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Technical and economic feasibility of seabass fry production according to organic techniques

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Abstract

Over the past few years, consumers have been increasing their awareness about environmental, health and safety concerns, gradually changing their habits in favour of organic food. In Europe, the organic aquaculture is legislated by Commission Regulation (EC) 710/2009. In Italy, only ten farms are involved in the supply of certified organic fish and only some pilot projects were carried out for organic farming of different species. Therefore, the purpose of this research was to evaluate organic technical feasibility and production costs, comparing them with conventional production. This study contains the first considerations about organic production and its relative costs for seabass fry, one of the most reared species of the country. Conversion to organic production naturally involves additional costs concerning the conversion process itself, the production of a new type of product and the lower output. In fact, results have shown that certification and feed costs represented the most significant difference between conventional and organic production..

Introduction

Over the past few years, consumers have been increasing their awareness about environmental, health and safety concerns and they have been gradually changing their habits in favor of organic food, controlled production chain and certified products. In aquaculture sector, the first legislative framework regarding the organic production in Europe was the Directive (EEC) 2092⁄91, which was replaced by the Directives (EC) 834⁄07 and (EC) 889⁄08 (EU 1991, 2007, 2008) and most recently by Commission Regulation (EC) 710/2009 (EU 2009). The Regulation aims to achieve a balance between the existing national rules and private schemes so as to give a minimum standard for organic aquaculture and seaweed products on the Community market. The chapter for aquaculture animals requires animal welfare conditions in husbandry and slaughter to be addressed (including maximum stocking densities). Total organic aquaculture production reached about 53,500 tons in 2009, accounting for about 0.1 percent of aquaculture production worldwide. Further production increases are foreseen. In the last five years market development has been slow because of a limited number of reliable organic seafood suppliers. This situation is changing right now for major products like salmon and shrimps. The number of certified organic aquaculture enterprises amounts to 240 in 29 different countries in 2009, most of them located in Europe where the lead product in organic aquaculture is Atlantic salmon, followed by the Mediterranean species seabass and seabream, freshwater salmonids (rainbow and brown trout, and charr species), and carp (IFOAM, 2010). In Italy, only ten farms are involved in the supply of certified organic fish and only some pilot projects were carried out for organic farming of different species (Castellini et al., 2012). On the other hand, Italy is a major producer of conventional seabass and seabream fry. In fact, in 2002 production was 95 million, of which 27 was exported mainly to Greece. Production is dominated by 3 large hatcheries which account for around 50% of production. There is an important sub sector in Italy which on-grows fry to fingerling size 10-15g (Final report, 2004). In addition, a number of companies have developed semi intensive methods of fry production, which give better quality at lower cost. Therefore, the purpose of this research was to define or verify the principal standards for organic seabass farming, evaluating technical feasibility and production costs, comparing them with conventional production. This study contains the first considerations about organic production and its relative costs for sea bass fry, one of the most reared species of the country.

Material and methods

The study was carried at Ittica Caldoli srl, a fish farm located in the Apulia region close to Lesina lake. The farm is able to cover the entire productive cycle for seabass and seabream species being characterized by a hatchery, pre-growing and on growing systems. For the project, the experiment was run using a breeding tank of a volume of 20 m³, at a stock density of 5 kg/m3 with an optimal ratio male-female, expressed in kg, of 3:7. The fertilized seabass eggs were then transferred into the collector placed outside the spawning tank

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having filters of 0.25 mm mesh. Egg incubation was carried out into a cylindro-conical hatching tank of 2 m³ volume for 48/72 h. Subsequently, larvae were divided and kept in 10 rearing tanks of 10 m³ volume for 58 days till weaning. Finally 6 circular tanks of 50 m³ volume were used as nursery and larvae kept at the maximum density of 15 kg/m3 till they reached the size of 2 g in order to be sold. Broodstock was feed with organic pellet twice a day for a total consumption estimated on a percentage of 1.5 of the body weight. Feeding protocol for larvae is characterized first by the use of rotifers (*Branchionus plicatilis*) in quantity of 5-10 organisms/ml and then by Artemia till they are transferred to the nursery. Here feeding rate on Artemia in the first 4-5 days is the same, since this is an adaptation period for the larvae to the new rearing environment. Artemia ration is linearly reduced until the fish is completely weaned over to the new diet on organic pellet.

Conversion to organic sea bass farming

In order to produce organic seabass fry, the farm has been certified by a private certification body (BIOS srl) on the basis of the guidelines established by Commission Regulation (EC) 710/2009. After an inspection to verify the rearing condition of the farm and analyzing all the documents, the farm passed through the conversion period of a length of 6 months. As required by specific regulatory framework, the farm applied low animal stocking density; use of good quality water with sufficient oxygen levels; use of temperature and light conditions in accordance with the requirements of the species; adequate flow rates and physiochemical parameters that safeguard the animals' health and welfare and provide for their behavioral need; use of organic feed products derived from sustainable managed fisheries; no preventive antibiotics or synthetic chemicals or hormones used; microbiological checking and applied organic fish processing process.

Production cost evaluation

Having ascertained the technical feasibility of organic fry production, the study went on to assess its economical feasibility. The cost-benefit assessment of conversion to organic fish production was carried out quantifying the costs of the different tasks (feeding, facilities, labour, broodstock, etc.). The cost of each task has been found with the direct costing technique by considering the effective use of resources and manpower at standard prices. Moreover, for each task we have considered and subsequently compared the costs of conventional production to the ones for the organic. Finally, considering the income from conventional sales obtained in 2012 from a production of 6,600,000 fry sold at a price of € 0.215, and estimating an approximated income from the organic sales at a price of € 0,256 we compared the profit between the two systems.

Results and Discussion

The percentage of spawned eggs was the 20-25% of female body weight with a percentage of fertilized eggs equal to 50%, thus the total number of produced eggs was 7,500,000. The survival rate of these items that reached the final size of 4 g was estimated at 20% resulting in an available quantity of 1,500,000 fry for sales. Conversion to organic production naturally involves additional costs concerning the conversion process itself, the production of a new type of product and the lower output. The analysis of the cost are shown in table 1, 2 and 3. The cost of maintenance and insurance for facilities and equipment as well as the depreciation charges did not show differences between the two systems (tab 1).Fuel and energy consumption are generally used for running seawater pumps, oxygenation and other machinery, vehicles and refrigeration plant. Labour costs in Italy mostly depend on characteristic of the level of labour required to manage the different production systems that are installed. Thus demands a high level of technical ability from the operators and often requires technical and engineering staff to be present or on stand-by 24 hours/day in case of mechanical failure, affecting total costs. Moreover, due to a longer production cycle in organic (200d vs 170d), fuel, labour, energy and oxygen cosnsumption resulted higher in organic production Certification and feed costs represented the most significant difference between conventional and organic production. Although the certification cost can be assumed as fixed price and total amount paid was only € 1,000 it should be taken into account that the certification body claims a percentage equal to 0.3% on the total sales of fry per year (table 2). Additionally, organic feed costs are mostly affecting the full production cost because world market prices of the raw materials are still high and only few feed companies sell organic aquafeed. Therefore, purchase conditions and discounts that might be negotiated with feed companies, are very limited. Analyzing the net margin in table 3, considering the output unit in order to have a realistic comparison, data shown a negative difference (-0.012€/fry) applying the organic system. Finally, the current market situation is characterized by a low demand for organic fish; an inadequate product differentiation from conventional (domestic or foreign) ones; a legislation still in progress; an unstructured and scarse offer for

organic; which does not allow to consider organic aquaculture as an activity that today can assure adequate profitability for the most part of Italian aquaculture firms.

Table 1: Unit fixed costs of seabass management referred to a production of 6,600,000 fry (€)

Fixed costs	Organic and Conventional
Broodstock depreciation and insurance	0.000
Machinery and buildings depreciation	0.016
Machinery and buildings repairs and insurance	0.002
Interest rate	0.001
Total Fixed costs	0.018

Table 2: Unit variable costs of seabass larvae management referred to 2012 production of organic and conventional fry till a size of 4 g (€).

Variable costs	Conventional	Organic
Feeds	0.029	0.039
Energy, oxigen and fuel	0.085	0.114
Labour	0.031	0.043
Services	0.039	0.053
Certification	-	0.001
Interest rate	0.002	0.002
Total variable costs	0.187	0.252

Table 3: Conventional and organic fry unit costs and prices (€).

Variable costs	Conventional	Organic
Fixed costs	0.187	0.250
Total cost	0.018	0.018
Price	0.205	0.268
Net margin	0.215	0.256

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