

Ministry of Agriculture of the Republic of Kazakhstan
S.Seifullin Kazakh Agrotechnical University

Reviewed by
at the meeting of the University
Academic Council
Minutes № 15 «30» 05 2019



Chairman of the Board
S. Seifullin Kazakh Agrotechnical
University JSC
A.K.Kurishbayev
2019

EDUCATIONAL PROGRAM

“Aquaculture and aquatic bioresources”

Code and classification of education field: 6B08 - Agriculture and bioresources
Code and classification of training direction: 6B083 - Fisheries
Code in the International Standard Classification of Education: 0811
Qualification: Bachelor of Agriculture in EP "Aquaculture and aquatic bioresources "
Studying period: 4 years
Form of study: full-time

Nur-Sultan 2019

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Academic Committee:

Chairman - Aubakirova Gulzhan Amanzholovna – PhD, ass.professor

Members of the Committee:

1. Barinova Gulnaz Kaldybaevna – Candidate of Biological Sciences, acting ass. professor
2. Asylbekova Ainur Serikbayevna – Candidate of Agricultural Sciences, ass. professor
3. Bazhenova Diana Alexandrovna – 3rd year of the OP "Aquaculture and aquatic bioresources"
4. Zhubaev Askhat Bakhtygalievich - Head of the Department of Reproduction of Fish Resources of the Committee of Fisheries of the Ministry of Fisheries of the Republic of Kazakhstan
5. Ayan Kairatovich Bakhiyanov – Deputy Chairman of the Fisheries Committee of the Ministry of Ecology, Geology and Natural Resources of the Republic of Kazakhstan

The Academic Committee was approved by Order No. 516-N of 04.10.2022 for the S.Seifullin Kazakh Agro Technical Research University.

The educational program "Aquaculture and aquatic bioresources" was reviewed at the meeting of the Department of Hunting and Fisheries Protocol № 11 of "11" 05 2023 .

approved by the Council of the Faculty of Forestry, Wildlife and Environment Protocol № 9⁶ "25" 05 2023.

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1 Passport of the educational program

1.1 The purpose of the educational program: mastering by students the basics of rational use of aquatic biological resources, methods of intensification and technology of cultivation of aquatic organisms in fish farms.

The main objectives of the program are:

1. provision of conditions for obtaining full-fledged, high-quality professional education;
2. formation of basic professional competences of future specialists of fisheries;
3. creating prerequisites for independent search and research activities of students in the framework of the experiment at all its stages;
4. ability to work with scientific and technical information, to use domestic and foreign experience in professional activity, to systematize and generalize the received information.

1.2 Learning outcomes

ON 1. Possess the basics of economic knowledge, have scientific ideas about management, marketing, finance, the role of the public sector in the economy. Know how to solve systems of linear equations, problems related to matrices and study and solve engineering problems. Analyze the conditions of production development in logical and quantitative accounting, study innovative entrepreneurship and anti-corruption culture, formulate inventions.

ON 2. Have an idea about cell division, fertilization, patterns and laws of heredity, chromosomal theory of fish heredity. Know the types of invertebrates and vertebrates, their structure, patterns of settlement, the relationship with the environment. Have research skills in fish physiology. Understand the structure features of biomolecules, sugars, nucleotides, nucleic acids, fatty acids, vitamins and trace elements.

ON 3. To know the life forms of hydrobionts, the systematic position of fish in the systematics of the animal world, the morphology, ecology and anatomy of fish, the biology of fish, as well as the peculiarities of the development of embryos, the development of germ cells – gametogenesis, morphology and physiology of gametes. To determine the species diversity, systematics, structure of coastal aquatic plants. Be able to use agro-climatic and agrometeorological information for conducting fish-breeding activities.

ON 4. To know the patterns of interaction of aquatic organisms, ecological groupings of hydrobionts, features of natural waters, hydrochemical composition of natural waters, patterns of its changes depending on chemical, physical and biological processes. To study the structure, physiology, biochemistry of microorganisms, general characteristics of viruses. Use mathematical methods of statistical analysis in relation to biological objects. Know the ecosystem of the aquatic environment.

ON 5. Possess knowledge about the basics of the formation of production processes in the reservoir, autotrophic and heterotrophic nutrition. To know the concept of feed resources of the reservoir, compound feed and their characteristics, the development of a recipe for fish feed. Be able to use the most effective methods of growing fish in the RAS. Analyze methods to ensure favorable conditions, safety of workers and labor organization.

ON 6. Know the legislative framework in the field of fisheries and conservation of aquatic biological resources, breeding and cultivation of fish in special fish-breeding tanks, as well as valuable species in lake-commodity farms. Be able to set research goals, conduct morphobiological analysis of fish, process and summarize the results obtained. Have an idea of the biological basis of natural and artificial reproduction of fish.

ON 7. Have an understanding of the mechanisms of fish behavior, their reaction to natural and artificial physical stimuli. Know about the current distribution of the fauna of hydrobionts and other animals. Evaluate the general principles of fish stocks protection, chemical composition and nutritional value of fish meat, organoleptic, post-mortem changes in raw materials and principles of its preservation, fish processing. Possess knowledge about the technology of growing whitefish.

ON 8. Have an idea of modern technologies of artificial reproduction and cultivation of aquatic organisms, forms of intensive fisheries, industrial methods of fish cultivation. Understand the classification of fishing gear, the organization of fishing in inland waters. To know the basics of general pathology, parasitology, epizootology, preventive and therapeutic measures, theoretical methods for studying the dynamics of the number of fish, age, size and sex structure of the fish population.

ON 9. Possess knowledge about the design features of spawning, lake-commodity, industrial farms, the construction of the head hydrotechnical node, the construction of water supply and drainage networks of fish-breeding enterprises, technical operation of hydraulic structures of fish-breeding enterprises. To know the objects of pond fish farming, the types of pond farms, the technology of keeping and growing carp, whitefish, salmon, catfish and other fish in pond farming conditions.

ON 10. Have some knowledge about aquariums and the technology of growing ornamental fish. Know the breeding and commercial cultivation of seaweed, invertebrates, fish under controlled conditions. Possess knowledge about water pollution and periodic mapping of water quality by physico-chemical and biological characteristics. Know the toxicity of the aquatic environment, as well as the patterns of reactions of aquatic organisms of different systematic positions.

2. General characteristics of the educational program (relevance, features, competitive advantages, uniqueness, stakeholders, etc.)

The educational program "Aquaculture and aquatic bioresources" was created in accordance with the Law of the Republic of Kazakhstan dated July 9, 2004 "On the protection, reproduction and use of wildlife", taking into account the request of employers. This educational program solves the main problems of conservation and rational use of aquatic biological resources.

The relevance of the educational program lies in the fact that it reflects the issues of environmental protection in the field of protection of aquatic biological resources and fisheries management, taking into account modern realities.

The peculiarity of this educational program is that it takes into account the world experience in the field of aquaculture and the organization of fisheries (University of Eastern Finland, University of Putra Malaysia, Novosibirsk State Agrarian University), as well as taking into account the work and proposals of UNDP, ACBK, etc.

The competitive advantage of the educational program is that, based on the experience of various countries, this OP is aimed at solving issues of protection and rational use of aquatic biological resources and the development of aquaculture in the Republic of Kazakhstan.

The uniqueness of the educational program lies in the fact that it reflects significant tasks in the field of fisheries development with the use of modern innovative technologies, the introduction of new aquaculture facilities for the Republic of Kazakhstan. For the implementation of the educational program, there is an appropriate material and technical base (Scientific Research Center "Fisheries", educational and production hunting and fishing farm "Dudaray", UAZ cars, devices for monitoring living objects, swim. tools, fishing gear, expedition gear, etc.), as well as bases of practices provided by employers such as the Fisheries Committee of the Ministry of Ecology and natural resources of the Republic of Kazakhstan, interregional basin inspection of fisheries of the fisheries committee of the ministry of ecology, and natural resources of the republic of Kazakhstan", LLP "Scientific and production center of fisheries", ALE "Kazakhrybkhov", LLP "Fish nursery "Maybalyk", oceanarium "Ailand", SNR "Korgalzhyn" and other entities in the field of fisheries.

3. Competence model (portrait) graduate

3.1 Areas of professional activity - Fisheries Committee of the Ministry of Ecology and natural resources of the Republic of Kazakhstan; fish farms; fishing organizations and enterprises; research institutes; environmental organizations; fish processing enterprises.

3.2 Types of professional activity: taxonomic determination of aquatic biological objects, quantitative and qualitative accounting of aquatic organisms, biological and morphological characteristics of fish; determination of biological productivity of reservoirs, breeding of fish and economically valuable aquatic organisms in natural and artificial reservoirs; obtaining sexual products and insemination of eggs; biological provision of conditions for incubation of eggs and rearing of juvenile fish; intensification of fish breeding processes; organization of fishery reclamation; organization of industrial fishing of aquatic organisms; organization of breeding and breeding work; organization and operation of fish-breeding enterprises of all types; conducting experiments to study the species composition of hydrobionts, features of biology, distribution and classification of hydrobionts; determination of productivity of reservoirs and ways of infection of fish diseases; study, monitoring, protection and fishing of fish and other aquatic biological resources in the inland waters of Kazakhstan.

3.3 General education competencies

Upon completion of the study of the compulsory disciplines of the cycle of general education disciplines, the student will be able to:

- 1) to collect and interpret information for the formation of judgments taking into account social, ethical and scientific considerations;
- 2) evaluate the surrounding reality on the basis of worldview positions formed by knowledge of the fundamentals of philosophy, which provide scientific understanding and study of the natural and social world by methods of scientific and philosophical cognition;
- 3) to show a civic position based on a deep understanding and scientific analysis of the main stages, patterns and peculiarities of the historical development of Kazakhstan;
- 4) apply knowledge and understanding of facts, phenomena, theories and complex dependencies between them in the field under study;
- 5) understand the importance of the principles and culture of academic integrity.

3.4 Basic competencies based on the results of teaching basic disciplines, the student must:

- 1) demonstrate knowledge and understanding in the field of fisheries based on advanced knowledge of this field;
- 2) apply knowledge and understanding at a professional level, formulate arguments and solve problems in the field of fisheries;
- 3) apply theoretical and practical knowledge to solve educational, practical and professional tasks in the field of fisheries;
- 4) training skills necessary for independent continuation of further training in the field of fisheries;
- 5) know the methods of scientific research and academic writing and apply them in the field of fisheries;

3.5 Professional competencies during the implementation of the OP, the student acquires the following competencies:

Know and understand:

- organization, planning and direct implementation of a complex of works on artificial breeding, cultivation and acclimatization of valuable economic species of fish and invertebrates;
- organization and planning, direct implementation of a complex of works on protection and control of rational use of natural biological resources;
- biology and fishing features of the main objects of fish farming and fishing, their ecology;
- hydraulic structures of fish-breeding enterprises, their technical operation, technical justification of fishery construction;
- achievements of science and technology, advanced domestic and foreign experience in the relevant work performed, areas of knowledge;

Be able to:

- apply the acquired knowledge to solve specific scientific, practical, information retrieval, methodological and educational tasks;
- use modern methods of studying natural phenomena and processes;

- to determine the practical significance of populations of commercial fish species;

Acquire practical skills:

- apply the methodology of field and laboratory ichthyological and hydrobiological studies;
- apply methods for assessing fish stocks, bonitization of reservoirs.

4 The base of passing professional practices (all types of practices). In the process of implementing the OP, students undergo training practice in the discipline of ichthyology and hydrobiology at the end of the 2nd year in the field. The training practice will be conducted under the guidance of a teacher of the department on the basis of the reservoirs of the Akmola region (Koyandy reservoir, Astana, Lake Zhaltyrkol, Uyaly-Shalkar, Yesil River) and on the fish ponds of Maybalyk Fish Nursery LLP. Departure to the listed reservoirs will be carried out according to the agreement with the Republican State Institution Esil interregional basin inspection of fisheries of the fisheries committee of the ministry of ecology and natural resources of the republic of Kazakhstan".

To consolidate theoretical knowledge, the graduating department organizes industrial and pre-graduate practice. The main bases of practices for passing professional practices are the SIC "Fisheries", LLP "Scientific and production center of fisheries", LLP "Fish nursery "Maybalyk", NGO "Society of Hunters and Fishermen of Astana and Akmola region", LLP "Halyk-balyk", "Zerendinsky Fishery Enterprise", LLP "Kazakh Osseter", LLP "Karaganda fish nursery", East Kazakhstan regional Public Association of hunters and fishermen, oceanarium "Ailand".

5 Structure of the Bachelor's degree program

№	Name of cycles and disciplines	Total labor intensity	
			в академических кредитах
1	2	3	4
1	Cycle of general education subjects	1680	56
1)	Core subjects	1530	51
	History of Kazakhstan	150	5
	Philosophy	150	5
	Foreign language	300	10
	Kazakh (Russian) language	300	10
	Information and communication technologies (in English)	150	5
	Module of socio-political knowledge (sociology, political science, cultural studies, psychology)	240	8
	Physical education	240	8
2)	Electives component	150	5
	Basic of economics / Basics of anti-corruption culture / Fundamentals of business	150	5
2	Cycle of Base requirements	3090	103
1)	University component	1500	50
	Fish genetics	150	5
	Zoology	180	6
	Fish physiology	120	4
	Biochemistry	120	4
	Ichthyology	150	5
	Fish embryology	120	4
	Hydrobiology	150	5
	Mathematics	120	4
	Biological bases of fish farming	120	4
	Zoogeography of reservoirs in Kazakhstan	150	5
	Educational practice	120	4
	2)	Electives component	1590
Hydrochemistry /Microbiology and Virology		120	4
Structure and taxonomy of coastal plants /Meteorology		150	5
Protection of water bioresources / Basics of legislation in fishery		150	5
Fundamentals of research in fisheries / Lake commercial		150	5

	fish farm		
	Breeding of decorative fishes /Sanitary hydrobiology	150	5
	Fish ethology /Ichthyogeography	150	5
	Particular Ichthyology /Aquatic Ecosystem	150	5
	Technology of processing of fish products /Whitefish cultivation	150	5
	Biological efficiency of reservoirs /Operation recirculation installations	150	5
	Ecology and life safety /Labor protection and basics of life safety	120	4
	Mariculture /Toxicology of reservoirs	150	5
3	Cycle of profession requirements	2190	73
1)	University component	1860	62
	Aquaculture	150	5
	Technology of cultivation of hydrobionts	150	5
	Fishing	150	5
	Theory of formation of fish stocks	150	5
	Fishery design	120	4
	Fishery hydraulic engineering	120	4
	Ichthyopathology	150	5
	Industrial fishfarming	180	6
	Feed and feeding of fish in aquaculture	150	5
	Internship	390	13
	Pre diploma practice	150	5
2)	Electives component	330	11
	Piscine fish breeding /Trout breeding	150	5
	Artificial reproduction of fishes/ Sturgeon culture	180	6
4	Additional courses		
1)	Electives component		
	Military training		
5	Final certification	240	8
1)	Writing and defending a thesis, graduation project, or preparing and passing a comprehensive exam	240	8
	Total	7200	240

Appendix 3. Matrix of achievability of the formed learning outcomes according to the educational program with the help of academic disciplines

№	Name of the discipline	Short description of the discipline (30-50 words)	Number of credits	Generated learning outcomes									
				ON 1	ON 2	ON 3	ON 4	ON 5	ON 6	ON 7	ON 8	ON 9	ON 10
Cycle of general education subjects Electives component													
1	Basic of economics/ Basics of anti-corruption culture/ Fundamentals of business	<p>The subject of economic theory and research methods. Foundations of social production and a social economy form. A mechanism of the functioning of market systems. Production, costs and income of the company. National economy. Economic growth and market instability. Inflation and unemployment - a manifestation of economic instability. Financial and monetary system in the national economy and economic security.</p> <p>Basics of anti-corruption culture. The discipline explores the theoretical and methodological foundations of the concept of "corruption" and examines the improvement of socio-economic relations of the Kazakh society as a condition for combating corruption, psychological features of the nature of corrupt behavior, the formation of anti-corruption culture, features of the formation of anti-corruption culture of youth, ethnic features of the formation of anti-corruption culture, moral and ethical responsibility for acts of corruption in various spheres. The discipline allows you to learn about the legal responsibility for corruption offenses.</p> <p>Fundamentals of business. The subject of the basics of entrepreneurship. The concept of entrepreneurship under the legislation of the Republic of Kazakhstan. Ownership in the Republic of Kazakhstan. Legal status of legal entities. Property rights. Private</p>	5	V									

		entrepreneurship. Individual entrepreneurship. Licensing of entrepreneurial activity. Legal regime of foreign investments.											
Cycle of base requirements													
University component													
2	Biochemistry	The discipline of biochemistry studies the features of the structure of biomolecules (amino acids, peptides, proteins), sugars, nucleosides, nucleic acids, fatty acids, vitamins and trace elements; the chemical foundations of biological processes and the most important principles of molecular logic of the living; the main chemical components of the cell, the molecular foundations of biocatalysis and heredity.	4		V		V						
3	Fish genetics	The discipline studies the basic patterns of inheritance of traits and the principles of heredity of fish. Chromosomal theory of fish heredity. Molecular bases of heredity. Sex determination and some issues of hormonal regulation of sex in roundworms and fish, mutation process and various types of mutation, some molecular aspects of regulation of gene expression in fish and other eukaryotes.	5		V								
4	Hydrobiology	Discipline studies the physicochemical conditions of the aquatic population, the hydrosphere, continental water bodies and their populations, as well as the biological production of aquatic ecosystems and ways to increase it.	5		V	V	V						
5	Zoology	Studies the fitness and regularity of the distribution of various animals on Earth, their systematics, the origin of various animal species, ways of development, the diversity of animals, their role in nature, animal ecology. Examines the species of invertebrates and all types of vertebrates.	6		V		V						
6	Ichthyology	The discipline studies the development of ichthyology, systematics and anatomy, external and internal	5		V	V							

		structure, skeleton and muscular system, biology and ecology, nutrition and reproduction of fish.												
7	Biological bases of fish farming	The discipline studies the state and prospects of fish farming, the importance of fish farming in the conservation and increase of fish stocks, the biological foundations of various links of natural and artificial reproduction of fish.	4						V					
8	Mathematics	The course covers all the necessary sections of mathematics: elements of mathematical logic and number theory; linear algebra; vector algebra, analytic geometry, differential and integral calculus of functions of one and several variables, differential equations, multiple integrals, series theory, introduction to probability theory and mathematical statistics, solving mathematical problems using computer programs	4	V			V							
9	Zoogeography of reservoirs in Kazakhstan	The discipline studies the distribution of hydrobionts and other animals in the reservoirs of Kazakhstan. The main objects of zoogeography are faunas and habitats. She studies the distribution of fish species and other taxa in Kazakhstan, studies the distribution of faunal complexes, as well as the processes of settlement and extinction of animals in the process of expansion and reduction of their ranges.	5		V					V				
10	Fish physiology	The discipline studies the physiological processes of the gastrointestinal tract, respiratory, excretory, nervous, endocrine and other systems of the fish body, as well as their specific features.	4		V		V							
11	Fish embryology	Discipline studies the characteristics of embryo development, also the development of germ cells - gametogenesis, morphology and physiology of gametes, fertilization, explores the causes and mechanisms of morphological processes and the relationship of organisms with the environment.	4			V								

Cycle of base requirements

Electives component												
12	Fish ethology/ Ichthyogeography	<p>The discipline studies the mechanisms of fish behavior and the possibility of using them in fishing and fish farming, the study of fish reception organs and the peculiarities of their perception of physical fields, fish reactions to artificial and natural physical fields, as well as their use in fish farming.</p> <p>The discipline studies the idea of the modern distribution of fish fauna, shows the causes and patterns of settlement and origin of ichthyogeographic complexes, identifies the reasons for the differences between the ichthyofauna of the regions of the World Ocean and continental reservoirs.</p>	5						V	V		
13	Biological efficiency of reservoirs / Operation recirculation installations	<p>Biological efficiency of reservoirs. The discipline studies the basics of the formation of production processes in a reservoir, autotrophic and heterotrophic nutrition, the influence of external factors on the rate and volume of productivity, anthropogenic impact on biotopes, methods of improving the ecological situation in the reservoir.</p> <p>Operation recirculation installations. The discipline studies the structure scheme of the components of a RAS, the features of the structure of a biological, mechanical filter, the features of the structure of a RAS from the destination.</p>	5					V				
14	Hydrochemistry / Microbiology and Virology	<p>Hydrochemistry, the science of the chemical composition of natural waters and the laws of its change depending on the chemical, physical and biological processes occurring in the environment. Knowledge of the chemical composition of water (determining its quality) is necessary for such areas of practice as water supply, irrigation, fisheries; hydrochemical information is important for assessing the corrosion of building materials (concrete, metals), for the characteristics of mineral waters, in the search for minerals (oil, ore</p>	4				V					V

		deposits, radioactive substances), etc. The study of the chemical composition of water is of great importance in the fight against pollution of water bodies Microbiology and Virology. Basic information about the place of prokaryotes and eukaryotes among living organisms, about the morphology, physiology and genetics of microorganisms, as well as about metabolism in a microbial cell. General characteristics of viruses. The use of microorganisms and their metabolites in the food industry. The influence of external factors on microorganisms. Mechanisms of metabolism in microorganisms. Conversion of nitrogen compounds by microorganisms.					V						
15	Structure and taxonomy of coastal plants / Meteorology	Structure and taxonomy of coastal plants. The discipline studies the external and internal structure of vegetative and generative organs of aquatic and coastal plant species, the main systematic groups of plants of water basins. Meteorology. Instruments for meteorological observations, methods, characteristics and assessments of climate and weather conditions of the growing season. Types and forms of meteorological information, their use in forestry to adjust the elements of technology for the care of tree and shrub species. The use of agrometeorological information for programming in forestry.	5			V							
16	Protection of water bioresources/ Basics of legislation in fishery	The discipline studies measures for the protection of aquatic biological resources, species of aquatic organisms listed in the Red Book, and factors influencing the abundance of aquatic biological resources. Fundamentals of legislation in fisheries discipline studies the legislative framework used in fisheries; measures for the protection of aquatic biological resources; to combat poaching.	5						V	V			

17	Fundamentals of research in fisheries/ Lake commercial fish farm	The discipline studies the goals and objectives of scientific research, the methodology of hydrobiological, hydrochemical, ichthyological research. The discipline studies the fishery use of reservoirs, by completely or partially replacing the ichthyofauna in them by catching economically low-value fish, settling, growing and subsequent catching of valuable fish species in them.	5			V			V				
18	Technology for processing of fish products/ Whitefish cultivation	The discipline studies techniques and methods of obtaining, processing raw materials, semi-finished products carried out in various industries. The discipline studies the factory production of whitefish offspring, as well as the cultivation of high-quality planting material. Study of fish feeding standards.	5			V			V		V	V	V
19	Ecology and life safety/ Labor protection and basics of life safety	Ecology and life safety studies the laws of the existence, formation and functioning of biological systems at all levels – from the body to the biosphere and their interaction with the environment. The discipline contributes to the formation of students' knowledge, practical skills to create safe and harmless living conditions, to prevent the causes and prevention of dangerous situations, to protect the population and production personnel and objects of the national economy from the possible consequences of emergency situations. It also studies the peculiarities of labor protection for women and youth, supervision and control of the implementation of labor protection legislation and responsibility for violation of labor protection requirements.	4					V					
20	Breeding of decorative fishes/ Sanitary hydrobiology	The discipline studies the prospects of using aquariums as an applied branch of fisheries and technologies for growing ornamental fish species. The discipline studies the pollution of reservoirs, periodic mapping of water quality by physico-chemical	5			V							V

		and biological characteristics, studies of the ecology of aquatic organisms in clean reservoirs, studies of the physiology and ecology of aquatic organisms, their changes under the influence of toxicants and wastewater.				V							V
21	Mariculture / Toxicology of reservoirs	The discipline studies the breeding and commercial cultivation of seaweed, invertebrates, fish under controlled conditions, including changing environmental parameters in order to create favorable conditions for cultivated habitat organisms. The discipline studies the toxicity of the aquatic environment, the patterns of reactions of aquatic organisms of different systematic positions and different levels of organization to the toxic effects of the aquatic environment.	5							V			V
										V			V
22	Particular Ichthyology / Aquatic Ecosystem	The discipline considers the taxonomic characteristics of the ichthyofauna, evaluates the external development and structure of fish, features of biology and ecology of various representatives of the order of fish and determines their species. Studies their species characteristics, biology, phylogeny, taxonomic position, taxonomy, economic significance and role in nature. The discipline studies the ecosystem of the aquatic environment in which communities of organisms that depend on each other live.	5		V	V							
							V						
Cycle of profession requirements													
University component													
23	Feed and feeding of fish in aquaculture	The discipline studies the concept of feed resources and the feed base of the reservoir, compound feed for fish and their characteristics, the composition and nutritional value of feed used for the production of compound feeds, live feed breeding, the development of feed recipes for various species of fish and aquatic organisms, technological methods of rational feeding of fish, ensuring their normal growth and development.	5			V		V					

24	Aquiculture	The discipline studies artificial breeding of freshwater fish, feeding standards and landing standards in fishery reservoirs, reclamation measures in fish farms.	5					V		V	V		
25	Industrial fish farming	The discipline studies the breeding and rearing of fish in special fish-breeding tanks (pools, cages, circulating water supply systems, closed water supply installations) with intensive feeding and planting density.	6						V		V	V	
26	Fishery design	The discipline studies calculations and operations that play a crucial role in the subsequent construction work.	4								V	V	
27	Fishery hydraulic engineering	The discipline studies the design and operation of hydraulic structures, design methods and techniques of their construction.	4								V	V	
28	Fishing	The discipline studies the history of fishing development, classification of industrial fishing gear, selectivity of fishing gear, net materials and construction of fishing gear, storage and assessment of the condition of fishing gear, organization of fishing in inland waters.	5							V	V		
29	Theory of formation of fish stocks	The discipline studies a brief overview of the theory of fish stock formation, factors affecting the formation of fish stocks, food relations, fertility, old age and growth, general and natural mortality, patterns of predator impact on the population, the influence of abiotic conditions on fish mortality, causes of fluctuations in fish numbers, methods of accounting for fish numbers.	5					V			V		
30	Technology of cultivation of hydrobionts	The discipline studies the production of sexual products by the factory method in fish and cultivation to marketable weight in commercial fish farms, with the use of artificial balanced feeds.	5					V		V	V		
31	Ichthyopathology	The discipline studies infectious, invasive, non-communicable diseases of fish and their treatment and prevention.	5					V			V		

**Cycle of profession requirements
Electives component**

32	Piscine fish breeding/ Trout breeding	<p>Piscine fish breeding. The discipline studies the breeding and rearing of fish in ponds, types and categories of ponds, reclamation activities in pond farms.</p> <p>Trout breeding. The discipline studies methods of obtaining sexual products and further commercial cultivation of trout using artificial feeding.</p>	5							V	V	V	
33	Artificial reproduction of fishes/ Sturgeon culture	<p>Artificial reproduction of fishes. The discipline studies the artificial reproduction of fish, the rearing of juveniles to the resilient stages of development and its release into reservoirs of fishery importance.</p> <p>Sturgeon culture. The discipline studies the technology of growing sturgeon fish in ponds, RAS, cages, obtaining resilient juveniles, feeding fish groups of different ages.</p>	6							V	V		
										V	V		

