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Sustainable Aquaculture for a Secure Future

**Title:** **Life Cycle Assessment of Chinese Shrimp Farming Systems Targeted for Export and Domestic Sales**

**Author(s):** Ling Cao*[1], James S. Diana[1], Gregory A. Keoleian[1], and Qiuming Lai[2]

[1]School of Natural Resources and Environment, University of Michigan, Ann Arbor, Michigan 48109, United States
[2]Ocean College, Hainan University, Haikou, China

**Date:** **August 02, 2011** Publication Number: CRSP Research Report **11-273**

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**Abstract:** We conducted surveys of six hatcheries and 18 farms for data inputs to complete a cradle-to-farm-gate life cycle assessment (LCA) to evaluate the environmental performance for intensive (for export markets in Chicago) and semi-intensive (for domestic markets in Shanghai) shrimp farming systems in Hainan Province, China. The relative contribution to overall environmental performance of processing and distribution to final markets were also evaluated from a cradle-to-destination-port perspective. Environmental impact categories included global warming, acidification, eutrophication, cumulative energy use, and biotic resource use. Our results indicated that intensive farming had significantly higher environmental impacts per unit production than semi-intensive farming in all impact categories. The grow-out stage contributed between 96.4% and 99.6% of the cradle-to-farm-gate impacts. These impacts were mainly caused by feed production, electricity use, and farm-level effluents. By averaging over intensive (15%) and semi-intensive (85%) farming systems, 1 metric ton (t) live-weight of shrimp production in China required 38.3±4.3 GJ of energy, as well as 40.4±1.7 t of net primary productivity, and generated 23.1±2.6 kg of $SO_2$ equiv, 36.9 ± 4.3 kg of $PO_4$ equiv, and 3.1 ±0.4 t of $CO_2$ equiv. Processing made a higher contribution to cradle-to-destination- port impacts than distribution of processed shrimp from farm gate to final markets in both supply chains. In 2008, the estimated total electricity consumption, energy consumption, and greenhouse gas emissions from Chinese white-

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leg shrimp production would be 1.1 billion kW-h, 49 million GJ, and 4 million metric tons, respectively. Improvements suggested for Chinese shrimp aquaculture include changes in feed composition, farm management, electricity-generating sources, and effluent treatment before discharge. Our results can be used to optimize market-oriented shrimp supply chains and promote more sustainable shrimp production and consumption.

This abstract was excerpted from the original paper, which was published in Environmental Science & Technology (2011), 45 (15): 6531-6538.

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