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Introduction of Insect Meal in the Fish Diet: First Economic Evaluations on European Sea bass Farming

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Abstract

Aquaculture is the fastest growing food industry in the world and contributes to the production of more than half of world fish production [1, 2]. The pivotal role of this practice in rearing, growing or producing sea or freshwater organisms [3] derives from its capability to meet the increasing requests of fish that cannot be met by fisheries, accused of being the cause of the decline in the availability of wild aquatic organisms [4]. Furthermore, aquaculture is crucial in the fight against hunger and malnutrition, in food security, in the provision of livelihoods and in sustainable production through the intelligent use of natural resources [5–8].

These functions related to the social and environmental dimension of sustainability can be provided only addressing they synergistically with the economic dimensions of fish farming, which play a determinant role in achieving sustainable development.

The biggest economic problems currently facing fish farming concern the cost structure and in particular in costs of feeds [2, 9–14]. These troubles reverberate on environmental sustainability dimension. The reason is that whether the fish farm doesn't make a right profit, it will be incapable bearing the cost of new techniques of production or new eco-friendly feed, often more expensive than the present state of affairs.

The European Commission (EU), with the Regulation 893/2017, has responded to the problems of environmental and economic sustainability of the aquaculture industry. On the basis of numerous studies, that demonstrated that insects represent a valid substitute for the fish meal, fish oil and soy [10, 15–18], EU has allowed the use of three species of insect meal in the diet of farmed fish with limitations on their production and amount of use in the fish diet.

The peculiarities of insects (low environmental impact and in the limited need of arable land, rapid breeding cycles and high-value protein [10, 19, 20] are fundamental for the intensification of aquaculture production, which requires the use of food with a high protein

value [2]. In this regard, the insect meal can be a driving force behind individual companies' growth.

This article contributes to the recent stream of research on sustainable substitute of fish meal [10, 15, 19, 21]. More specifically, this research aims to fill the gap in the current literature with regards to the economic effects derived from the introduction of insect meals into the dish diet.

The research is conducted by the case study method, that allowed for a deep analysis of Sardinian companies specialized in the production of European sea bass, that is "a major species culture in Mediterranean region" [19, p. 35].

This proposal has a twofold objective. Firstly, the incidence of fish meal basis diet into the total farm cost structures was analyzed. Findings suggest that about 63% of farming cost related to feeding cost. Secondly, on the basis of the prior empirical experiment on the introduction of increasing levels of Tenebrio Molitor (TM) [19], meals into the fish diet, the possible effects on costs related to the introduction of such innovative diet was simulated. Preliminarily, in order to describe the baseline scenario, a balance sheet analysis was applied; afterwards, we simulated the possible main cost effects derived from the introduction of TM meal into the European sea bass diet, under the assumption of different percentage of insect meal inclusion in the diet and market hypotheses.

Keywoeds: Tenebrio molitor meal, Economic sustainability, Small-scale fish farming

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