ID: W2887157340

TITLE: LCA of aquaculture systems: methodological issues and potential improvements

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ABSTRACT:

The aquaculture sector is the fastest growing food production industry. Life-cycle assessment (LCA) can be a useful tool to assess its environmental impacts and ensure environmentally sustainable development. Years ago, critical reviews of LCA methodology have been conducted in that field to evaluate methodological practice. However, how effective were these reviews in improving LCA application? Are there any remaining issues that LCA practitioners should address in their practice? We tackle the above questions by critically reviewing all LCA cases applied to aquaculture and aquafeed production systems from a methodological point of view. A total of 65 studies were retrieved, thus tripling the scope of previous reviews. The studies were analysed following the main phases of the LCA methodology as described in the ISO standards, and the authors? choices were extracted to identify potential trends in the LCA practice. We identified five main methodological issues, which still pose challenges to LCA practitioners: (i) the functional unit not always reflecting the actual function of the system, (ii) the system boundary often being too restricted, (iii) the multi-functionality of processes too often being handled with economic allocation while more recommendable ways exist, (iv) the impact coverage not covering all environmental impacts relevant to aquaculture and (v) the interpretation phase usually lacking critical discussion of the methodological limitations. We analysed these aspects in depth, highlighting trends and tendencies. For each of the five remaining issues, we provided recommendations to be integrated by practitioners in their future LCA practice. We also developed a brief research agenda to address the future needs of LCA in the aquaculture sector. The first need is that emphasis should be put on the construction of aquaculture life-cycle inventory databases with a special need for developing countries and for post-farming processes. Additionally, method developers should develop and/or refine characterisation models for missing impact pathways to better cover all relevant impacts of seafood farming.

SOURCE: ˜The œinternational journal of life cycle assessment

PDF URL: None

CITED BY COUNT: 57

PUBLICATION YEAR: 2018

TYPE: article

CONCEPTS: ['Life-cycle assessment', 'Scope (computer science)', 'Aquaculture', 'Production (economics)', 'Environmental impact assessment', 'Unit (ring theory)', 'Environmental resource management', 'Business', 'Risk analysis (engineering)', 'Environmental planning', 'Management science', 'Computer science', 'Engineering', 'Environmental science', 'Fish <Actinopterygii>', 'Political science', 'Economics', 'Mathematics education', 'Mathematics', 'Fishery', 'Biology', 'Law', 'Macroeconomics', 'Programming language']