Development strategies for maritime farms in Crimea

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Abstract. The paper presents the results of studying current problems of mariculture industry operation. The results pinpoint factors that allow for an effective development of aquaculture sector, prove its importance for global fishing industry and its potential role in the food supply of the population of the region. The most perspective areas of development are identified based on the current world trends and actual characteristics of natural resource potential of Crimea peninsula. An accent is made on the commercial production of hydrobionts as a socially oriented field of fishing industry which allows for the preservation of ecosystem integrity and a way to become an alternative job provider, which in turn can help reach the objectives of the fishery industry in all three system areas – regional, environmental and socio-economic. Arguments are provided in favor of development of a rigid financial system, including actual means of targeted support of mariculture farms, in order to provide sustainable operation of said mariculture farms.

1. Introduction

The current task of Russia as a maritime power is to ensure optimal and sustainable functioning of the marine system which relies on the use of mineral and biological resources and energy. At the same time, fishing practices of recent decades show that biological reserves of our planet's hydrosphere are far from limitless and need to be protected and cultivated. Intensive and ineffective use of bio-resources of aquatic environment, deterioration of ecological conditions under anthropogenic pressure on marine ecosystems, as well as adverse natural factors have led to the depletion of population of many species and plants of the ocean, and decrease in bio productivity in a number of it areas [1]. This fact indicates significant importance of development of aquaculture. The factors in favor of this argument include:

- ability to deliver high quality marine products, especially fresh and live products, which are in constant high demand;
- fishing is limited to the depletion of fish resources, various legislation, bans on fishing in some areas and an increase in the cost of developing new fisheries;
- aquaculture requires less start-up capital to start production and the initial product cost is lower than in fishing;
- thanks to its farming system, aquaculture is a less risky and more predictable business than fishing [2].

Many governments are paying significant attention to aquaculture sector and try to prioritize economic and social development to its support thus recognizing increasing importance of aquaculture sector in world fisheries and international trade.

The economic role of coastal fisheries is to ensure the stable supply of a wide range of fish and non-fish products to the population and industrial consumers, to involve undeveloped resources and territories into...
the economy, and therefore increase the output of goods and tax cashflow into local regional budgets.

The social role of coastal fisheries is to provide employment for the able population and to create new jobs. In addition, an important factor is the increase in the average level of well-being of the population, as well as formation of local’s sense of "ownership" and, consequently, increased responsibility for the preservation of environment and respect for environmental management.

Implementation of the coastal fisheries and mariculture farming development program, in our view, can attract significant investment flows of both local and foreign capital, and enhance the development of medium-sized and small business, which will lead to improved financial conditions and economic growth in the region in general.

In many coastal regions of the world, coastal fishing is a leading component of the economy. Each fisherman's workplace provides 6-8 jobs in related areas. The social and economic effect of this value chain is so great that in many countries the state provides direct or indirect financial support when its first stage, which is fishing, is unprofitable [2]. Interest in the revival of coastal fishing is now observed in all coastal regions of Russia.

The state should be sponsoring a closer and more cost-effective union of seafood production and their deep processing at onshore capacities, which in turn would not only reduce the share of the raw material component of export of fisheries, but also improve the social infrastructure of the coastal areas of the region. A way to sponsor such activities is to provide state guaranties and benefits to fisheries that provide supply for onshore processing plants. In addition, a more efficient loading of existing fish processing plants and the construction of new ones can be achieved by securing the ownership of raw materials behind onshore companies [3].

Mariculture should participate in the strategy of revitalization of the fishing industry and coastal economy, as well as provide alternative income, paid jobs, while simultaneously not disrupting the environment and not hindering in the traditional fish farming practices and aquaculture. The introduction of mariculture can also contribute to the development of related economic areas, such as food and non-food production, fish processing, production of concomitant equipment and other agricultural and marine activities.

In addition, the operation of the mariculture complex should be based on the latest scientific advances in physical oceanography, hydrobiology, hydrochemistry, marine geology and geophysics, ecology as well as relevant basic technologies, environmental approaches and integrated management systems.

Mariculture starts to play a special role in those regions that are more perspective for its development such as Crimea. This stipulates the necessity of development of an effective management system that would solve following tasks [4]:

- development a regulatory and legal framework for maricultural farms, adequate to the tasks of effective development;
- creation and implementation of a mechanism for long-term and effective management of the development of maricultural farms in Crimea Republic;
- development of measures of state support for mariculture farms;
- overcoming administrative barriers, promoting the creation of new enterprises, with their strengthening and development;
- expansion of research and development in the cultivation of hydrobionts, strengthening of scientific, technical and educational capacities;
- development and use of new credit and investment mechanisms, the creation of conditions that facilitate access to financial, information, production and other resources for mariculture farmers;
- development of knowledge and information system for the maricultural sector;
- improvement of protection of water biological resources and their habitats;
- development of international cooperation in mariculture;
- infrastructure elements development.

Unique hydrogeological and climatic characteristics of Crimea Republic play to the traditionality of fishing activity in the region; recognition of the importance of the fishery complex as an element of food
security and its importance in laying the foundations of a socially-oriented economy actualizes the development of the region's fisheries as the most important direction in environmental development of the region.

At the same time, despite the significant potential in this area and the positive dynamics (average growth rate of production of aquaculture goods (including mariculture) of Crimea Republic is 1.73 times higher than the average growth rate production in the Southern Federal District), the total production volume of Crimea Republic accounts for no more than 4% of the total production of the Southern Federal District (table 1, Figure 1).

### Table 1. Dynamics of commercial aquaculture production in the Southern Federal District.

| Region                        | 2014 | 2015 | 2016 | 2017 | 2018 |
|-------------------------------|------|------|------|------|------|
| Rostov region, thousand tons  | 21.82| 21.24| 23.41| 26.99| 28.45|
| Krasnodar region, thousand tons| 19.77| 19.65| 21.99| 22.89| 22.52|
| Astrakhan region, thousand tons| 18.05| 17.88| 23.18| 23.28| 22.07|
| Republic of Crimea, thousand tons| 0.29 | 0.62 | 1.65 | 2.52 | 2.86 |
| Volgograd region, thousand tons| 2.78 | 2.62 | 2.34 | 2.68 | 2.54 |
| Other regions, thousands of tons| 0.09 | 0.16 | 0.24 | 0.26 | 0.25 |
| Southern Federal District, total, thousand tons| 62.8 | 62.17| 72.81| 78.62| 78.69|
| The share of the Republic of Crimea in the total volume of commercial aquaculture, %| 0.46 | 1.00 | 2.27 | 3.21 | 3.63 |

We have assessed the investment potential of the development of maricultural farms of Crimea Republic with the following results. The strengths include natural and recreational potential; the weaknesses are - bureaucratization and corruption, low level of business interaction with scientific institutions, weak involvement of local authorities, unresolved land ownership issues. The opportunities are connected to the climate of the region (warm climate of Eastern Crimea provides for a shorter growth period for mussels and oysters to reach commercial size), the threats include increased social tension, business raiding, an increase in the cost of financial resources [4].

In connection with the assessment findings, given current world trends as well as characteristics of the natural resource potential of Crimea, the authors consider it necessary to focus on the commercial cultivation of hydrobionts because: they are socially oriented arm of fishing industry; they contribute to the preservation of the integrity of the ecosystem; they act as an alternative source of employment that can help reach the objectives of the fishery industry in all three areas of development – regional, environmental and socio-economic.
Considering the organization of mariculture farms of Eastern Crimea, we can note several areas for its development, which depend on the type of object of cultivation, adopted system or technology, as well as on the category of reservoir or characteristics of the marine area:

- fish nurseries specializing in the cultivation of young valuable fish and non-fish mariculture objects;
- pastoral maricultures: using marine areas to grow shellfish on artificial carriers in monoculture, or in combination with other marine inhabitants; using closed or semi-closed water facilities with saltwater for foraging of sea fish or crustaceans (commodity foraging lake-estuary farms);
- commercial marine farms that use marine cages (for fish) or carriers (for invertebrates) to grow commercial products;
- other possible forms of maricultures.

Simultaneously, the first priority is to organize large-scale artificial reproduction of rare and valuable types of hydrobionts, as well as to organize intensive commercial cultivation of some delicacies and popular species of fish on the basis of natural reservoirs, ponds, swimming pools and cage farms, which allows for the usage of both scientific and natural-resource potential of the region [5].

The authors found that the key direction of aquaculture development in mass commercial cultivation of fish (e.g. rainbow trout and So-iuy mullet) is marine cage culture, which has several advantages over the cultivation of hydrobionts in natural bodies of water without the use of artificial barriers.

Thus, scientists from the FSBSI “AzNIIRH” have investigated the areas of location of commercial farms of Crimea Republic and their expected output of products in these territories (table 2). Based on the provided data Lake Donuzlav in Eastern Crimea is considered to have a preferable natural resource base, whose hydrogeological and biotic characteristics are unique and are most suitable for organizing mass commercial cultivation of fish and other types of seafood [6]. At the same time, the most appropriate type of business activity at this water facility, we believe, is the organization of mixed fish-mussel-oyster farms with an incomplete fish production cycle (with the receipt of fish-planting material from specialized farms).

Table 2. Recommended areas of commercial farms location in Crimea Republic [6].

| Commercial farm location | S  | Expected output of goods by species                  |
|--------------------------|----|-----------------------------------------------------|
| 1. Pre-strait part of the Black Sea from cape Takil to cape Chauda | 3500 | mussel - 3.3 thousand tons oysters - 4.0 million pcs.  |
| 2. Dvuyakornaya bay from cape Ilya to cape Kiik-Atlama               | 300  | mussel - 0.3 thousand tons 0.                   |
| 3. South Coast of Crimea from Sudak Bay to cape Megan to cape Fiolent | 800  | rainbow trout - 0.15 thousand tons bass - 0.05 thousand tons mussels - 0.8 thousand tons oysters - 1.5 million pcs.  |
| 4. Calamit Bay from cape Margopoulo to cape Yevpatoriya              | 1500 | rainbow trout - 0.25 thousand tons bass - 0.1 thousand tons mussels - 1.8 thousand tons oysters - 3.0 million pcs.  |
| 5. Lake Donuzlav and adjacent areas of the Black Sea                  | 1100 | mussels - 1.3 thousand tons oysters - 3.0 million pcs.  |
| 6. Western Crimea from bay Karadzhinskaya, cape Tarhankut to cape Peschanoy of Baikalskaya bay | 900  | rainbow trout - 0.3 thousand tons bass - 0.15 thousand tons mussels - 1.0 thousand tons oysters - 2.0 million pcs. |

At the same time, given the importance of continuous innovation to create the competitive advantage of the region, we believe it is appropriate to develop following areas: introduction of innovative projects to grow marine and freshwater macro- and microalgae, and the production of valuable food, feed, pharmacological and cosmetic products; introduction of deep waste-free processing of grown seafood for the purpose of obtaining food, feed and medical-therapeutic products, in particular, protein-
carbohydrate concentrates from mussels of a wide range of therapeutic and medicinal action [7].

The scale and effectiveness of industrial mariculture development in the short, medium and long terms will be determined by the success of financial, organizational, environmental, socio-economic, and legal problem solving.

Financial difficulties are connected to the significant value of required capital investment into mariculture farms. They include search for initial funding for the organization, construction and operation of marine plantations and relatively long return on investment period. Even with sufficient funding, the return on investment period of the project of growing mussel meat in the waters of Japanese aquatic region of Eastern Crimea is at least 3 years, provided that the investor will be ready to implement such projects for at least 5 years. Additionally, it is necessary to compare the indicators of reproductive capabilities of marine areas as well as various modifications of contraptions for growing mussels (collectors) [8].

The results of the assessment of investment potential of development of maricultural farms of Crimea Republic indicate following characteristics: the strengths include natural and recreational potential; the weaknesses are - bureaucratization and corruption, low level of business interaction with scientific institutions, weak involvement of local authorities, unresolved land ownership issues. The opportunities are connected to the climate of the region (warm climate of Eastern Crimea provides for a shorter growth period for mussels and oysters to reach commercial size), the threats include increased social tension, business raiding, an increase in the cost of financial resources.

It should be noted that a sustainable and well-established financial system is necessary for the successful activities of mariculture farms. Such a system would provide necessary financial capabilities as well as their concentration in the key areas of operation. The issue of forming an effective investment strategy for maricultural farms is very acute.

The financial system of maricultural farms should include the following blocks [3]:

1. Total amount of cash flow sources.
2. The mechanism of cash revenue accumulation cash and its further investment (distributions) in innovation, investment, social, environmental and other projects and targeted programs.
3. Assessment of effectiveness of use of own and borrowed capital.

In our opinion, the main sources of funds for financing mariculture farms should be:
- budget allocations at the federal and regional levels;
- own funds (investments from profits and production);
- financial resources of various types of commercial structures (investment companies, commercial banks, insurance companies, etc.)
- foreign investment by industrial and commercial firms and companies.

Moreover, financing should be carried out in the form of long-term loans and mortgages, as the production cycle of growing shellfish and algae is at least 2-4 years.

Mariculture as production has great similarity with agriculture, which determines the importance of leasing support and the possibility of renting areas for plantations for a long period of time. In order to intensify the process of creation of maricultures on the Black Sea coast, it is necessary to develop and approve laws regulating the allocation of areas of water and land for this type of activity, to determine the order of its implementation as well as align numerous regulations and requirements of local government controlling organizations. It is also important to note that in the conditions of the Black Sea coast, the mariculture of shellfish should be considered as one of the high priorities for coastal region development. It not only contributes to saturation of the domestic market with high-value seafood, but also leads to the development of small businesses and coastal settlements, job creation, maintenance of water quality and biodiversity of reservoirs as well as preservation of its fishery and recreational value [9-11].

At the same time, we believe that the most useful financial instrument for maricultural farms is the use of financial leasing, which allows financing the rapid industrial development of large technical innovations requiring acquisition of expensive specialized hydro biotechnological equipment, unique control and measurement equipment, boats and ships, etc.
In the current economic environment, it will be very difficult to organize long-term investment of such projects, which necessitates an assessment of the risks associated with doing business in fishing industry.

Difficulties in the environmental sector are already indicated in the absence of a methodical toolkit for scientific reasoning of the methodology in assessing the impact sway of aquaculture farms on the coastal marine ecosystem, the formation of a new system of local indicators to ensure the sustainable environmental safety of aquaculture farms.

Thus, in order to form an independent economic system in the region, it is necessary to create conditions for the development of entrepreneurship, attract investment for the expansion, restructuring and reconstruction of maricultural farms. Following factors will contribute to the sustainable development of the region: restoration and preservation of natural environment of the Crimean Peninsula and its landscape, efficient use of natural resources, transition to a new development level of key industries. A single mechanism should form a balance among following key development areas: social welfare, economic expediency and ecological balance.

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