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RESEARCH REPORTS

Sustainable Aquaculture for a Secure Future

Title: Open-water integrated multi-trophic aquaculture: environmental biomitigation and economic diversification of fed aquaculture by extractive aquaculture

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Abstract: Integrated multi-trophic aquaculture (IMTA) seeks to biodiversify fed aquaculture (e.g. finfish or shrimps) with extractive aquaculture, recapturing the inorganic (e.g. seaweeds) and organic (e.g. suspension- and deposit-feeders) nutrients from fed aquaculture for their growth. The combination fed/extractive aquaculture aims to engineer food production systems providing both biomitigative services to the ecosystem and improved economic farm output through the co-cultivation of complementary species. Major rethinking is needed regarding the definition of an 'aquaculture farm' and how it works within an ecosystem. The economic values of the environmental/societal services of extractive species should be recognized and accounted for in the evaluation of the full value of these IMTA components. Seaweeds and invertebrates produced in IMTA systems should be considered as candidates for nutrient/carbon trading credits. While organic loading from aquaculture has been associated with localized benthic impacts, there have also been occurrences of increased biodiversity and abundance of wild species in response to moderate nutrient enrichment and the use of infrastructures as substrates. To develop efficient food production systems, it will be important to understand and use the duality of nutrients (essential when limiting/polluting when in excess) to engineer systems producing them in moderation so that they can be partially recaptured while maintaining their concentrations optimal

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for healthy and productive ecosystems. Measures of species diversity, colonization rates, abundance, growth and ecosystem functions with respect to nutrient partitioning and recycling, species interactions and control of diseases could represent valid indicators for the development of robust performance metrics.

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