

Ministry of Education and Science of Ukraine
Black Sea Universities Network

ODESA NATIONAL UNIVERSITY OF TECHNOLOGY

International Competition of
Student Scientific Works

BLACK SEA SCIENCE 2022 PROCEEDINGS



ODESA, ONUT 2022

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BLACK SEA SCIENCE 2022

Proceedings

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INTRODUCTION

International Competition of Student Scientific Works “Black Sea Science” has been held annually since 2018 at the initiative of Odesa National University of Technology (formerly Odesa National Academy of Food Technologies) with the support of the Ministry of Education and Science of Ukraine. It has been supported by Black Sea Universities Network (the Association of 110 higher education institutions from 12 countries of the Black Sea Region) since 2019, and by Iseki-FOOD Association (European Integrating Food Science and Engineering Knowledge into the Food Chain Association) since 2020.

The goal of the competition is to expand international relations and attract students to research activities. It is held in the following fields:

- Food science and technologies
- Economics and administration
- Information technologies, automation and robotics
- Power engineering and energy efficiency
- Ecology and environmental protection

The jury includes both Ukrainian and foreign scientists. In the 4 years that the competition has been held, the jury included scientists from universities of 24 countries: Angola, Azerbaijan, Benin, Bulgaria, China, Czech Republic, France, Georgia, Germany, Greece, Israel, Italy, Kazakhstan, Latvia, Lithuania, Moldova, Pakistan, Poland, Romania, Serbia, Slovakia, Switzerland, Turkey, USA.

At the same time, every year the geography has expanded and the number of foreign jury members has increased: from 46 jury members representing 25 universities from 12 countries in 2018, to 73 jury members of the 46 universities from 19 countries in 2022.

More than a thousand student research papers have been submitted to the competition from both Ukrainian and foreign institutions from 25 countries: China, Poland, Mexico, USA, France, Greece, Germany, Canada, Costa Rica, Brazil, India, Pakistan, Israel, Macedonia, Lithuania, Latvia, Slovakia, Romania, Kyrgyzstan, Kazakhstan, Bulgaria, Moldova, Georgia, Turkey, Serbia.

The interest of foreign students in the competition grew every year. In 2018, the students representing 15 institutions from 7 countries have submitted 33 works. In 2021 the number of submitted works increased to 73, authored by the students of 40 institutions from 18 countries.

The competition is held in two stages. In the first stage, student research papers are reviewed by members of the jury who are experts in the relevant fields. In the second stage of the competition, the winners of the first stage have the opportunity to present their work to a wide audience in person or online.

All participants of the competition and their scientific supervisors are awarded appropriate certificates, and the scientific works of the winners are included in the electronic proceedings of the competition. Every year the competition receives a large number of positive responses from Ukrainian and foreign colleagues with the desire to participate in the coming years.

2. ECONOMICS AND **ADMINISTRATION**

**AQUACULTURE – A FIELD OF THE FUTURE: NATIONAL PROPERTY,
WORLD TRENDS OF DEVELOPMENT**

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Annotation. The paper considers aquaculture as the fastest growing livestock sector. Aquaculture in Ukraine is the third most important source of animal protein after livestock and poultry. In addition, the development of aquaculture makes a significant contribution to the employment of the rural population and the population of coastal areas.

Aquaculture in Ukraine as a whole is developing similarly for the whole of Central Europe as a whole: stagnation, and sometimes a decline in the production of marketable products, the main in the recent past in terms of aquaculture facilities.

The development of small and medium-sized enterprises in the field of industrial fishing and fish farming is associated with the predominance of small and medium-sized enterprises in the fisheries sector. The paper characterizes aquaculture as a type of entrepreneurial activity, outlines the role of small business in the development of aquaculture.

The study identified risk factors as groups of threats that hinder the development of the fisheries complex (external and internal), and systematized the risks that limit the development of enterprises in this sector.

Keywords: aquaculture, small, medium enterprise entrepreneurship, agriculture, fisheries sector, risks

I. INTRODUCTION

The world experience of countries shows that small and medium-sized businesses play an important role in the economy. It is the driving force behind development, a criterion of dynamism, openness, equalizing the chances of all social groups and strata of the population in the struggle for well-being. At the same time, small businesses are characterized by: relatively low profitability combined with high labor intensity, the difficulty of introducing new technologies and equipment, due to limited own resources, and increased risk in intense competition.

The fishery sector of Ukraine is a multifunctional complex of the economy, including a wide range of activities from the study and forecasting of the raw material base, the extraction and processing of aquatic biological resources to the organization of trade in fish products, providing employment in related sectors of the country's economy.

The development of small and medium-sized businesses in the field of industrial fishing and fish farming is associated with the predominance of small and medium-sized enterprises in the fisheries sector. Over the past fifteen years, the reform of the fishery sector in Ukraine has led to a halving of the fish catch.

Currently, small and medium-sized businesses in the fisheries sector are experiencing significant difficulties that impede its effective development, in particular: the COVID-19 pandemic, lack of credit resources, low liquidity of assets, which are typical for the country's economy today. The measures currently taken by the state have not fully resolved the accumulated systemic problems facing small and medium-sized businesses in the country's fisheries sector. In this regard, the issues of improving the tools for supporting small businesses and attracting small businesses to aquaculture become topical.

Recently, aquaculture has been one of the fastest growing sectors of food production and is increasingly becoming an important industry that contributes to the food supply of the population.

In Ukraine, there are all opportunities for obtaining social, economic and environmental benefits from the development of aquaculture. At the same time, the organization and development of enterprises in aquaculture is constrained by a number of problems that are identical in composition and content to both the general problems of the development of the fishery sector and the economy of the regions and the country as a whole.

The above circumstances determined the choice of the research topic.

The problems of small business are widely represented in the literature and scientific periodicals.

Issues of the formation and development of entrepreneurship, approaches to determining the factors influencing the development of aquaculture most were studied in the works of such scientists as V. Balukhtyna, V. Zyuz, I. Irtysheva, O. Nesterova, M. Stegney and V. Lagodienko, D. Archibisova, and many other domestic scientists.

The information base of the work was the laws of Ukraine, Decrees of the President of Ukraine, resolutions of the Cabinet of Ministers of Ukraine, statistical materials of the State Statistics Service of Ukraine, other ministries and departments, scientific works of leading domestic and foreign scientists, conferences and seminars, monographs, collections and scientific articles; Internet resources, etc.

II. ANALYTICAL REVIEW OF LITERATURE

2.1. Characteristics of aquaculture as a form of entrepreneurial activity

In world practice today, aquaculture, i.e. cultivation of aquatic organisms (fish) under managed or controlled conditions is the most dynamically developing branch of food production. Aquaculture got its development in the 70s of the last century, when economists in many countries came to the conclusion that high rates of exploitation of oceanic fish resources could lead to their gradual complete disappearance. As an alternative to providing the population with fish products, the cultivation of marine and

freshwater crops was proposed, which has become a priority in the fishing industry in many countries.

Aquaculture plays a decisive role in ensuring the country's food security, increasing tax revenues, increasing employment, and in the near future will be able to actively influence the improvement of the economy.

«According to the law of Ukraine, aquaculture, ie artificial reproduction (breeding) of aquatic bioresources - is the activity of breeding (reproduction), cultivation of aquaculture facilities, associated with their subsequent introduction into water bodies (their parts) for restoration natural populations, replenishment of aquatic bioresources and conservation of their biodiversity» [1].

Also, this Law defines aquaculture (fish farming) as agricultural activity for artificial breeding, maintenance and cultivation of aquaculture facilities in fully or partially controlled conditions for agricultural products (aquaculture products) and their sale, feed production, reproduction of biological resources, selection -breeding, introduction, resettlement, acclimatization and reacclimatization of aquatic organisms, replenishment of aquatic bioresources, conservation of their biodiversity, as well as the provision of recreational services» [2]. It should be noted that in a number of regulations [3,4,5,6].

The concepts of «fish farming» «aquaculture» are similar in meaning and according to legislators, have the same meaning and are identified. However, in legal science there are views on the delimitation of these concepts. For example, O.V. Boyko in his dissertation research notes that the content of such concepts is different and therefore they can not be identified. Thus, the concept of «fish farming» is broader in its meaning and includes both aquaculture and mariculture. That is why in order to reveal the content of the second main element of the structure of fisheries - fish farming, it is necessary to study its content and identify subspecies [7].

According to D.S. Archibisova, aquaculture - is the breeding, cultivation and procurement of fish, mollusks, algae and other organisms in all types of aquatic environment; a method used to produce food and other commercial products, restore habitats and replenish wild stocks, and restore populations of endangered and endangered species [8].

According to the Law of Ukraine «On Aquaculture», for aquaculture legal or natural persons may be provided with water bodies, fishery technological reservoirs, parts of water bodies (exclusively for accommodation of garden farms) and water area (water space) of inland sea waters, territorial sea, exclusive (marine) economic zone of Ukraine [9].

According to the Classification of Economic Activities [10] «aquaculture» as a type of economic activity is included in Section A «Agriculture, forestry and fisheries», section 03 «Fisheries and aquaculture», group 03.2 «Fisheries (aquaculture)». This group includes «aquaculture» (or fish farming), ie the process of production, which consists in the cultivation and breeding (including harvesting) of marine organisms and crops (fish, mollusks, crustaceans, plants, crocodiles and amphibians, etc.) using technology designed to increase the productivity of organisms and increase their natural growth in the environment (eg regular stockpiling, fattening and protection from predators). In addition, aquaculture includes individual, cooperative or state

ownership of individual organisms in order to increase their numbers, including their collection. This section contains two Classes 03.21 «Marine fish farming (aquaculture)» and 03.22 «Freshwater fish farming (aquaculture)».

Class 03.21 «Marine fish farming (aquaculture)» includes: breeding of fish in seawater, including breeding of marine aquarium fish keeping caviar of bivalve molluscs (mussels, etc.), lobsters, shrimp, fish fry and its manual cultivation of red algae and other algae, bivalves, other molluscs and other aquatic animals in seawater. This class also includes: fish farming (aquaculture) in salt water, fish farming (aquaculture) in seawater reservoirs, operation of fish farms for marine fish farming, operation of sea worm farms, frog breeding, activities of reserves for sport fishing.

Class 03.22 «Freshwater fish farming (aquaculture)» includes: breeding of fish in fresh water, including breeding of freshwater aquarium fish, breeding of freshwater crustaceans, bivalves, other molluscs and other aquatic animals in fresh water, operation of fish farms, breeding frogs, breeding crocodiles and other amphibians. This class excludes: fish farming (aquaculture) in seawater reservoirs, sport fishing activities.

2.2. The role of small business in the development of aquaculture

Small business is a basic element of the market system of management. Small businesses - the most numerous layer of private owners - small and medium-sized enterprises.

Currently, small businesses are represented in almost all sectors of the economy and the service sector. They function not only in trade, light and food industries, but also appear in mechanical engineering, woodworking, chemical and electrical industries.

The economic dictionary of B. A. Raizberg gives the following definition of a small enterprise - a firm is a small enterprise of any form of ownership, characterized primarily by a limited number of employees (no more than a few hundred) and occupying an extremely small share, in general, in the country, region, the volume of activity, which is profile for the enterprise [11].

According to Article 42 of the Commercial Code of Ukraine, entrepreneurship is defined as «independent, proactive, systematic, at their own risk economic activity carried out by economic entities (entrepreneurs) in order to achieve economic and social results and make a profit.» In particular, Article 55 of the CCU stipulates that «economic entities, depending on the number of employees and income from any activity for the year, may belong to small businesses, including micro, medium or large businesses» [12].

An analysis of the economic literature has shown that the economic essence of the concept of «small business» identifies such concepts as «own business», «small business» or «self-operating firm».

Thus, small business is a special type of business activity, which is carried out at the discretion and risk of individual entities of any form of ownership and corresponds to the legal forms of business organization for profit.

2.3. Problems and risk factors limiting the development of entrepreneurship in aquaculture

Most economists understand risk as the probability (threat) of losing a part of their resources by a person or organization, shortfall in income or the appearance of additional costs as a result of the implementation of a certain production or financial policy. For any business, it is important not to avoid risk in general, but to anticipate it and make the best decision regarding a certain criterion that reflects the main interest of the entrepreneur [13, 14, 15].

Despite the fact that the risk is present in almost all areas of business activity, it is of paramount importance for the sphere of fish farming and fishing, it accompanies almost all types of business operations and all areas of its activity, and the forms of enterprise risk are characterized by great diversity. Features of the manifestation of risk are closely related to the scope of entrepreneurial activity. Researchers of this issue among the most common external and internal threats hindering the development of the fishery complex include:

- aggravation of global competition for the right to harvest aquatic biological resources;
- political instability in certain areas of intensive fishing;
- unstable conjuncture of world prices for fish products;
- ongoing pollution of water bodies;
- a significant rise in the cost of fuel and energy resources;
- imperfection of the regulatory and legal framework in terms of organizing control over the by-catch of aquatic biological resources;
- growth of competitiveness of imported into the territory of Ukraine;
- the imperfection of the legal support for the functioning of the country's fisheries;
- lack of a regulatory framework harmonized with international requirements to ensure the release of safe and high-quality products of industrial fishing and fish farming;
- insufficient level of state support for fisheries, including fisheries and aquaculture;
- significant rise in prices for most types of goods and services used by fisheries;
- low level of use of aquatic biological resources;
- insufficient monitoring of the state of stocks of aquatic biological resources;
- lack of monitoring of the quality of aquatic biological resources, products of industrial fish farming and fishing, their production and processing processes;
- high level of physical deterioration and obsolescence of the fishing fleet and fish processing infrastructure;
- insufficient level of state support to minimize the risk from the introduction of new technological solutions for the processing of aquatic biological resources for the fishing business.

The emerging threats listed above can lead to the emergence and implementation of risk events also in the field of pond aquaculture.

A number of scientists and researchers in aquaculture have repeatedly noted that the low level of fish production is associated with a weak institutional framework (lack of a unified organizational structure, imperfection of the legislative framework) in the fishery sector of the economy.

At the same time, we note that there are a large number of small (up to 5 hectares) reservoirs, the operation of which is not profitable for the state, despite the fact that there is no influx of entrepreneurs into fish farming.

The imperfection of the tax system is especially acute for small businesses, which have many ways to escape into the «shadow» economy and, at the same time, as with the correct organization of the tax business, small enterprises are able to provide significant tax revenues.

III. OBJECT, SUBJECT AND METHODS OF RESEARCH

Object of research: phenomena and processes in the field of pond aquaculture.

Subject of research: economic relations and management decisions, which are the basis for the development of entrepreneurial activity in conditions of economic risks.

Research methods: to solve research problems used general and special research methods:

- dialectical method - at the stage of collecting, systematizing and processing information and factors promoting aquaculture;
- statistical and comparative analysis - in determining the effectiveness of combined cultivation in specialized places according to the technological scheme;
- forecasting - in strategic planning of aquaculture development, determining the level of consumption of fish products in the near future;
- monographic, logical generalization of results - to develop recommendations for the development of entrepreneurial initiatives in the field of pond aquaculture.

The information base of the study consists of legislative acts of Ukraine, statistical materials of the State Statistics Service of Ukraine, scientific works of leading domestic and foreign scientists, materials of conferences and seminars, monographs, collections and scientific articles; Internet resources, etc.

IV. RESULTS OF WORK

Management of the development of any sector of the economy is possible only with an idea of its real state, knowledge of the structure of production, its technological features, as well as the characteristics of the consumer market of a product. And this can be done only if the systematic collection and analysis of statistical information on the volume of aquaculture production as a result of economic activity.

In order to track the volume of aquaculture production and their dynamics, the Law of Ukraine «On Aquaculture» stipulates that aquaculture entities are obliged to «submit to the central executive body implementing state policy in the field of fisheries, reporting information on aquaculture production. According to the State Statistics Service of Ukraine, the volume of extraction of aquatic bioresources over the past three years tends to decrease (see Table 1) [16].

Table 1. Extraction of aquatic bioresources for 2018-2020 years (tons)

Years	Extraction of aquatic bioresources				Including fish
	total	including by major fishing areas			
		aquaculture	inland waters objects	other fishing areas	
2018	86222,5	13576,6	46819,8	25826,1	64737,9
2019	92682,0	12675,4	22928,7	57077,9	58095,8
2020	76508,1	11932,6	23291,4	41284,1	48228,6

According to the latest data of the territorial bodies of the State Fisheries Agency, the number of aquaculture entities is 4,568 enterprises of various forms of ownership, of which reported on the form № 1 A-fish (annual) «Aquaculture production in 2020» 1,870 such enterprises or 41% of the total subjects of aquaculture, and in 2019 the reporting was 51% (see Fig. 1).

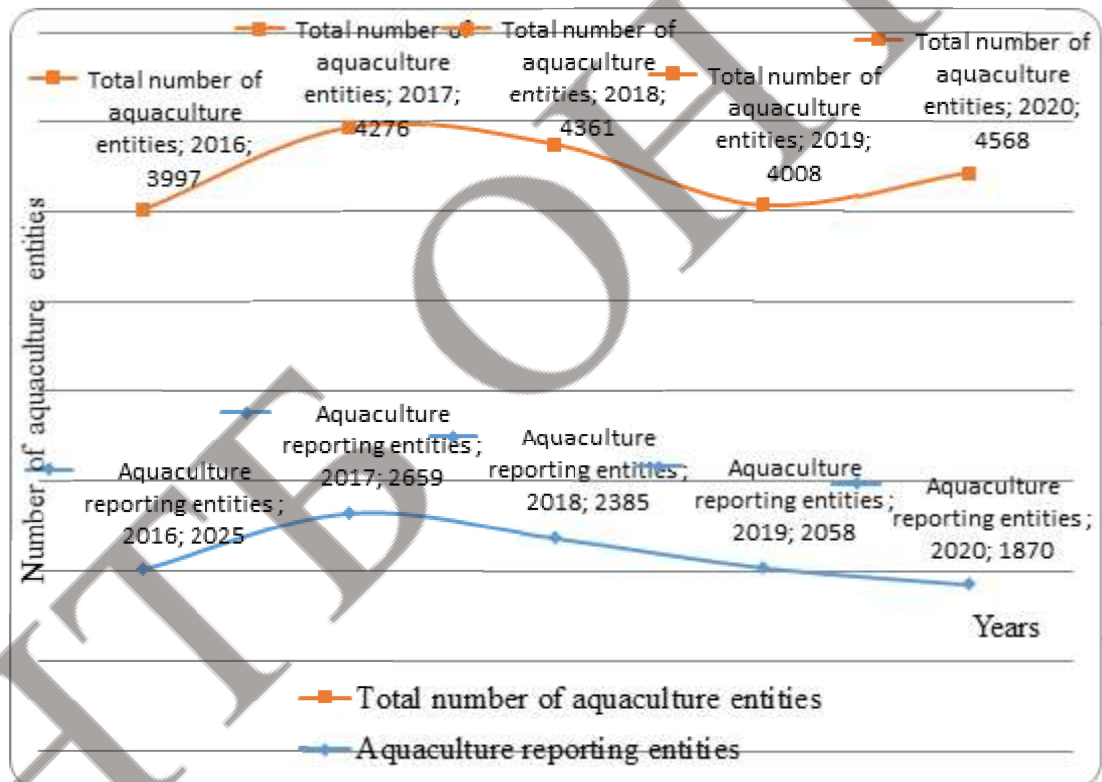


Fig. 1. Dynamics of the number of aquaculture entities

This situation has developed, inter alia, under the influence of the risks associated with entrepreneurial activities in the field of aquaculture.

In this regard, it is important for this study to divide the risks according to the level of financial losses:

- acceptable risk, in the implementation of which the financial losses of the business structure do not exceed the estimated amount of profit on the business transaction;

- critical risk, in which financial losses do not exceed the estimated amount of gross income from the business transaction;
- catastrophic risk, financial losses which threaten the partial and even complete loss of equity and as a consequence the cessation of business.

The general idea of the external risks in the field of aquaculture is shown in Table 2 [13, 14].

Guided by such a classification, it is advisable to single out the most significant risks that can generate negative impacts leading to catastrophic consequences from the whole variety of risks accompanying entrepreneurial activity in the field of aquaculture.

The types of risks presented in the table are of a general nature and are associated with the need to modernize industrial potential, create a social security system, solve problems in the field of employment, improve the monetary and credit and financial system, etc. In this regard, this table requires an explanation of the level of criticality of each type of risk in relation to entrepreneurial activities in the field of aquaculture.

Table 2. External, systematic risks inherent in entrepreneurial activities in aquaculture

Sphere of leakage	Type of risk	Possible consequences of the offensive
1	2	3
Macroeconomic system, state, region	Inflation risk	allowable, critical
	Risk of changes in legislation and judicial practice on issues related to activities (including licensing issues)	critical, catastrophic
	The risk of a decrease in the income of the population, a fall in effective demand	allowable, critical
	Criminogenic risk	allowable, critical
	Risk of changes in the rules of customs control and duties	allowable, critical
	Tax risk	critical, catastrophic
Financial system of the state, region	Currency risk, as an unstable exchange rate and changes in the pricing policy of the central bank in relation to foreign exchange	allowable, critical
	Interest risk as a change in interest rates on loans and borrowings	critical, catastrophic
	Deposit risk	allowable, critical
Industry market and competitive environment	Rise in the cost of fuels and lubricants and spare parts, an increase in energy prices	critical, catastrophic
	Investment risk	allowable, critical
	The risk of reducing the capacity of the domestic market	allowable, critical
	Risk of increasing competitors' offers due to accession to the European Union	allowable, critical
	Underdevelopment of infrastructure, road network, access roads	allowable, critical
	Risk of falling demand due to lower prices in other segments (poultry, seafood, etc.)	allowable, critical

Currently, one of the most important issues for aquaculture is the organization of aquaculture business, in particular, the establishment of fish farms, fish farming in recirculating aquaculture systems, ponds and gardens, breeding technologies and standards of fish production.

Bringing the aquaculture business out of the shadows is also an urgent task. We know from world practice that business needs to be stimulated and supported, especially by small and medium segments. Only in this way it is possible to control the analysis of their effectiveness and obtain reliable statistics. That is why a single state information system is being created, which will contain information on agricultural producers and ensure proper administration of state support. The system will be called the State Agrarian Register, which will include data on agricultural entities wishing to receive support. The system automatically checks their status, quickly checks compliance with the criteria for granting subsidies, determines the possibility of assessing the effectiveness of the proposed support and forms a «single office of farmers.» But let's return to the support of farmers, in particular, we are interested in what areas of support proposed by the developers of the legal act to aquaculture entities.

In order to study the demand for the proposed state support among aquaculture producers in Ukraine, the Budget Institution «Methodological and Technological Center for Aquaculture» is currently collecting information on:

- acquisition of special technological equipment by aquaculture subjects;
- construction or reconstruction of production facilities;
- the amount of costs for growing, breeding and maintenance of aquaculture facilities» [17].

To improve the functioning of the state support system for agriculture, eliminate administrative barriers and costs for agricultural producers in receiving state aid in 2020, the Law of Ukraine «On Amendments to Some Laws of Ukraine on the Functioning of the State Agrarian Register and Improving State Support for Agricultural Producers» was adopted. It is significant for aquaculture entities, because the proposed changes and additions to the entire aquaculture industry have opened up new opportunities for public financial support [18].

Areas of state support that have become available to aquaculture entities with the adoption of this Law:

1. State support for producers engaged in agricultural activities for artificial breeding, maintenance and cultivation of aquaculture facilities shall be provided by:

- partial compensation of up to 30% of expenses, taking into account the restrictions specified in the second paragraph of paragraph 2-1.4 of Article 2-1 of this Law, incurred for such activities;
- providing a subsidy per unit of output or area of a water body.

2. Agricultural producers (up to 50%) and agricultural cooperatives (up to 70%) are reimbursed for the cost of construction and reconstruction of livestock farms and complexes for keeping livestock and poultry, fish farms, apiaries, milking parlors, processing facilities and storage of agricultural products and / or by-products of animal origin belonging to categories II and III, as well as the cost of purchasing machinery, mechanisms and equipment for the production and processing of agricultural products.

V. CONCLUSIONS

All over the world, aquaculture, like agriculture, is subsidized. Existing practices of agricultural production provide support for subsidies to producers (especially small and medium-sized businesses) to increase their competitiveness, sustainable development of rural areas. Aquaculture, as an area of agriculture, needs significant state aid. And this assistance should not only stimulate the development of this business, but also ensure the introduction of new biotechnologies on a sustainable basis.

It is obvious that the development of Ukrainian aquaculture, as well as European, lies in the harmonization of the production sphere, the natural environment and the improvement of relations between members of local communities.

The analysis of the work leads to the conclusion that aquaculture in Ukraine as a whole is developing similarly for the whole of Central Europe as a whole: stagnation, and sometimes a decline in the production of marketable products in the recent past in terms of aquaculture.

The development of aquaculture in Ukraine requires two main prerequisites. The first is the growing consumer demand for freshwater fish species, the cultivation of which is mainly based on the undiscovered potential of inland fishing. The second is the implementation of a set of measures to restore the resource and production potential of the fisheries industry. In particular, it should be noted the feasibility of creating a favorable economic environment to attract investment in the introduction of new resource-saving technologies for intensive pond, pond, river and basin fisheries. This requires: the adoption of a state target program to ensure preferential lending to fisheries enterprises in order to upgrade the material and technical base, restoration of water bodies and hydraulic structures; development of sales infrastructure aimed at selling products through a direct channel from producer to consumer for a greater impact of enterprises on the selling price, which in turn will help reduce consumer prices for fish for the population.

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