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Sustainable Aquaculture for a Secure Future

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**Title:** A Strategic Approach to Carrying Capacity Analysis for Aquaculture in Estuaries

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**Abstract:** Estuaries are coastal watercourses that are subject to both marine and riverine influences. Their principal hydrographic controls are morphology, tides, freshwater inflows, meteorology, and density currents. The propagation of tides and the distribution of salinity are important indicators of circulation in an estuary. Circulation in particular imposes a limit on the ability of an estuary to assimilate wastes without degrading its water quality. This is an important constraint on concentrated aquaculture operations that circulate water, since these produce a large volume of wastewater and also require a supply of uncontaminated water. A general procedure is outlined for determining the "carrying capacity" of the estuary. This requires (1) specification of the water quality parameter(s) that form the basis of water quality evaluation, (2) determining the parameter value(s) of acceptable water quality, (3) development of a water quality model appropriate for the estuary, and (4) establishing the conditions that are critical for water quality.

The water quality model is central to the procedure: it is a combined hydrodynamic and mass balance calculation, designed to reflect the space-time scales controlling the water management problem. Its development requires an extensive base of field data. The model is applied to predicting the water quality regime that would result under a hypothetical distribution and volume of waste-loads. The largest volume of waste-loads that results in water quality equal to the level judged acceptable under critical conditions is the assimilative capacity. It is important to note that assimilative capacity is a function of position in the estuary, and depends upon both local and larger scale hydrography. Single values of

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<http://pdacrsp.oregonstate.edu/> >.

"carrying capacity" or "flushing time" applied to an entire estuary are of little use. A case study is presented of shrimp aquaculture in Golfo de Fonseca, Central America. A preliminary analysis of the operations around Estero Pedregal is performed using a one-dimensional model, to illustrate the kinds of analyses that can be carried out and the types of results that can be obtained. These results indicate that shrimp aquaculture in this area is already approaching a level of being self-limited.

This abstract was excerpted from the original paper, which was in Water Effluent and Quality, with Special Emphasis on Finfish and Shrimp Aquaculture, Proceedings of the Twenty-Fourth U.S.-Japan Aquaculture Panel Symposium, Corpus Christi, Texas, October 8-10, 1995, p. 71-84.