論文内容の要旨

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The Pangasius aquaculture is one of the fastest growing types of aquaculture in the world. Vietnam is by far the world's largest producer of Pangasius. And the Mekong delta is the most productive area for Pangasius aquaculture in Vietnam. In order to sustain the Pangasius industry, water environment in the delta is one of the most important factors. The impact of climate change with sea level rise on salinity intrusion now is a serious threat to this industry in the context of Vietnam - one of countries most vulnerable to the impacts of climate change. In this study, we used MK4 – A software for hydraulic and substances transport computation in river network to estimate salinity intrusion in the Mekong delta by a combined impact of upstream flows, tides, engineering structures and sea level rise corresponding to the emission scenario B2 (0.73m of sea level rise and 29% reduction of the Mekong River flow in the dry season by the year 2100) for Vietnam with the base year 2010. The vulnerability in Pangasius farming by effect of climate change on salinity intrusion was considered in the whole Mekong delta, Vietnam. The study period is dry season from 1stApril to 30thApril when salinity intrusion is the most serious in a year. The simulated results showed that the saline water will shift landward by 70 - 80 km which covers almost 63% approximately 2.49 million hectares of the Mekong delta. Moreover, it illustrated that the Pangasius farming area will be reduced by approximately 11% with the shrinkage of the freshwater zone due to the salinity intrusion. These adverse impacts could affect Pangasius industry in the delta if no remedy is taken. The results can be used as a technical prerequisite for development of a regional strategy and action plan to prepare for salinity management of the vulnerable aquaculture.

Besides that, the rapid growth of Pangasius industry has generated income but also raised a number of environmental concerns. The most common environmental concern is the direct discharge of effluent into surface water. However, the impacts of Pangasius aquaculture to water environment have not been well documented. Therefore, we carried out a simulation of effluent discharge from My Hoa Hung Pangasius farming from 24th April 2007 to 27th April 2007 by using a three-dimensional numerical transport model. The model not only takes into account dissolved nitrogen and phosphorus but also particulate nitrogen and phosphorus accumulated on the river bed. Simulated results were verified by observed data. The results showed that discharging fishpond effluent directly to river resulted in a high level of nutrients (31 mg/L - 39 mg/L for dissolved nitrogen, and 2.3 mg/L -12.5 mg/L for dissolved phosphorus) in surrounding surface water. When sludge was periodical pumped out, particulate wastes from sludge settled quickly and accumulated on the river bed. The highest simulated concentrations of particulate nitrogen were 1,000 mg/L - 2,000 mg/L; of particulate phosphorus were 140 mg/L - 320 mg/L, respectively. These concentrations quickly decreased after stopping discharge waste due to large river and high velocity in the Mekong River. The pollution situation was local and temporary. However, reduction of environment pollution was a crucial issue to enable sustainable development of this industry in the Mekong delta.

And applying wastewater from fishpond for irrigation of rice field could reduce remarkably nutrients level in fish farming area, 77% for total nitrogen and 73% for total phosphorus, respectively. This technique could be applied as an effective technology for improving quality of surface water in the Mekong delta.

This research has made an assessment of the water environment in the Pangasius farming in the Mekong delta, Vietnam. Numerical models that may be successfully used for planning and monitoring purposes illustrated economical solutions in water management in fish farm.