Review progress of carrying capacity models for mariculture

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ABSTRACT: In this paper, the definition, history and assessment methods for carrying capacity are discussed and major results of carrying capacity studies are reviewed. The cultivation of bivalves in coastal and estuarine ecosystems around the world has led to the development of massive industries, especially in developing countries such as China. Impacts of bivalve culture on coastal and estuarine ecosystems have increased in the last decade due to the enlargement of standing stocks and scale of culture. As a consequence, it is necessary to assess the carrying capacity for bivalve culture in coastal ecosystems. Although many definitions for carrying capacity have been proposed, there is no formal definition for carrying capacity in regard to fresh water and sea water farming areas for certain cultured animals and plants. This is due to the fact that in certain farming areas carrying capacity is not only dependent on the physical and chemical parameters of the culture system, but on political, economical, and cultural factors as well. Bivalve carrying capacity has been studied in more than 20 coastal ecosystems. There are four methods to estimate carrying capacity including 1) Models based on physio-ecological parameters; 2) Models based on ecological information; 3) Models based on semi-in situ experiments, and 4) Models based on historical production and environmental data. In general, in Asia, Africa, and Australia, semi-insitu experiments and physio-ecological models have been used to estimate carrying capacity, while in Europe and America, the ecosystem box model and physio-ecological model have been used. More than ten bivalve species in different coastal ecosystems have been studied including; *Chlamys farreri, Crassostrea gigas, Crassostrea virginica, Mercenaria mercenaria, Mytilus edulis, Mytilus gallprovincialis, Patinopectin yessoensis, Placopecten magellanicus, Ruditapes philppinarum*, and *Saccostrea glomerata*. Considerable research has been conducted to determine bivalve physio-ecological parameters and ecosystem structures resulting in many kinds of models being developed. Assessment of the results indicates there are significant differences between the experimental ecosystems. Because of this, comparisons between studies are difficult to make. Only a few results were obtained for Sangou Bay, Sishiliwan Bay, Dongshan bay and Tong'an Bay in China; Kamak Bay and Deukryang Bay in Korea; Funka Bay, Mutsu Bay and Saloma Bay in Japan, Saldanha Bay in South Africa, Marennes-Oleron bay in France, and Carlingford Lough in Ireland. The reason that only a few figures on carrying capacity of bays are provided in the published literature, despite extensive research being conducted around the world, may be due to the fact that the standing stock for commercial production were high or close to the carrying capacity in those bays. To improve bivalve production, product quality and protect the coastal environment, studies on carrying capacity should be linked to research on impacts of bivalve culture on ecosystems, optimal culturing techniques and bioremediation.

KEY WORDS: Carrying capacity, Bivalve, Model, Mariculture