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## Southeast Asian aquaculture: How far are we?

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South Asia and Southeast Asian countries are the leading contributors of fish and fishery products in the world fish market. Countries such as China, Indonesia, India, Vietnam and Myanmar contest to be known as the prime fish producer in Asia, though China stands to be the biggest producer and consumer of fish since 2010 as stated in World Fisheries and Aquaculture Report of 2012. Other Asian countries, static, but thrive to produce good quality of fish, enhancing their productivity through alteration of the traditional fishing method into advanced technologies coming from the 1st World Countries. Reflecting the development of aquaculture industries, vis-à-vis' commercialization is quiet imbalance due to unstable sustainability. Some challenges involve the kind of feed use and its supplementary, culture system and production, and poor biosecurity causing major disease outbreaks from the wild. Food security is now the key point towards attaining higher yield and productivity, a basic requirement for importation and export of fish and fishery products worldwide. The concept towards aquaculture changes and the desire of each country for a suitable fish farming center in the production of good quality of fish that are safe for human consumption, either inland or marine aquaculture.

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## Aggregation of variables and applications to population dynamics

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Population and community models are complex in the sense that they usually take into account many variables and parameters. We present methods allowing the reduction of the dimension of the system which may become, in this way, mathematically more tractable. The reduction of the proposed system is undertaken with the help of aggregation methods which aim at studying the relationships between a large class of complex systems, in which many variables are involved, and their corresponding reduced or aggregated systems, governed by a few variables. The kind of aggregation methods that we consider is based on time scale separation methods. In order to illustrate the methods in population and community dynamics, we present an application of these aggregation methods in the context of fishery modelling. We consider a general 2L-patch model of harvesting population dynamics with continuous time. Fish movements between the sites, as well as vessel displacements between the fishing sites, are assumed to take place at a faster time scale than the variation of the stock and the change of the fleet size. We take advantage of these two time scales derive a reduced model governing the dynamics of the total fish stock and the total fishing effort. This reduced model is used to determine the optimal size and number of a marine reserve in order to maximize the catch at equilibrium. We show that the optimal number that maximizes the total fish catch at equilibrium depends intricately on the size of the reserve: A small number of reserves is optimal when the size of the reserve is higher and inverse.

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