Title: An organic matter and nitrogen dynamics model for the ecological analysis of integrated aquaculture/agriculture systems: II. Model evaluation and application

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Abstract: The performance of a model developed to simulate organic matter and nitrogen dynamics in integrated aquaculture/agriculture systems was evaluated using sensitivity analysis and model verification procedures with data from three sites. The model sensitivity analysis results were used to identify parameters that required high accuracy in measurement, and to suggest areas of future research in integrated aquaculture/agriculture systems. Model sensitivity analysis results showed that research on stocking density, sediment processes and water management practices was required, in order to improve the overall understanding of the functioning of the integrated aquaculture/agriculture system. Results from model verification runs showed that the model performance was satisfactory with respect to fish growth, crop growth, pond and terrestrial nitrogen and organic matter simulations. However, the modeling of phytoplankton biomass was less satisfactory and the results suggested the need for more site-specific calibration of exogenous factors and the consideration of phytoplankton species composition in simulating grazing preferences by fish. Application of the model to investigate the effects of different cycling pathways on nitrogen retention and productivity showed that the recycling of plant wastes to aquaculture ponds had a major effect in reducing system nitrogen losses and increasing system productivity. Sediment organic matter processes were identified as the major determinants of system nitrogen retention, as measured by the nitrogen retention index. The modeling study also showed that the number of linkages between the aquaculture and agriculture components was not directly related to nitrogen retention and productivity in the system. The results of the modeling study suggest that the system nitrogen status may be more important than the number of pathways.
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in determining the number and type of cycling pathways that should be incorporated in integrated aquaculture/agriculture system.

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