Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development
Vol. 18, Issue 4, 2018
PRINT ISSN 2284-7995, E-ISSN 2285-3952

ECOLOGICAL AQUACULTURE IN SOUTH MUNTENIA REGION

Simona SPÂNU[1], Virgil NICULA[2], Marin FLOREA[3]

[1]"Lucian Blaga" University of Sibiu, Faculty of Agricultural Sciences, Food Industry and Environment Protection, 7-9 Ion Rațiu, Sibiu, Romania, Phone: 00 40 748 675 375; Email: simona_spanu@yahoo.com
[2]"Lucian Blaga" University of Sibiu, Faculty of Economics, 17 Calea Dumbravii, Sibiu, Romania, Phone: 00 40 745 311 090; Email: niculavirgil@yahoo.com
[3]"Lucian Blaga" University of Sibiu, Faculty of Engineering, 4 Emil Cioran, Sibiu, Romania, Phone: 00 40 771 589 170; Email: floreasb@yahoo.com

Corresponding author: simona_spanu@yahoo.com

Abstract

The paper presents the sustainable fishing in relation to environmental protection, the main measures taken by the state to encourage and develop sustainable and lasting fisheries. Time series have been used with regard to the total catches of commercial fishing in Giurgiu County in 2017, total capture from aquaculture in Giurgiu County in 2017 and total catches (tonnes) reported by economic operators authorized to fish commercially in flowing waters under Romanian jurisdiction over 2008-2015. Also, statistical data on fish consumption were used including a questionnaires addressed to fishermen and aquaculture units in Giurgiu County. Last but not least, it includes assessments of ecological aquaculture, the eco-label and measures that our country takes to protect biodiversity, focusing on the balanced exploitation of the fishery resource. Conversion to organic and ecological aquaculture requires a financial support to continue to develop in Romania.

Key words**:** *ecological aquaculture, fisheries sector, environment protection, sustainability*

INTRODUCTION

Ecological aquaculture is a relatively new field of organic production, compared to organic farming, which has long been experienced at farm level. Given the growing consumer interest in organic aquaculture products, it is expected that the number of units going into organic production will continue to grow. This will quickly lead to the accumulation of experience and technical knowledge. In addition, it is to be expected that the planned research activities will result in the acquisition of new knowledge, in particular on restraint systems, the need to use organic feed ingredients or the stocking density for certain species.

It is necessary to provide for the development of an environmental assessment, in order to optimally adapt the space devoted to this activity to the environment and to mitigate possible negative effects.

It should be considered that such assessments should ensure that the production of aquaculture animals is not only environmentally acceptable but is, in relation to other options, predominantly consistent with wider, appropriate and sustainable public interests in environmental point of view.

Since water is a soluble environment, it is imperative that organic production units be properly separated from non-organic aquatic units. Given the diversity of situations existing in EU countries, with regard to both freshwater and marine environments, it is preferable that the separation distances are set at the level of each Member State, best placed to manage this issue, having view the heterogeneity of aquatic environments.

All EU Member States are facing shortages in the supply of organic probiotic crops. At the same time, imports of organic protein feeds are insufficient to cope with demand. The cultivation area of organic probiotics is not high enough to meet the demand for organic protein; therefore it is necessary to conditionally authorize the feeding of protein

feeds from parcels in the first year of conversion.

The general principles of organic production are based on the proper design and management of biological processes based on ecological systems that use the natural resources of the system, using methods that use, in particular, aquaculture practices that respect the principle of sustainable exploitation of fisheries resources. Only in this way can biodiversity of aquatic ecosystems be maintained in aquaculture production. These principles are optimistically based on risk assessment and the use of precautionary precautions when appropriate.

Artificial stimulation of reproduction of aquaculture animals by means of hormones and hormone derivatives is incompatible with the notion of organic production and the way consumers perceive organic aquaculture products. Thus, in Europe, the maximum admissible percentage of non-organic young farmed aquaculture animals introduced in the farm was 80% in 2011, 50% in 2014 and 0% in 2015.

Given that the organic production of aquaculture animals is at an early stage, this sector also faces an insufficient availability of ecological originators. This is why it is necessary to introduce very young and non-organic specimens in the involved states. Organic aquaculture production must ensure that the needs of the animals are met, depending on the species. In this respect, growing practices, management systems and basin systems are based on meeting the animal welfare needs.

MATERIALS AND METHODS

The evolution of the means and methods in recent years in the production of aquaculture animals has led to an ever wider use of closed recirculation systems. These systems, however, depend on external inputs and have high energy consumption, but reduce waste discharges and prevent animals from escaping. In accordance with the principle that organic production must be as close as possible to the natural environment, the use of such systems for organic production is not recommended but exceptionally the use of closed systems is only allowed for artificial breeding, incubation and nursery plants.

Animal health management must be based mainly on disease prevention. Certain substances for cleaning, for treatment against organic deposits and for disinfection of equipment and/or production facilities should be allowed, but under strict control. The use of substances in the presence of live animals requires special precautions and measures to ensure that their application is not harmful.

Feed allocated to livestock in organic aquaculture establishments must meet their nutritional needs, while respecting the health requirements imposed by Community regulations in the field. Raw materials used in fish feed are recommended to be the result of the sustainable exploitation of fisheries resources or organic food from organic aquaculture sources [1].

Nutrients, water, the site chosen for the farm are the most important aspects of the ecological sustainability of aquaculture farms. Efficient use of nutrients needed for food is also essential for ecological sustainability. One of the most important elements is the reduction of food losses through an advanced feeding system and the proper selection of animal feed. The feed source used is another aspect that can contribute to ecological sustainability.

In this paper, time series have been used with regard to the total catches of commercial fishing in Giurgiu County in 2017, total capture from aquaculture in Giurgiu County in 2017 and total catches (tonnes) reported by economic operators authorized to fish commercially in flowing waters under Romanian jurisdiction over 2008-2015. Also, statistical data on fish consumption were used including a questionnaires addressed to fishermen and aquaculture units in Giurgiu County [3].

RESULTS AND DISCUSSIONS

The incipient nature of organic aquaculture and the sustainable exploitation of fisheries resources sometimes justify the inadequacy of organic food or food obtained as a result of

the sustainable exploitation of fisheries resources. This is why clear provisions need to be made in the area of non-organic food use, thereby establishing sanitary rules for fish raw materials that can be used in aquaculture, but prohibiting the feeding of a fish species with fish products of the same species. It is also allowed to use under control certain raw materials used for non-organic food, certain food additives and organic auxiliaries.

In Romania, there were about 100,025 ha of aquaculture farms, structured in 84,525 ha (84.5%) and 15,500 ha of nurseries (15.5%). Virtually all of this area was used by Cypriot farms, except for a 25-hectare area of salmon farms.

In 2013, according to ANPA statistics, there are 748 aquaculture licenses for an area of 102,356 ha, of which 6,673 ha of nurseries (6.5%) and 95,682 ha of farms (93.5%). If the surface for aquaculture was largely kept within this 9-year period, there is an increase in the share of farms at the cost of nurseries. According to the Register of Aquaculture Units (RUA), there are 518 units in the aquaculture sector, which hold 575 aquaculture farms (pond, lakes, ponds, etc.). The 518 registered units are divided as follows: 19 nurseries (holding only a nursery license); 324 breeders (holding only farm license); 175 breeders and nurseries (both holding a nursery and a farm license).

Basically, aquaculture in Romania is currently being conducted exclusively in freshwater and is technologically characterized by two directions:

- intensive growth (especially of salmonids);
- extensive and semi-intensive growth of cyprinids in polyculture, in ponds (ponds, ponds and lakes).

Growth of cyprinids in polyculture in land basins and in extensive or semi-intensive regime has the advantage of preserving the water quality in the case of extensive growth or generates a minor or negligible risk to water quality in the semi-intensive growth regime. Most aquaculture farms have a relatively long history and fit well into the natural landscape, playing an important role in enhancing ecological balances, taking over water, securing and maintaining large areas of wetlands [2].

According to the Market Survey for the Romanian fisheries sector, the structure of aquaculture production by 2005 was dominated by Cypriots, both indigenous (carp, caraway) and Asian origin (Silver carp, bighead fish, grass carp), representing 85% of the total, the remaining 15% being trout, zander, pike, perch, catfish, sturgeon, etc.

In the period 2006 - 2013, this species structure was largely preserved, the tendency being slightly increasing towards cyprinids (carp, Prussian carp, silver carp, bighead fish), representing an average of 87%, as can be seen from Table1. The remaining 13% are the other species, the most important of which is trout.

Table 1. Volume of aquaculture production by species (tonnes)

Species	2006	2007	2008	2009
Carp	3,136	3,544	3,977	4,142
Prussian carp	1,268	1,653	1,462	1,623
Silver carp	2,091	1,696	2,959	2,971
Bighead fish	894	2,056	2,228	2352
Grass carp	256	41	426	283
catfish	19	26	149	133
zander	60	93	49	45
pike	80	27	14	22
perch	7	5	1	6
trout	123	725	1,037	1,238
sturgeons	-	-	-	-
African catfish	-	-	-	-
Other species	184	446	230	316
mussels, oysters	-	-	-	-
crab	-	-	-	-
Total quantity	8,088*	10,312*	12,532*	13,131**
Species	2010	2011	2012	2013
Carp	2,888	2,652	3,266	3,395
Prussian carp	934	1,048	868	1,004
Silver carp	2,016	1,323	2,087	2,031
Bighead fish	1,020	1,289	2,110	2,110
Grass carp	84	62	182	190
catfish	164	33	43	44
zander	57	42	56	43
pike	31	34	31	28
perch	6	4	7	2
trout	1,400	1,710	1,074	1,106
sturgeons	39	19	11	16
African catfish	-	72	150	94
Other species	342	64	112	68
mussels, oysters	-	1	9	16
crab	-	-	1	-
Total quantity	8,981**	8,353**	10,007**	10,147**

Source: FAO*, ANPA**

Traditional cypher culture in land basins is compatible with sensitive habitats and provides environmental benefits and services. In many of the Natura 2000 sites in Romania, aquaculture activities are carried out, which are fully compatible with the conservation of the natural values of the sites, the most eloquent proof being the designation of the aquaculture farm as a NATURA 2000 site. Extensive aquaculture farms have become firm multifunctional where other social and environmental services are provided: recreation, biodiversity maintenance and improved water management.

In Romania, the different configuration of the relief and the variety of aquaculture potential allow the development of aquaculture forms specific to each area. Thus, if the mountainous area is predominantly salmon culture, the cyphered farms are representative in the plain and meadow areas. In addition, in recent times, irrespective of the geographical area, intensive, recirculating aquaculture farms are being developed for a wide range of crop species.

Issues related to land use planning to harness the potential of aquaculture fall within a wider sphere of sustainable development. The execution of hydro technical works (sewage installations, dams, dams, dams) have morphological, hydrological and biological consequences, which is why studies are needed to correct the disturbances created in the original natural biotopes. In this context, the protection and sustainable use of water as a living environment for fish is essential.

There is also potential for the development of organic aquaculture, niche production, such as crayfish or shellfish, as well as for the diversification of aquaculture products with valuable species of indigenous ichthyofauna (linseed, chalice) or exotic species.

Romania has the potential and resources to increase fish production in aquaculture, as it will create an economic environment compatible with that in EU countries. Exploiting the exceptional potential of aquaculture in the European context, harmonized with an appropriate legal and institutional framework, will increase the competitiveness of Romanian aquaculture.

Starting from the current problems of aquaculture, specific to the sustainable development of the sector, in line with the European Union's economic and social policy, whose main objective is to reduce disparities and reduce development gaps between regions, investments have been promoted since 2007 through public and private participation.

Restructuring and modernization processes were imposed because in the area of aquaculture, the main added value of the primary sector (aquaculture) at the level of all the regions of the country was lower than that of the secondary sector (the fish processing industry). Primary sector values reflect the very low level of labour productivity due to poor equipment and equipment, excessive fragmentation of privatization and poor management of some private aquaculture farms.

Another phenomenon present in current aquaculture is the growing population/ repopulation of aquaculture farms, as owners are interested in turning traditional aquaculture farms into recreational / sport fishing. Thus, many artificial breeding stations of cyprinids have lost their activity. This situation was also determined by the lack of capital for the annual purchase of pre-developed larval and brood and market orientation towards imports.

At the South-Muntenia Region level, 12 farms for aquaculture were established since the NRDP 2007-2013, the most numerous being located in Prahova County (5 of which 2 for practicing sturgeoning, 1 for floating fish in floating life, 1 (3 salmon farms) and Dâmbovița County (2 intensive sturgeon farms), and the least in the Călărași and Teleorman counties (as a percentage of the total number of cyprinids in polydropon and 1 salmonic farm). On Measure 2.1.2, 10 projects were implemented in the region on 8 aquaculture farms, in Călăraşi and Giurgiu being two companies that have repeatedly accessed funds. According to the crop species, 8 projects were carried out in 6 cypheric farms, one for the completion of a salmonic farm and one for a sturgeon farm.

Areas that are favourable areas for the development of aquaculture are mainly represented by:
-untapped areas: abandoned aquaculture farms; natural lakes and reservoirs; certain areas of the watercourses, rivers and the Danube River; small areas having access to quality water, conducive to the establishment of recirculating aquaculture farms;
-landscaped but inefficiently exploited: partially productive aquaculture farms due to stuffing, clogging, etc.
The untapped potential of Romanian aquaculture is represented by: unproductive aquaculture farms; storage lakes; abandoned irrigation channels; exploitation of abandoned ballasts, etc.
Natural and anthropic freshwater ecosystems, both for direct and aquaculture in floating life, are represented by:
-permanent rivers (including the Danube River) - for the application of the technologies for the cultivation of the reophyll species;
-natural lakes or storage lakes - for the application of stagnant species culture technologies.
The reasons for non-productive aquaculture farms are:
-farms are undergoing redevelopment - modernization works are being carried out, dykes reconstruction, hydro technical works etc .;
-the farms were left without water after interventions/work at the source of supply or emptying for unblocking;
- investments in progress (new, still under construction, evidence or not in operation);
- farms belonging to some economic agents who have ceased their activity; firms in bankruptcy / insolvency;
- farms in conservation;
- non-concessional farms;
- companies in litigation/ judicial liquidation, with assets purchased by various economic agents, with facilities put up for sale by ANAF.
There is a category of economic agents who hold farms that are active, do not practice aquaculture, but only recreational/sport fishing. In the South-Muntenia they have identified 35 farms unproductive for aquaculture, the most numerous being located in Călăraşi (20), followed by Ialomița (5 farms) and Prahova (with 3 farms in each county). In the Argeş and Dâmboviţa counties, unproductive surfaces are negligible. In Călăraşi County, from the total non-productive area (approximately 443 ha), the largest is an abandoned steel basin (50 ha), the rest being smaller areas, fragmented on different farms. A special situation has been found in the County the farmed salmonids where no water left in the reservoir as it is emptied in order to supply the clogging, and to resume the feed pipes is necessary to construct a new river Ialomiţa.
The analysis of aquaculture needs based on the options received from key stakeholders in the sector concerned, on the one hand, a SWOT analysis for each development region and, on the other hand, the need to make production more efficient, how to use allocated funds and action lines/State intervention measures in close alignment with EU priorities [1]. The analysis of encouraging environmentally sustainable, resource - efficient, innovative, competitive and knowledge-based aquaculture in the South Region identified a series of needs on three levels:
- making production more efficient, proposals on how to use the funds and the action lines / state intervention measures that are outlined below:
- making investments for the re-technologic of production activity in aquaculture, making new investments;
- investments in the realization of the specific infrastructure: roads, warehouses, processing capacity;
- sustained efforts at national level to promote the consumption of fish and fish products and to inform consumers about the organoleptic characteristics of the different species of fish grown in aquaculture farms;
-proper labelling of fish products, with indication of provenance, implementation of quality standards for aquaculture products;
-financial support for research in the aquaculture sector: achieving efficient feeding recipe, developing laboratories for water quality control for aquaculture, development

of ihtio-pathological specialists for the monitoring of fish diseases;
-elimination of unfair competition, achievement of producer associations.
- proposals for the allocation of funds
- allocation of funds for the re-technologic of aquaculture farms;
-allocation of funds for the construction of new aquaculture farms;
-allocating funds for primary storage and processing capacities at farm level;
-allocation of compensation funds as a result of the action of protected ichthyophos birds;
- allocation of funds for a fish stock.
-the needs identified at national level for encouraging environmentally sustainable, resource-efficient, innovative, competitive and knowledge-based aquaculture support the achievement of both new investments and investment in the rehabilitation and modernization of farms existing aquaculture, taking into account the existing productive potential, by:
-the implementation of new aquaculture technologies (including ecological and intensive), competitive with those in EU Member States;
-introducing new species (from the endemic and not only panel) with good market prospects;
-implementation of new technological equipment in aquaculture;
-making investments to improve infrastructure in aquaculture farms (aquaculture facilities, hydro-technical installations and constructions, technological roads, warehouses, etc.);
-introduction of new species with high productivity, short growth cycle and good market prospects;
-developing technologies in traditional aquaculture;
-adopting a code of good fish farming/ aquaculture code and associating compliance with this code with a label / logo / brand;
-creating producer associations to streamline both inputs and outputs.
In addition to these main needs and identified as common in most development regions, there are a number of technical/technological needs, such as:
- the need to inform the general public on the benefits of fish consumption and, on the other hand, the actors involved in this activity, producers - producer organizations on the latest innovations in the field, new technologies, equipment and cutting-edge machinery, new treatments applied in aquaculture farms, etc. This is basically determined by the lack of collaboration between the central authorities in charge of the sector, the research activity in the sector and producers / producer organizations;
the need to specialize the lucrative staff in aquaculture farms, both for technology engineers and for skilled workers;
-the need to support research in the aquaculture sector with a view to developing new techniques and technologies that are appropriate to be applied in each region of the country, drawing up regional regulations in the light of current aquaculture conditions and not last but not least, technological transfer to producers in order to develop a competitive and sustainable aquaculture.
Similar to the investment needs of the sector, granting state tax incentives to stimulate the development of the aquaculture sector is an important necessity in all development regions. Producers in the sector feel discriminated because other areas of activity in the large branch of agriculture (animal husbandry, agricultural crops, vegetable growing, etc.) also benefit from tax incentives.
From the point of view of the administrative needs, identified at the regional levels, it is remarked:
-the need to increase and make transparent the dialogue between authorities and producer / producer organizations in order to make more efficient the problem solving in the sector;
-stimulating the consumption of fish among the population by applying communication and marketing strategies at all levels of the country;
-implementing an effective control and inspection system that, on the one hand, protect aquaculture farms against fish theft and, on the other hand, identify aquaculture farms conducting their productive activity;
- stimulating research on aquaculture;

In order to make aquaculture activities more efficient, producers / producer organizations in all development regions support the need to allocate funds for the rehabilitation and modernization of existing aquaculture farms, including the abandonment of abandoned farms [4].

For the aquaculture sector at regional level, the following needs were identified:

-developing the processing and marketing capacity of the fish produced, while promoting the consumption of fresh domestic fish;

-granting compensations as a result of the action of the birds protected on all farms;

-harmonizing the funding ceiling so that a maximum number of aquaculture farms can be funded;

-increasing the financial allocation for pilot projects to be carried out only in partnership with research institutes, whereby the new technologies identified as generating higher profits are tested at macro level;

-financial support for the setting-up of producer organizations.

Recognizing that European aquaculture needs support for its development, four priority action lines are identified to unlock the potential of European aquaculture: simplification of administrative procedures, coordinated spatial planning, competitiveness and a level playing field.

In this context, the general objective of developing Romanian aquaculture is to stimulate environmentally sustainable, resource-efficient, innovative, competitive and knowledge-based aquaculture:

-modern aquaculture is an essential area for the sustainable development of the fisheries sector, which is why specific activities must undergo a process of technical and technological modernization, through investment and innovation, through a more efficient management of financial, material, aquatic and human resources, such as and through the transfer of scientific knowledge, in the field of applied and managerial research, with strict respect for environmental conditionality and biodiversity;

-the viability of aquaculture involves commercial competitiveness, economic and financial profitability and environmentally sustainable activities;

-the competitiveness and profitability of operators, including SMEs, are conditioned by increased consumption of fish and fish products by the population, increasing demand by the processing industry and demand for fishery products on EU and non-EU markets.

These conditional factors have as a basis for their activation the existence of a permanent and increasing offer of high quality fish and affordable unitary price. Given that the supply of fish caught by fishing is limited for reasons of maintaining aquatic biodiversity, species perpetuation and overexploitation through fishing, the increase in supply of fish as close as possible to demand can be achieved by modernizing, rehabilitating or expanding farms of existing aquaculture and the construction of new farms. This obliges public authorities responsible for a global territorial approach to the development of aquaculture, which implies the identification and mapping of aquaculture areas; in which aquaculture was practiced and activity was abandoned; favourable to aquaculture activities by setting up new farms.

CONCLUSIONS

Promoting environmentally sustainable aquaculture and ecological aquaculture ensures the protection, conservation and restoration of biodiversity in aquatic ecosystems, and conversion from traditional aquaculture to ecological aquaculture, requiring financial support and compensation for losses during conversion to organic aquaculture.

The competitiveness of aquaculture is also ensured by the quality of human capital involved in the relevant activities of this field. In this regard, the strategy envisages a sustained intervention to increase the qualities and professional competencies of all categories of staff working in this important fisheries area which target specialized education activities organized within the fisheries, zoo technical education units and /

or of veterinary medicine, as well as continuous training for all categories of staff.

Given that the financial availability of aquaculture operators and those wishing to develop a business in this sub-area is in most cases limited in order to ensure co-financing of investments in aquaculture, it is intended to facilitate access to financial resources complementary banking through financial engineering techniques. The key condition for financially supporting the development of the aquaculture sector is strict compliance with relevant national and EU regulations.

The European Commission has committed itself to implementing a coordinated management plan at different levels without compromising the objectives of the Birds and Natura 2000 Directives, which also protect fish stocks and aquatic ecosystems. It is envisaged:

-the numerical increase of the aquaculture farms, respectively the afforested area, implementing additional environmental measures;

-support by granting compensation to aquaculture farms located in and around Natura 2000 sites;

-support for aquaculture farms providing social and environmental services, ecological tourism, recreational / sport fishing, educational activities related to knowledge, protection and conservation of aquatic biodiversity, improvement of water management;

-the use of multispecies populations that increase the quality of production;

-periodic maintenance and hygiene of aquaculture basins (discoloration).

The sustainable development of aquaculture is one of the main priorities of the EMFF. The money allocated to this priority may include:

-innovative equipment investments, upgrading to improve productivity, to limit negative environmental impacts and maximize positive effects;

-farm management and consultancy services;

-training and certification of staff;

-identifying and mapping appropriate aquaculture areas to improve territorial planning;

-support for new farmers entering the sector;

-consultancy and support for conversion into environmental management schemes;

-the provision of additional environmental services in favour of revenue growth based on production;

-eradication of diseases and schemes to improve the health and welfare of animals.

For 2014-2020, approximately 20% of the European Fisheries Fund and Maritime Fund (FEPAM) funding is planned to be invested in the aquaculture sector. Each Member State has developed an operational program which is then adopted by the Commission and outlines how funding from both national and EU sources will be geared towards the strategic priorities for sustainable jobs and growth in the aquaculture sector, in line with multi-annual strategic plans.

ACKNOWLEDGMENTS

This paper is carried out within the framework of the project *"LENA - Local Economy and Nature Conservation in the Danube Region"*, DTP - 1-189 -2.2.- LENA financed by the Danube Region Transnational Cooperation Program 2014-2020, Call 1, Priority Axis 2 - Environment and a responsible culture in the Danube Region, Specific Objective 2.2. - Sustainable use of heritage, natural and cultural resources.

REFERENCES

[1]Commission of the European Communities, 2005, Proposal for a Council Regulation on organic production and labelling of organic products, Brussels, Belgium

[2] CONSENSUS Project, www.euraquaculture.info, Accessed in March 10, 2018

[3]Nielsen R., Guillen J., Carvalho Natascha, Scientific, 2016, Technical and Economic Committee for Fisheries (STECF), Economic Report of EU aquaculture sector (STECF-16-19), Bruxelles

[4]SustainAqua case studies, /www.sustainaqua.org Accessed in Febr. 15, 2018