination of chicken manure and crop wastes. The model was run for 10 years using a 0.125 day time step, and each year's simulation consisted of a wet and a dry season, and fallow periods between crops that totalled 121 days for the year. Pond sediment organic matter concentrations increased over time for all input regimes in the following order: chicken manure×plant waste >chicken manure >artificial feed. Simulated organic matter concentration decreased in the first 4–5 years in ponds receiving chicken manure and artificial feed. Contrary to predictions of models that used a single decay rate constant for the organic matter, steady state sediment organic matter were not achieved within the first 5 years of production. These results were consistent with those obtained from long term sediment organic matter experiments in tropical aquaculture ponds. The results show that the multiple pool modeling approach may be more applicable to the simulation of pond sediment organic matter dynamics than those that assume organic matter to consist of a single pool decaying at a single rate.

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