An integrated epidemiological-economic model of sea lice control in aquaculture: A system dynamics approach

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Abstract

Different methodologies have been used in modeling the epidemiology and economics of aquaculture diseases, including input-output models, benefit-cost analysis, linear programming, simple spreadsheet-based models, compartment models based on differential equations, and spatial models. Despite the advantages that these models provide, there is a need to develop a more integrated approach to the epidemiology and economics of disease that better represents and captures existing feedback mechanisms, interventions to control aquatic disease, and the economic consequences of these interventions on economic incentives to control aquatic disease and producer behavior. System dynamics modeling approaches have utility in this context. While they have been used in modeling animal (livestock) health economics, their application in fisheries has been limited to questions of stock management. In this paper, we apply system dynamics modeling in aquaculture health economics in the context of sea lice control. Separate models of sea lice and salmon growth evolution were designed and integrated to capture the feedbacks between them and examine the impact of different control scenarios on the system. The preliminary results of the model showed that small scale treatments (i.e. at the cage/pen level) do not remedy the oscillatory behavior found in lice population dynamics in that cage/pen, suggesting the need to consider other treatment modalities.