
Organic Aquaculture as a Promising Direction for the Production of Organic Food

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Abstract

Over the past 15 years, there has been an increase in demand for seafood grown in accordance with certified organic standards, especially in European countries. The relevance of the research topic is determined by the need to substantiate the prospects for the development of organic food, in particular organic aquaculture. The purpose of this article is to summarize the trends in aquaculture production, organic farming, and to identify and describe the main trends in organic aquaculture production in Russia. To assess the prospects for the development of world production of fisheries and aquaculture products, methods of analysis of regulatory legal documents, methods of consolidation and synthesis of information, statistical analysis were used. The information basis for studying the production of organic aquaculture in the Russian Federation was made by expert assessments, data from the National Organic Union of official departments and periodicals. The article clarifies the factors affecting the development of aquaculture production. The main problems negatively affecting the demand for organic aquaculture in Russia are highlighted. Future perspectives and challenges for the further development of organic aquaculture are discussed in a broad context. Materials of the article will be useful for producers and potential investors, as well as other participants in the Russian market of organic products.

Keywords: ecological products, organic aquaculture, consumer culture, food, agriculture, aquaculture, organic food

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INTRODUCTION

The dynamics of population growth in the world dictates the need to intensify the development of agriculture and increase the volume of food. This can be achieved by relying on intensive forms of livestock, poultry and fish farming.

As part of the development of agriculture in the recent years, the organic direction has also been intensively developing, in the world practice the terms "organic agriculture" and ecological are used (Bragin et al. 2018, Khotinskaya and Chernikova 2017). The specificity of the production of organic products is to

limit or completely abandon the use of chemical fertilizers, pesticides, water additives, veterinary drugs, technological additives or auxiliary means of synthetic origin.

According to expert estimates, over the past 15 years, the global market for organic products has grown by almost 5 times - from \$ 18 to \$ 82 billion, its share is 10% of the total world food market, according to the forecasts by 2022 the market for organic products will exceed \$ 200 billion (Agroxxi 2018).

According to the National Organic Union, currently 179 countries of the world are developing

organic agriculture, it employs more than 2 million producers, 89 countries have their own laws in the field of production and turnover of organic products. Annual production growth is 12-15% per year, and, according to forecasts, such rates will continue until 2025.

Russia occupies 0.2% of the global market for organic products, but has great potential for expanding their production.

According to the Ministry of Agriculture, currently in the Russian Federation there are more than 10 million hectares, which can be put into circulation. Most of them are lands suitable for organic farming, but mineral fertilizers were not applied to them for a long period of time (Agroxxi 2018).

Aquaculture makes a larger contribution to food production worldwide, as the sustainable limits for most stocks of wild fish are now almost reached or even exceeded (Edwards 1998, Stanciu et al. 2015).

Production of organic aquaculture is one of the promising areas for the production of organic food. As Perdikaris and Paschos (2010) note, aquatic products from organic production are becoming more and more accessible to consumers. Over the past 15 years, there has been an increase in demand for seafood grown according to certified organic standards, especially in European countries (Prein et al. 2010). This is due to the fact that the process of aquaculture production can guarantee the transparency and manageability of production as a basis for improving safety and environmental friendliness.

Let us give an example of the definition of the term organic aquaculture from the standard Organic Aquaculture Standards. National Standard of Canada (2012). Canadian General Standards Board (2012) "Organic aquaculture is a holistic system designed to optimize the productivity and suitability of diverse communities in an aquatic ecosystem, including benthic organisms, algae, aquatic plants, aquaculture, animals and humans. The main goal of organic aquaculture production is the development of enterprises that are harmonious with the environment."

Organic aquaculture is becoming attractive for investors. The Global Investment Fund, Aqua-Spark, aims to build a network of 60-80 innovative aquaculture companies with a total investment of \$ 400 mln. For two years (2014-2016), the managing partners of the fund attracted \$ 19.25 mln to the fund (Impactalpha.com |

September 06, 2016), about \$ 17.8 mln. of which have already been invested in 7 innovative aquaculture companies. (Innovative aquaculture projects supported by the venture company Aqua-Spark).

Taking into account the available natural resources and the growing global demand for organic products, the development of ecological aquaculture may represent a niche market for local producers (Ahmeda et al. 2017, Paul and Reinhard 2013).

METHODOLOGICAL FRAMEWORK

The scientific basis of this study was the research of Russian and foreign researchers in the field of organic agriculture, aquaculture and organic aquaculture. In this study, the authors used the methods of analysis of normative legal documents, analytical, review and other materials, interpretation of the results, the method of consolidation and synthesis of information. To assess the prospects for the development of world production of fishery and aquaculture products, the method of statistical analysis of the report "The State of World Fisheries and Aquaculture (2018). The information basis for studying the production of organic aquaculture in the Russian Federation was made by expert assessments, data from the National Organic Union of official departments and periodicals.

Based on the results of the study was the generalization of the obtained results in the form of recommendations.

RESULTS AND DISCUSSION

Assessment of Aquaculture Development at the Present Stage

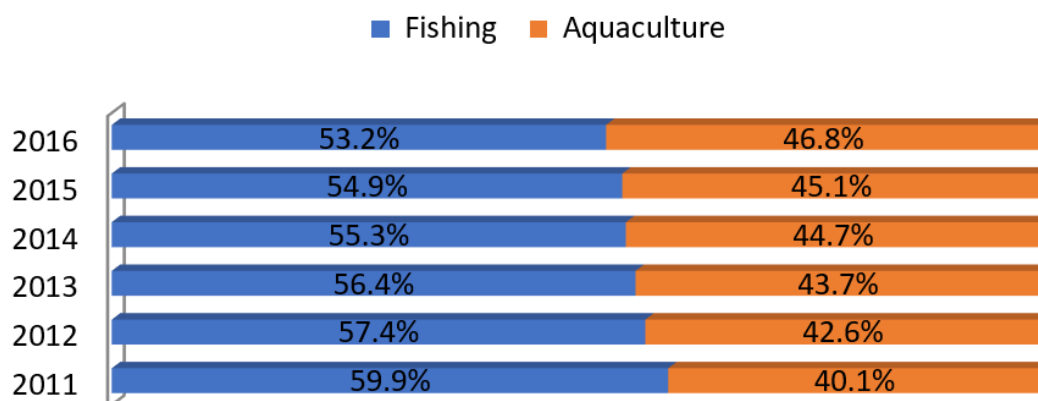
The assessment of aquaculture development at the present stage is based on the analysis of data presented in the report "The State of World Fisheries and Aquaculture" (2018).

In terms of development, aquaculture, as before, is ahead of other sectors of the fishing industry, although in comparison with the 1980 (11.3%) and the 1990 (10.0%), production growth slowed down. The average annual growth for the period of 2000-2016 was 5.8 %, while in a number of countries, especially in Africa, in 2006-2010 this figure remained two-digit. In 2016, global aquaculture produced 80.0 million tons of food fish, 30.1 million tons of aquatic plants and 37,900 tons of non-food products. 54.1 million tons of fish, 17.1 million tons of mollusks, 7.9 million tons of crustaceans and 938,500 tons of other aquatic animals were raised. The championship in world aquaculture belongs

Table 1. Production and use of fisheries and aquaculture products in the world

Production (million tons)	2011	2012	2013	2014	2015	2016
Fishing						
Internal waters	10,7	11,2	11,2	11,3	11,4	11,6
Sea waters	81,5	78,4	79,4	79,9	81,2	79,3
Total, fishing	92,2	89,5	90,6	91,2	92,7	90,9
Growth rate of fisheries products,%	-	97,1	101,2	100,7	101,6	98,1
Aquaculture						
Internal waters	38,6	42	44,8	46,9	48,6	51,4
Sea waters	23,2	24,4	25,4	26,8	27,5	28,7
Total, aquaculture	61,8	66,4	70,2	73,7	76,1	80
Growth rate of aquaculture production,%	-	107,4	105,7	105,0	103,3	105,1
Total, world fisheries	154	156	160,7	164,9	168,7	170,9
Growth rate of world fisheries,%	-	101,3	103,0	102,6	102,3	101,3
Utilization						
Food fish (million tons)	130	136,4	140,1	144,8	148,4	151,2
Growth rate of the use of food fish,%	-	104,9	102,7	103,4	102,5	101,9
Non-food fish use (million tons)	24	19,6	20,6	20	20,3	19,7
Growth rate of the use of non-food fish,%	-	81,7	105,1	97,1	101,5	97,0
Population, billion	7	7,1	7,2	7,3	7,3	7,4
Fish supply per capita (kg)	18,5	19,2	19,5	19,9	20,2	20,3
Growth rate of fish supply per capita,%	-	103,8	101,6	102,1	101,5	100,5

Category 2011 2012 2013 2014 2015 2016

**Fig. 1.** Structure of the world fishery products of 2011-2016, %

unconditionally to China: it not only surpassed other countries in 2016, but since 1991 it has grown more fish than all other countries of the world together. In 2016, Bangladesh, Vietnam, Egypt, India, Indonesia and Norway were among the largest manufacturers. From aquatic plants, algae were first grown and, in much smaller amounts, microalgae. The largest producers of marine plants in 2016 were Indonesia and China. Growing species of marine animals that require the use of feed has grown faster than species for which feed is not required; production of the latter, as before, continues to grow. In general, the production of species that do not require the use of feed reached 24.4 million tons in 2016 (30 % of the total number of farmed fish). This figure includes 8.8 million tons of filter-feeding fish (mostly white and big-cut silver carp) and 15.6 million tons of marine invertebrates, mostly bivalves, which are grown in the seas, lagoons and estuaries. Often, algae and bivalve mollusks are referred to as

biofilters that can clean the environment of waste from it, including cultivation waste of species that require the use of feed and reduce nutrient saturation of water. The development of aquaculture should follow the path of simultaneous cultivation on the same areas of species requiring the use of feed and biofilters. In 2016, biofilters accounted for 49.5% of total aquaculture production (The state of world fisheries and aquaculture 2018).

The contribution of Russian aquaculture to the total volume of fish production in the country remains small - just over 4% (Statistics for 2016 2017). It is clear that the development of aquaculture in Russia still does not correspond to the country's potential natural resources or global average indicators of industrial development. Such low volumes of aquaculture production can be explained, in particular, by the fact that fish protein requirements have so far been covered by relatively large volumes of fish products that are abroad.

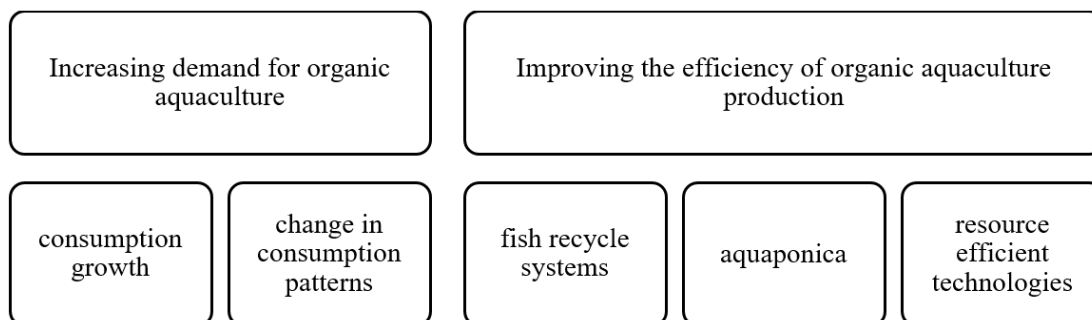


Fig. 2. Factors affecting the development of aquaculture production

Thus, an analysis of statistical data clearly demonstrated that aquaculture has the potential to reduce the gap between food supply and demand and help countries achieve their goals in the economic, social and environmental areas. Aquaculture provides nearly half of the fish products consumed for fish. Certain issues are associated with this sector in terms of food safety and human health.

Fig. 2 shows the main factors contributing to the development of aquaculture.

The works (Ottinger et al. 2016) and other researchers emphasize that consumption growth due to an increase in population which is one of the main factors behind the growth in demand for aquaculture. The growth of the purchasing power of the population, the progress of dietary science, the growth of public awareness about the health effects of nutritional patterns resulted in the development of the organic food market.

It should be noted that environmental friendliness is not always guaranteed for fisheries, due to the complexity of controlling the entire supply chain: from the place of catch of fish to the route and method of transportation. The urgency of increasing transparency and control over the logistics of fishery products led to the implementation of relevant international and national programs (Dvoryaninova et al. 2017, Technical Regulations of the Eurasian Economic Union “On the safety of fish and food fish products” 2017). Most of the intensive industrial aquaculture has a highly centralized structure in terms of production and distribution (Wurts 2000).

On the other hand, the emergence on the market of technologically updated and new aquaculture production technologies reduces the resource intensity of production, which creates broader opportunities in terms of technological and financial accessibility,

creation and development of aquaculture facilities for small and medium-sized businesses (Little 2009).

Trends in the Development of Organic Aquaculture

As it is noted above, the production of organic products is increasing every year. For example, in the EU, the total area of organic farming projects in 2017 was 12,600,000 hectares, which is 25% more compared to 2015, and amounted to 7% of the total agricultural land. It is noted that among the EU member states the largest share of organic territory belongs to Austria, in which 23.4% of agricultural land is cultivated according to the principles of organic farming. In the second and third places are Estonia (19.6%) and Sweden (19.2%), followed by Italy (14.9%), the Czech Republic (14.1%), Latvia (13.9%) and Finland (11.4%). In Germany, from 2007 to 2017, the number of organic chickens in German enterprises increased from 1.8 million to 5.1 million, organic eggs, then in 2017, 1.3 billion were produced, in total, Germany received selling 12.1 billion eggs., approximately one in ten eggs in the stores of the country is organic certified. In recent years, sales of certified organic products have also increased dramatically in the United States, since in 2016, American farms and ranches sold about \$ 7.6 billion in certified organic products, more than double the sales of \$ 3.5 billion in 2011 .

With respect to organic aquaculture there is no such detailed statistics. Organic aquaculture, as a promising direction for the production of organic food, is characterized by high rates of development. This is confirmed by expert estimates, in Prein et al. (2010), it is noted that in 2008 the total volume of organic aquaculture production in the world was about 53,500 tons with a total market value of 300 million US dollars. The article by Lagutkina and Ponamarev (2018) notes that the production of organic aquaculture is focused on the cultivation of salmon (10%), mollusks (5%), carp (1%), shrimp (1%), trout (0.3%) and sturgeon (0.3%). Most of the organic products, out of 400 thousand tons,

are produced in China - 304 thousand tons (80%) and in Europe - 76 thousand tons (19%). In 29 countries, certified organic aquaculture products comprise 30 species. Further market penetration of organic aquaculture products will depend on improved coordination between production and market (Xie et al. 2013).

Today, there are about 90 different standards of organic aquaculture, of which almost 20% are in the countries of the European Union. The trend is the continued steady growth of the organic aquaculture sector, accompanied by the creation of more national standards in addition to existing world standards. National standards for the production of organic aquaculture contain such formulations as a ban on antibiotics, a restriction on density (by type), a ban on the use of chemical anti-fulants, restrictions on the treatment of pesticides, nutrition control, including restrictions and a total ban on artificial dyes and other synthetic additives. Fishmeal and fish oil should be organic when they are commercially available (or otherwise obtained from scraps of fish already caught for human consumption in sustainable fisheries).

Monitoring compliance with the requirements established in the standards is carried out from the stage of production of feed, equipment, incubator, production of planting material, water supply system until delivery to the final consumer. Compliance with the requirements ensures high quality, environmental friendliness and product safety.

In Russia, the regulatory and legal framework for the development of the market for organic production is not fully formed, the Federal Law "On Organic Products and on Amendments to Certain Legislative Acts of the Russian Federation" comes into force on January 1, 2020.

The law introduces the definition of organic products, prohibits its production on the same equipment as conventional products, as well as the mixing of organic and inorganic products during storage and transportation. It is forbidden to use packaging, consumer and transport packaging, which can lead to pollution of organic products and the environment, including the use of polyvinyl chloride (PVC, used for the production of pipes and window profiles) for packaging, consumer and transport packaging. It also imposes a ban on the use of agrochemicals, pesticides, antibiotics, growth and fattening stimulants for animals, hormones - with the exception of those permitted by the national, interstate and international standards in

the field of organic production in the Russian Federation. It is also prohibited to use embryo transplantation, cloning and methods of genetic engineering, genetically modified and transgenic organisms, as well as products manufactured using genetically modified and transgenic organisms. The production of organic products is also incompatible with the hydroponic method of growing plants.

The growth in consumption of organic products is due to consumer motivation for environmental safety of food; preservation of the natural environment in the production process; lack of genetically modified organisms.

Thus, in recent years, Russia has intensified work on supporting organic products, in particular organic aquaculture, in terms of creating a national system of legal acts regulating this type of activity, as well as consolidating the efforts of participants in the Russian organic market.

In 2013, the group of companies "Agranta"; "The Alphabet of Taste"; LLC "ARIVERA"; Agrarian System Technologies LLC and Organic Corporation established the National Organic Union, the purpose of which is to provide a comprehensive assistance to the formation and sustainable development of the national market for organic products in Russia, including the creation of organizational, economic, legal and social conditions, necessary for the development of domestic production of organic agricultural products.

As it was noted in the study, the implementation of ecological, in other words, organic, commercial fish farming is inextricably linked with the general formulation of the question of the production of organic agricultural products.

Volumes of production of organic products in Russia are insignificant (**Fig. 3**). According to expert estimates, the demand for organic products falls mainly on large Russian cities, which is largely due to the high price. Two main factors negatively affect demand: a high level of consumer mistrust, the volume of organic counterfeit in Russia is estimated at more than 80%, and a high price (Mironenko 2018). The high cost of organic products is due to a small number of enterprises - 80 certified manufacturers. The enactment of the law on organic products is aimed at forming a legal field, and accordingly build real programs of support for producers of organic products, preferences, and measures of state support for bona fide agricultural producers producing organic products.

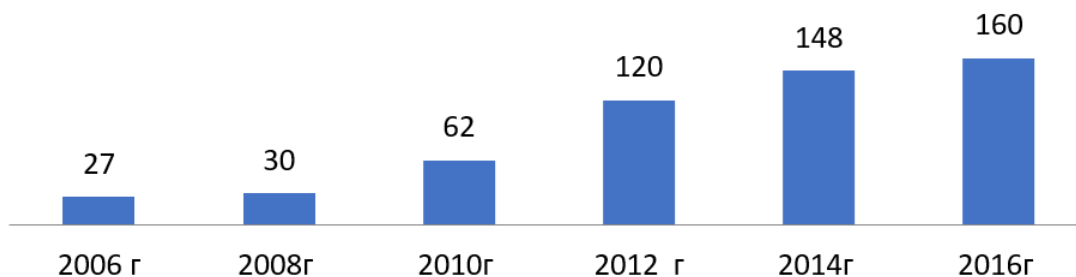


Fig. 3. Market volume of organic products in Russia (million dollars)

Source: <http://agrovesti.ru/rubrika/article/oleg-mironenko-mirovoy-rynok-organiki--eto-otkrytaya-nisha-dlya-rossiyskih-proizvoditeley->

CONCLUSION

According to the results of the study, the following conclusions can be drawn:

- aquaculture makes a greater contribution to food production worldwide, as the sustainable limits for most stocks of wild fish are now almost reached or even exceeded.
- production of organic aquaculture is one of the promising areas for the production of organic food

– Russia holds an insignificant share of the global market for organic products, but has a great potential for expanding their production.

In order to ensure sustainable development of organic aquaculture, it is necessary to form a national system of legal acts regulating this type of activity, developing and implementing programs to support bona fide agricultural producers producing environmentally friendly products.

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