



Jul 1st, 12:00 AM

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Oh, H. T.; Lee, W. C.; Lee, S. M.; Jung, R. H.; and Hong, S. J., "Sustainability Evaluation for Shellfish Production in Gamak Bay based on the Systems Ecology" (2008). *International Congress on Environmental Modelling and Software*. 151.
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Sustainability Evaluation for Shellfish Production in Gamak Bay based on the Systems Ecology

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Keywords: EMERGY Analysis, Gamak (Kamak) Bay, Shellfish Aquaculture, Marine Management Policy, System Ecology

This research outlines a method for sustainability evaluation for shellfish aquaculture production in Gamak Bay for based on Emergy evaluation of the environmental resources. For a better understanding of environmental factor influencing oyster production and the management of oyster stocks, it is important to understand and assess the real value of environmental sources such as solar energy, river, tide, wave, wind, etc. In this research, EMERGY(Odum, 1996; Ulgiati and Brown, 2007) flows from environment were 76% for shellfish aquaculture in Gamak Bay. EMERGY yield ratio, Environmental Loading Ratio, and Sustainability Index (Brown and Ulgiati, 1997; Tilley and Vito, 2006) are 4.2, 0.3, 13.8 respectively.

Using the Emergy evaluation data, the predicted maximum shellfish aquaculture production in Gamak Bay and FDA (Food and Drug Administration, U.S.) designated area in Gamak Bay were 10,845 ton/yr, 7,548 ton/yr, respectively. Actually predicted shellfish production were about 1.3 times more than produced shellfish production in 2005. Therefore, the carrying capacity of the Gamak Bay may be estimated to be 1.3 times as high as the present oyster production.

This research was performed to develop a method of strategic environmental assessment on the operation of sewage treatment plant and reuse of seeding areas by using the environmental accounting based on emergy evaluation (Kang and Park, 2002; Valyi and Ortega, 2004). The result was applied to marine environment policy in order to evaluate the real wealth of the regional environment and economy for present phase, and developed phase from scenario. Using the result of comparison of Emergy indices between present system and new system (Sewage Treatment Plant, Seeding), the new 1(STP), new 2(Seeding), and new 3(STP & Seeding) cost-benefit output show 1.88, 0.78, and 1.29, respectively.

In this study, an energy systems model was built to simulate the variation of sustainability of the oyster aquaculture. The results of simulation based on calibration data in 2005 show that oyster production yield slowly slightly increase and money and asset show increase to the steady state because of the law of supply and demand. The results of simulation based on the variation of inflation rate show that the more increase the oil price, the more decrease the oyster production and asset after using the excess environmental resources around 10 years.

ACKNOWLEDGEMENTS

The authors wish to thank the National Fisheries R&D Institute for the financial support of the project “Assessment of Carrying Capacity in Coastal Aquaculture Sites”.

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