

Training of Specialists for the Rational Use and Protection of Aquatic Biological Resources

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Abstract. The environmental safety of surface waters is the main condition for preserving biodiversity, the health of the population, and sustainable developed areas. Aquatic biological resources belong to the closed system of the planet's water space. Therefore, clean water problems and the protection of aquatic ecosystems are becoming more and more acute as civilization develops and the technological impact on the environment intensifies. Effective, rational use and management of water, land, biological resources are impossible without the training of qualified specialized specialists. Today, in modern Russia, the sectoral nature of the management of educational institutions of higher education (universities) is preserved. About a third of students in state universities study at universities of industry departments. The largest number of specialists in demand in agriculture, forestry, and water management, including nature management, technosphere safety, environmental engineering, are trained in agricultural universities. It is the agrarian branch education that effectively builds the implementation of training directions in order to provide professional assistance to business entities specializing in the use of aquatic biological resources, monitoring and environmental protection measures of water bodies, the purity of the water area (water structure, pollution, distribution of aquaculture) in various hydro-climatic conditions. The fundamental factor in the interaction of production, water use, land use, and education is the existence of an established mechanism that supports the functioning of universities as communication platforms for improving socio-economic relations, including as a "thought factory." The development of a strategy, forecast, assessments of the development of aquatic biological and other resources in all territories of the country is due to the demand from business entities for the training of personnel of particular professions and qualifications and research and development in the relevant field.

1 Introduction

Protection of water resources in Russia is ensured at the legislative, including the international level. The basis for the regulation of the sphere of rational use, protection, and cultivation of aquatic biological resources, including aquacultures, is the Government Decree "On the approval of the state program of the Russian Federation" Development of the fishery complex" [6], the federal law "On fishing and conservation of aquatic biological resources" [7]. Legislative acts regulate all areas of activity of legal entities and individuals concerning farming, including water. In current conditions, the main problem in the use of water space is water pollution, which mainly occurs as a result of the discharge of industrial, household, and agricultural waste into it. In some reservoirs, pollution is so significant that it completely degraded to the disappearance of animals living in these areas and as a source of water supply. A small amount of pollution cannot cause a significant deterioration in the state of water bodies since it can cleanse biologically. However, the problem is that, as a rule, the number of pollutants discharged into the water is very large, and the water

body cannot cope with their neutralization. Due to the violation of the ecological balance of the water space, there is a serious threat of a significant deterioration of the ecological situation in general. Therefore, humanity faces the enormous task of protecting the hydrosphere and maintaining the biological balance in the biosphere. The solution to this problem lies at the heart of increasing the "environmental literacy" of the management of the country and the population through receiving special education. In this case, we can talk about a positive correlation between the support of the state and investment nature of enterprises whose activities are related to water resources and the financing of the results of scientific and educational, research and practical activities of universities training in the field of the fishery complex [1]. As a rule, an increase in the differentiation of various professions depends on the advanced proposals of science and education to implement new potentially demanded learning strategies in the form of profile specializations. Profile specializations can be successfully implemented in industrial and social relations [2]. Educational organizations represent a complex mechanism of interaction between such structural units as branches,

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faculties, departments, research, design, production, and other divisions, which face multi-purpose tasks to implement numerous processes to improve personnel training of qualifications. Educational organizations regularly monitor and plan the distribution and number of students in large groups of training areas because these indicators affect the specifics of educational activities and reflect the demand for professions.

2 Materials and methods

In the study, an analysis of information and analytical materials was carried out based on the results of monitoring the effectiveness of the activities of educational institutions of higher education, implementing training areas in the field of aquatic biological resources and aquaculture, hydro reclamation, and industrial fishing. We examined the documents of the Parliamentary Hearings of the Federation Council of the Federal Assembly of the Russian Federation with the key factors in the development of agricultural education. As a particular example of a situational analysis for the rational use and protection of aquatic biological resources, the Khanty-Mansiysk Autonomous Okrug – KhMAO (Yugra) has unique hydro-climatic conditions is considered. The quantitative and qualitative characteristics of the district's water resources were assessed based on materials and monitoring of fish resources, oil and gas production enterprises, and field research.

3 Rational use and protection of aquatic biological resources: role, significance and potential in training personnel for agriculture

The agro-industrial complex is the most important branch of the Russian economy, providing society with vital products. It has a huge economic potential [3]. According to the order of the Ministry of Agriculture of the Russian Federation No. 342, "On the concept of the development of agrarian science and scientific support of the agro-industrial complex of Russia until 2025," the development of agricultural science should be carried out by improving the management system and the network of research institutions, deepening fundamental and priority applied research to develop competitive scientific and technical products, strengthening the innovative process of participation of science in the development of scientific developments in production, ensuring the effective development of the agro-industrial complex of the Russian Federation [8]. The problems of the rational use of aquatic biological resources are included in the system of international regulation of the conservation of the biosphere as the main global factor in the sustainability of ecosystems. Finding optimization solutions when organizing economic, industrial, and other activities in any territory or in water areas depends on the coordinated, scientifically grounded actions of all stakeholders, all levels of government (local, regional,

federal, international). The leading role in this process is played by educational organizations, which train professional personnel capable of performing all types of work, actions, and functions to preserve and increase fish stocks, aquatic animals, plants, and aquacultures. Its rich natural potential distinguishes the Khanty-Mansi Autonomous Okrug (Ugra), the economy of which is focused on the development of traditional industries, including the intensive use of water resources. With a large anthropogenic impact in connection with oil and gas extraction, various types of pollution occur both on the surface of the earth and water sources. Pollution of water bodies is observed throughout the entire period of development of the oil and gas complex. Oil products entering water bodies form various water forms of pollution, which settle to the bottom and are adsorbed by soils of heavy fractions. Under the influence of oil bacteria and other bacteria, heavy fractions disintegrate, and a process of partial purification of water and soil from oil pollution occurs. The characteristics mentioned above of the surface waters of the Ob basin reflect a rather clear tendency for a decrease in fish catch in river water bodies. In recent years, stocks of whitefish and sturgeon have sharply decreased in the district. Pollution of lakes and rivers with wastewater containing oil products leads to the death of fish and food organisms, disables spawning grounds, etc. During surface water pollution, migration routes change, for example, muksun; instead of the traditional ascent for spawning in the tributaries of the upper Ob, part of the spawning stock began to enter the tributaries of the Irtysh. Oil products accumulating in fish tissues lead to disturbances in the embryonic development of eggs and larvae. Due to the high content of aromatic hydrocarbons in fish (from individual rivers flowing through the fields), it cannot be used for food (Table 1).

Due to the climatic features of the territory, considerable water potential, specific flora and fauna have developed, which the district is rich in, and valuable non-renewable resources such as oil, gas, gold.

The impact of economic activity on aquatic organisms and ecosystems is manifested in two forms:

- certain types of pollution and their totality (communities);
- changing the parameters of the regime of reservoirs and water quality, in connection with the technogenic impact.

For example, in the reservoirs of the Khanty-Mansi Autonomous Okrug, a decrease in fish catch was noted in 2019. The reason for this is the change in water quality. Compared to the beginning of the fifties, the district's catch has decreased by nine times, and at present, it does not exceed 2–3 thousand tons (Table 2).

Certain activities are of strategic importance for ensuring food security and stability in the economy and society. These activities are the protection of water resources and various activities related to fishing and the production and sale of products of water resources. Industrial and industrial use of aquatic biological resources allows providing our products for more than 60 sectors of the economy and the personal households

of citizens. It employs 1.1 million people or 5 % of the total number of workers in material production. One job in the fishery sector employs 2–3 people compared to other sectors of the economy. The agro-industrial complex today is a modern production using the most

advanced technologies. Therefore, staffing the agro-industrial complex is of decisive importance for maintaining the positive dynamics of the growth of aquatic biological resources and their production on an innovative basis.

Table 1. Content of oil products in bottom sediments (fragment of the study)

River post	Selection date, month, year	Maximum Permissible Concentration, mg/dm ³	Extremely high pollution mg/dm	Concentration, mg/dm ³	Exceeding the Maximum Permissible Concentration	Component
Khanty-Mansiysk, Irtysh river	08.19	0.001	0.05	0.0005	5.2	DDT
Vakhovsk, Vah river	09.19	0.05	2.5	5.46	109	Petroleum products
Sosva, Northern Sosva river	08.19	0.5	2.5	5.59	112	
Gornopravdinsk, Irtysh river	09.19	0.5	2.5	7.89	158	
N-Yugansk, Ob river, Yuganskaya Avenue	09.19	0.5	2.5	10.84	217	
Sosva, Northern Sosva river	09.19	0.5	2.5	3.27	65	
N-Yugansk, Ob river, Yuganskaya Avenue	10.19	0.5	2.5	5.43	109	
Sytomino, Ob river, Sytominka Avenue	10.19	0.5	2.5	14.31	286	
Vakhovsk, Vah river	10.19	0.5	2.5	11.16	223	
Berezovo, Northern Sosva river	10.19	0.5	2.5	3.48	70	
Nizhnevartovsk, Ob river	10.19	0.05	2.5	14.37	287	
Gornopravdinsk, Irtysh river	10.19	0.05	2.5	10.1	202	
Khanty-Mansiysk, Irtysh river	10.19	0.01	0.5	0.563	56	
Berezovo, Northern Sosva river	11.19	0.01	0.5	0.592	60	

Table 2. Dynamics of fish catch in the water bodies of the Khanty-Mansi Autonomous Okrug (tons)

Fish species	Years		Changes +/-
	2000	2019	
Sturgeon	0.245	0.182	- 0.063
Sterlet	0.459	1.141	+0.682
Nelma	0.141	0.174	+0.033
Muksun	32.123	16.167	-15.956
Peled	14.673	1.888	-12.785
Burbot	25.965	20.104	-5.861
Ide	317.32	236.001	-81.319
Pike	129.417	102.411	-27.006
Crucian carp	3.891	3.631	-0.260
Perch	6.520	0.582	-5.938
Roach	125.565	135.541	+9.976
Small fish 3 gr.	21.476	3.701	-17.775
Bream	5.675	4.911	-0.764
Ruff	1.503	-	-1.503
Yelets	88.711	-	-88.711
Shchokur	0.122	-	-0.122
Total	773.806	526.434	-247.372

Agrarian universities are the centers for training highly qualified personnel for the agro-industrial complex. At the same time, a modern university is also an innovation center, a center for the generation of knowledge, applied scientific research, a source of transfer of the results of intellectual activity into production. As the most important social institutions, agricultural universities are an effective tool for implementing state programs for the development of the agro-industrial complex, national projects, and peoples of the North.

Considering the large volumes of water resources in Russia, the Council for Professional Qualifications of the Agroindustrial Complex has developed a structure of professional qualifications for the protection and use of aquatic biological resources, covering the following types of professional qualifications (Table 3) [4].

Table 3. Professional qualifications in the field of professional activity "Fishing and fish farming," "Food industry" (as of 06.04.2020)

Professional standard	Number of qualifications
1 Fishing machine operator	2
2 Hydrobiologist	1
3 Hydrochemist	2
4 Fishmonger	3
5 Manufacturer of fishing gear	1
6 Design engineer of commercial fishing gear and seafood	5
7 Fish Engineer	1
8 Ichthyologist	4
9 Ichthyopathologist	5
10 Food Biotechnology Specialist	2
11 Fishing Specialist	2
12 Fishing Master	1
13 Quality control specialist for fish and seafood products	3
14 Aquaculture Technology Specialist	3
15 Microbiologist	1
16 Specialist in the operation of reclamation systems	3
17 Fish and seafood processing technologist	6
18 Chemist-technologist, laboratory assistant for fish and seafood processing	5
TOTAL	50

In 2019, the total number of skilled workers in fish farming and fishery was 583 thousand people. Professional qualifications of the agro-industrial complex in the field of professional activity "Fishing and fish farming," "Food industry" are formed based on particular areas of training/specialties of higher education, which constitute the core of agricultural education (Table 4) [9].

Table 4. List of areas of training/specialties of higher education that make up the core of agricultural education

The level of education	The code of the direction of training/specialty	Direction name
<i>19.00.00 Industrial ecology and biotechnology</i>		
Bachelor/Master	19.03/04.01	Biotechnology
	19.03/04.02	Food from vegetable raw materials
	19.03/04.04	Product technology and catering
<i>20.00.00 Technosphere safety and environmental management</i>		
Bachelor/Master	20.03/04.02	Environmental management and water use
<i>35.00.00 Agriculture, forestry and fisheries</i>		
Bachelor/Master	35.03/04.08	Aquatic biological resources and aquaculture
	35.03/04.09	Industrial fishing
	35.03/04.11	Hydro-reclamation
<i>36.00.00 Veterinary and Animal Science</i>		
Bachelor/Master	36.03/04.01	Veterinary and sanitary expertise
	36.03/04.02	Animal science
Specialty	36.05.01	Veterinary Medicine

Specialists are trained in 49 out of 54 universities subordinate to the Ministry of Agriculture of the Russian Federation. On average, annually, the distribution of students in the above-enlarged groups of areas and specialties is as follows: 19.00.00 Industrial ecology and biotechnology – 15 312 people; 20.00.00 Technosphere safety and environmental management – 12 881 people; 35.00.00 Agriculture, forestry, and fisheries – 67 530 people; 36.00.00 Veterinary and Animal Science – 34 632 people. [10]. The total number of students is 130 355 people. Personnel training increases or decreases depending on the availability of budget places and the demand in the labor market.

According to statistics, these specialists are in demand in various types of economic activities (Table 5).

Table 5. Value of indicators by type of economic activity related to the use and protection of aquatic biological resources in 2019, thousand people [5]

Economic activities	Indicators				
	Number of employed	Number of employed and having higher education	Number of employed at the place of main job	Number of employed and with 10 years of work experience or more	Number of unemployed at the last place of work
Fishing and fish farming, agriculture, forestry, hunting	6831	541	4196	1076	246
Manufacturing industries	12091	2750	10258	3980	401
Water supply; sewerage, waste collection and disposal, activities for the elimination of pollution	436	121	516	203	23
Transport and storage	5561	1288	6314	2365	200
TOTAL	24919	4700	21284	7624	870

Analyzing the activities of specialists who implement professional knowledge, skills, and abilities in water resources and related production processes, it can be stated that the number of people employed in this area is 36 % of the total number of people employed in all types of economic activity. Furthermore, 19 % of employees have higher education in this area. The principal workplace in organizations, farms, and households is occupied by 29.5 % of employees, who have more than ten years of work experience recorded in 29.1 % of people. A particular indicator reflecting the stability of production activity is the percentage of unemployed. In the area under consideration, this is 25 %.

The percentage ratio of indicators indicates the need to increase the number of specialists with higher education and stabilize the functioning of various organizations and enterprises of the industry sector.

4 Conclusion

Insufficiently high provision of qualified personnel in industries that ensure the use of aquatic biological resources can decrease the overall level of economic effect and ignore the water management principles of organizing the rational use and protection of natural resources. To date, there is a need to expand the following scientific research:

- marine industrial fish farming; marine/freshwater fish farming (pasture);

- reproduction of marine/freshwater biological resources (artificial);
- melioration of fishery of sea and mineralized water bodies;
- development of a set of technical means and methods for the conservation of water areas and aquatic biodiversity.

In addition, the universities successfully operate scientific schools, whose activities aim to develop new approaches, principles, technologies for ensuring the safety of water space. Financial support and the development of new training areas for all levels of education will allow developing innovations in fisheries, including fishing technologies, breeding, and growing aquacultures, processing aquatic biological resources, and water purification.

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