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BOOK OF ABSTRACTS

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LIFE CYCLE ASSESSMENT OF FISH OIL SUBSTITUTION WITH VEGETABLE OILS IN DIETS FOR *SERIOLA DUMERILI*

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ABSTRACT: The fast growth of the aquaculture sector is often associated with a strong environmental impact. Eutrophication, emission of greenhouse gasses and intensive exploitation of land and water mainly derive from aquafeed production, with fish-derived ingredients such as fish oil being the major contributors. The present study aimed at evaluating the environmental impact of the substitution of fish oil with vegetable oils in the diets for Mediterranean yellowtail (Seriola dumerili) juveniles by using Consequential Life Cycle Assessment (CLCA). A total of 150 fish (177±6.0g initial weight) were reared in a recirculating aquaculture system (six 1750 litre-tanks, 25 fish per tank) and fed two experimental isonitrogenous (59% crude protein) and isolipidic (15% crude lipids) diets (75 fish per diet) which lipid source was either fish oil (control diet; FO) or a blend of vegetable oils (diet VO; linseed oil, sunflower oil and palm oil, 4:3:3). After 109 days of feeding, diets did not affect fish growth (423 g and 419 g of final weight in FO and VO, respectively), whereas survival was lower in fish fed VO compared to FO diet (80.3% vs. 92.7%; P < 0.05). The CLCA model included global warming without and with land use change (GWP and GWP_LUC, kg CO₂-eq) and eutrophication (EP: g PO_4 -eq) potentials as impact categories, considering 1 kg of diet as functional unit. The effects of fish oil substitution on external food systems were modelled by assuming that the marginal coproducts (protein meals) of vegetable oil production were credited to poultry system as the most expanded animal-based production system. The marginal product associated to fishmeal was assumed to be soybean meal concentrate. The marginal production of 1 kg of FO diet was associated to the emission of 2.52 kg CO₂-eq (GWP), 2.92 kg CO₂-eq (GWP LUC) and 11.1 g PO₄-eq (EP). Compared to the FO diet, the marginal production of 1 kg of VO diet emitted 1.65 kg CO₂-eq (GWP; -35%), 2.47 kg CO₂-eq (GWP_LUC, -15%) and 13.8 g PO₄-eq (EP; +24%). The most important processes contributing to the whole impact were the productions of soybean meal concentrate for GWP, especially when including land use change, and sunflower oil for EP. The substitution of fish oil with vegetable oils in marginal fish diet production determined opposite effects, mitigating global warming potential and exacerbating eutrophication potential. In conclusion, the optimization of feed substitution in fish diet shall consider jointly productive and environmental aspects.

Keywords: fish oil; vegetable oils; global warming; eutrophication; consequential LCA

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