

**MINISTRY OF AGRICULTURE OF THE REPUBLIC OF KAZAKHSTAN
"NJSC "S. SEIFULLIN KAZAKH AGROTECHNICAL UNIVERSITY"**

Approve
NJSC "Saken Seifullin Kazakh
Deputy Chairman of the Management
Board Academic Activity-Rector
_____ A.M Abdyrov.
« _____ » _____ 2021.

CATALOG OF ELECTIVE COURSES

For students in groups of educational programs

Aquaculture and aquatic bioresource

Nur-Sultan, 2021

**MINISTRY OF AGRICULTURE OF THE REPUBLIC OF KAZAKHSTAN
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Brief description of elective disciplines of the educational program

Veterinary Radiobiology

1	Name of course	Structure and systematics of coastal aquatic plants
2	Code of course	SSPVR 1214
3	Cycle of course	BD
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	1
8	Prerequisites	School course on the subject of biology
9	Postrequisites	Pond fish farming, aquaculture and hydrobiont cultivation technology
10	Course summary	the course of the discipline studies the role of plants in the system of the animal world, systematics, taxonomic categories, structure of the plant cell, morphology of aquatic plants, phytoplankton, ecological groupings of algae. Quantitative accounting of algae.
11	Learning outcomes	Know the general questions of the organization and features of the structure and functioning of plants, both lower and higher; - be able to: distinguish the highest plant from the lowest by morphological characteristics; make herbariums

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Brief description of elective disciplines of the educational program

Laboratory diagnostics in veterinary medicine

1	Name of course	Zoology 1
2	Code of course	Z 1201
3	Cycle of course	BD
4	Amount of credits	3
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	1
8	Prerequisites	School education in biology
9	Postrequisites	Fish morphology, fish physiology, biochemistry, genetics, ichthyogeography, ecology and life safety, aquaculture, hydrobiont cultivation technology, ichthyology, fish embryology
10	Course summary	The discipline studies the basic concepts and concepts of morphology, anatomy, biology, systematics, ecology of invertebrates and their role in the biosphere and human life, modern systematic positions of representatives of all types of the animal kingdom, the structure of the studied representatives, features of life cycles and ontogenesis, the level of organization of the studied objects, distribution, phylogeny.
11	Learning outcomes	to know the basic levels of animal organization, to form an idea of the importance of all stages of individual development of animals; be able to apply the obtained data to solve scientific and practical problems; identify the biological features of the species, determine the external structure of animals, their species diversity, development, classification of animals, distribution, origin, their relationship with the environment, their significance in nature and for humans, possess the skills of analyzing cause-and-effect relationships in the relationship between animals and nature.

1	Name of course	Zoology 2
2	Code of course	Z 1203
3	Cycle of course	BD
4	Amount of credits	3
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	1
8	Prerequisites	School education in biology
9	Postrequisites	Fish morphology, fish physiology, biochemistry, genetics, ichthyogeography, ecology and life safety, aquaculture, hydrobiont cultivation technology, ichthyology, fish embryology
10	Course summary	The discipline studies the main levels of organization of animals, the stages of individual development of animals, the reasons for the diversity of the animal world and the main laws of its formation, modern views on the laws of the development of the organic world, systematics, structure, ontogenesis, ecology of types, classes of animals, as well as the main laws of the evolution of vertebrates.
11	Learning outcomes	know the reasons for the diversity of the animal world and the main patterns of its formation, modern views on the patterns of development of the organic world; be able to apply the obtained data to solve scientific and practical problems; identify and evaluate the role of different groups of animals in the evolution of the plant and animal world of the Earth; determine the internal structure of animals, their species diversity, development, classification of animals, distribution, origin, their relationship with the environment, their significance in nature and for humans. possess skills in setting scientific questions, and conducting research work

1	Name of course	Genetics
2	Code of course	Gen 2209
3	Cycle of course	BD
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	2
8	Prerequisites	Fish morphology, microbiology and virology, fish physiology, biochemistry,
9	Postrequisites	Theory of fish stock formation
10	Course summary	Genetics – the science of heredity and variability, the basis of modern biology. The course program also covers issues related to the needs of modern genetics and biostatistics. Since in the professional and scientific work of a future specialist, statistical processing of experimental data and comparative study of the results of observations is important. For the analysis of questions of genetics with biostatistics provide for the use of computers
11	Learning outcomes	Know the structure, structure, function and patterns of inheritance of chromosomes, genes and genome, changes in the characteristics of living organisms, methods of genetic engineering; Be able to: use the acquired knowledge in genetics and fish breeding to improve existing and develop new highly productive fish breeds, analyze the types of gene abnormalities and chromosomal diseases, types of genetic variability. Have the skills to: conduct biometric processing of primary breeding materials or experimental results. Have individual and group work skills. Be able to work with literature Possess: methods of improving and obtaining new fish breeds, obtaining highly productive fish resistant to diseases. The student must know and be able to use the knowledge gained to understand the peculiarities of heredity and variability of various organisms, to obtain and process data on fish breeding.

1	Name of course	Fish morphology
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2	Code of course	MR 1202
3	Cycle of course	BD
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	1
8	Prerequisites	zoology, hydrochemistry
9	Postrequisites	Ichthyology, fish embryology, hydrobiology and hydrology
10	Course summary	The discipline studies the main levels of organization of animals, the stages of individual development of animals, the reasons for the diversity of the animal world and the main laws of its formation, modern views on the laws of the development of the organic world, systematics, structure, ontogenesis, ecology of types, classes of animals, as well as the main laws of the evolution of vertebrates.
11	Learning outcomes	Know: The external and internal structure of fish. The relationship of changes in the external structure with the evolutionary changes in the internal organization of fish. The location of the fins. The external skeleton of fish. Types of scales and changes in their structure during the evolution of fish. The structure of fish scales. Mucosal and pigment cells. - the connection of the organism with the aquatic environment - influence of the chemical and biological composition of the environment. - mechanism of borrowing of organisms between themselves Be able to: apply theoretical knowledge of fishing with the practical branch of fishing. - apply theoretical knowledge in practical and research activities. Master the skills: analysis of the phylogeny and ontogenesis of fish in connection with their development and formation. To acquaint students with the main patterns of their development. Know the achievements of the current state of the fishing industry in Kazakhstan. Use the new achievements of science in this field.

1	Name of course	Fish physiology
2	Code of course	FR 2204
3	Cycle of course	BD
4	Amount of credits	4

5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	2
8	Prerequisites	Fish morphology, hydrochemistry
9	Postrequisites	Ichthyology, fish embryology
10	Course summary	Fish physiology studies the patterns of life processes in individual organs and tissues of fish and other representatives of aquaculture, as well as in organ systems, depending on the state of the aquatic environment in a healthy body. It is the basis of special disciplines.
11	Learning outcomes	Upon completion of the course of studying the discipline "Fish Physiology", students will be able to apply the knowledge and skills acquired in the course of training in the professional activity of an ichthyologist: Know: - the main patterns of formation and flow of physiological processes in the body of fish, depending on the state of the surrounding (aquatic) environment; - Anatomical and physiological features of the body of bony and cartilaginous fish - macro- and microstructure of tissues and organs of the fish body, the main laws of the functions of the body systems; - mechanisms of body functions and their differences in different types of aquaculture. Be able to: - apply the acquired practical skills in conducting hydrological and physiological studies, setting up experiments and the necessary mathematical calculations in order to apply them in the professional activity of an ichthyologist. - to form knowledge on theoretical issues of physiology that are important in practice. - be able to explain the mechanism of operation of individual organs and the body as a whole.

1	Name of course	Biochemistry
2	Code of course	Bio 2205
3	Cycle of course	BD
4	Amount of credits	4
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	2
8	Prerequisites	Fish morphology, hydrochemistry
9	Postrequisites	Ichthyology, fish embryology

10	Course summary	The discipline of animal and plant biochemistry studies the structure of biomolecules (amino acids, peptides, proteins), sugars, nucleosides, nucleic acids, fatty acids, vitamins and trace elements; the chemical basis of biological processes and the most important principles of molecular logic of living things; the main chemical components of the cell, the molecular basis of biocatalysis and heredity.
11	Learning outcomes	Upon completion of the course of study of the discipline, students will Know: - the basic laws of the structure of biomolecules Be able to: - apply the acquired practical skills in conducting biochemical research, setting up experiments and the necessary mathematical calculations. - to form knowledge on theoretical issues of biochemistry that are important in practice. - be able to explain the mechanism of operation of individual organs and the body as a whole. Master the skills: - biochemical processes in the body

1	Name of course	Ichthyology
2	Code of course	Iht 2211
3	Cycle of course	BD
4	Amount of credits	6
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	2
8	Prerequisites	Ichthyogeography, fish morphology
9	Postrequisites	Aquaculture, ornamental fish farming
10	Course summary	The discipline studies the development of ichthyology in Kazakhstan and the CIS, systematics and anatomy, external and internal organs, the skeleton and muscular system of fish. Biology and ecology, nutrition and reproduction of fish.
11	Learning outcomes	The student must know: the morphology of fish and their specific features; the main environmental factors that affect the biology and morphology of fish;

1	Name of course	Fish embryology
2	Code of course	ER 2207
3	Cycle of course	BD
4	Amount of credits	4
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	2
8	Prerequisites	Ichthyogeography, fish morphology
9	Postrequisites	Aquaculture, hydrobiont cultivation technology, industrial fish farming in Kazakhstan
10	Course summary	The discipline studies the features of the development of embryos, as well as the development of germ cells – gametogenesis, morphology and physiology of gametes, fertilization, examines the causes and mechanisms of morphological processes and the relationship of organisms with the environment.
11	Learning outcomes	The student must know: the main links of the life cycle of fish; fish biology (age and growth rate, nutrition, reproduction, migration, settlement and origin of fish); taxonomy and ecology of fish; private ichthyology

1	Name of course	Hydrobiology
2	Code of course	Gid 2210
3	Cycle of course	BD
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	2
8	Prerequisites	Zoology, structure and systematics of coastal aquatic plants
9	Postrequisites	Fish physiology, biochemistry
10	Course summary	The discipline studies the physical and chemical conditions of the aquatic population, the hydrosphere, continental reservoirs and their populations, as well as the biological production of aquatic ecosystems and ways to improve it.
11	Learning outcomes	The student must know the classification of continental and marine reservoirs, the morphology of reservoirs, the laws of the formation of the hydrological regime of rivers, lakes, reservoirs. - to know the structure and functional features of the population of aquatic invertebrates, the life forms and ecological bases of the life of hydrobionts, the basics of biological productivity of reservoirs, to master the methods of selection and analysis of hydrobiological and hydrochemical samples.

1	Name of course	Hydrology
2	Code of course	Gid 2206
3	Cycle of course	BD
4	Amount of credits	3
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	2
8	Prerequisites	Zoology, structure and systematics of coastal aquatic plants
9	Postrequisites	Fish physiology and biochemistry
10	Course summary	The discipline studies hydrological phenomena and processes that are inextricably linked to the geographical environment, as well as natural waters as an integral part of the geographical landscape, which is in continuous interaction with it.
11	Learning outcomes	The student must know the hydrological phenomena and processes that are inextricably linked with the geographical environment, the importance of meteorology for the forecast of the hydrological regime of reservoirs.

1	Name of course	Aquaculture
2	Code of course	Akv 3304
3	Cycle of course	SD
4	Amount of credits	6
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	3
8	Prerequisites	Hydrobiology, hydrology, ichthyology, fish embryology
9	Postrequisites	Pond fish farming, fisheries design and hydraulic engineering
10	Course summary	Water as a habitat. Classification of natural waters. The doctrine of the productivity of reservoirs. Production processes for obtaining offspring in warm-water farms. Production processes for obtaining offspring in cold-water farms. Intensification of the fish-breeding process in the warm-water fish farming. Industrial fish farming. Prevention of diseases in fish farms.
11	Learning outcomes	The student should be able to summarize the observed facts and offer recommendations for the rational use of water resources and the bio-productivity of water bodies. It is rational to conduct a fish-breeding event based on a scientific approach, taking into account the biological characteristics of aquaculture objects and the use of modern technologies.

1	Name of course	Technology of growing hydrobionts
2	Code of course	TVG 3302
3	Cycle of course	SD
4	Amount of credits	4
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	3
8	Prerequisites	Hydrobiology, hydrology, ichthyology, fish embryology
9	Postrequisites	Pond fish farming, fisheries design and hydraulic engineering
10	Course summary	Water as a habitat. Classification of natural waters. The doctrine of the productivity of reservoirs. Production processes for obtaining offspring in warm-water farms. Production processes for obtaining offspring in cold-water farms. Intensification of the fish-breeding process in the warm-water fish farming. Industrial fish farming. Prevention of diseases in fish farms.
11	Learning outcomes	The student should know how to analyze and plan fish-breeding and fishery activities. Draw conclusions about the expediency of the applied technological processes and economic efficiency.

1	Name of course	Fishing
2	Code of course	Ryb 3301

3	Cycle of course	SD
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	3
8	Prerequisites	Hydrobiology, hydrology, ichthyology, fish embryology
9	Postrequisites	Pond fish farming, theory of fish stock formation
10	Course summary	History of the development of fishing in Kazakhstan. Classification of industrial fishing gear. Selectivity of fishing tools. Straining fishing gear. Hugging fishing gear. Hook tackle. Traps. Fish pumps. Electrolov. Netmaterials and construction of fishing gear. Storage and assessment of the condition of fishing gear. Organization of fishing in inland waters.
11	Learning outcomes	The student must know the basics of fishing designed for the rational management of fish-breeding activities and the use of modern fishing technologies, have an idea of fishing methods, fishing techniques, determining the total allowable catch, sea and river fishing, swimming facilities. Apply practical skills in fishing, the use of innovative technologies in industrial fishing, fishing for hydrobionts, marine mammals.

1	Name of course	Theory of fish stock formation
2	Code of course	TFRZ 4307
3	Cycle of course	SD
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management

7	Year	4
8	Prerequisites	Hydrobiology, hydrology, fundamentals of legislation in fisheries, fisheries
9	Postrequisites	Thesis work
10	Course summary	The current state of commercial fish. Patterns of population change. Theories of reservoir productivity. Adaptations to self-regulation of the population. Commercial mortality.
11	Learning outcomes	know the basics of the theory of fishing, theoretical methods for studying the dynamics of fish numbers, an elementary population model and its study to obtain the main characteristics of the catch and population, the age, size and sex structure of the fish population, natural and commercial mortality, their determining factors, fish productivity of natural reservoirs.

1	Name of course	Fisheries engineering and hydraulic engineering
2	Code of course	PRHG 4308
3	Cycle of course	SD
4	Amount of credits	8
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	4
8	Prerequisites	Aquaculture, hydrobiont cultivation technology, protection of aquatic bioresources, fish nutrition and feeding
9	Postrequisites	Pond fish farming
10	Course summary	The content of the discipline is the study of the essence and concept of rationing of technological processes, technological standards and standard design, the role of standard design in the development of production.

11	Learning outcomes	The student must know about the procedure for the design and construction of new fish farms, the design features of carp and trout pond farms, the composition of construction works and the properties of building materials, the principles of designing the waterfall and spillway network, the layout of the farm, the principles of calculation, the principles of calculation of hydraulic structures. Be able to carry out fish-breeding calculations for carp and trout pond farms.
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1	Name of course	Industrial fish farming in Kazakhstan
2	Code of course	IRK 4306
3	Cycle of course	SD
4	Amount of credits	6
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	4
8	Prerequisites	Ichthyology, fish embryology, aquaculture and hydrobiont cultivation technology, ichthyopathology
9	Postrequisites	Operation of closed water supply installations
10	Course summary	Biotechnics of industrial fish farming, based on artificial reproduction of sturgeon, knowledge of artificial reproduction of fish, basic technological processes. Features getting mature producers. The factory method of reproduction. Incubation machines and production processes prior to the release of juveniles into natural reservoirs. The aim of the course: to equip students with knowledge of industrial fish farming using the technologies of the pool and pond method.
11	Learning outcomes	The student must know: - biology of sturgeon fish; - reproduction of sturgeon fish; - land reclamation measures used on sturgeon farms; - types of pools and ponds; - feed and feeding of sturgeon fish; - work with the methodology of studying sturgeon farming; - work with reference literature;

1	Name of course	Fundamentals of Economics
2	Code of course	OE 2118
3	Cycle of course	BD
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	2
8	Prerequisites	mathematics with the basics of biometrics
9	Postrequisites	production practice
10	Course summary	The course program is designed for the amount of teaching-150 hours, of which: 50 hours-for classroom work and 100 hours-for independent work. Introduction. Economic needs, goods, and resources. Types and forms of ownership. Types of economic systems. Market. The mechanism of its functioning. The law of demand and the behavior of buyers. The law of supply and the logic of business. Market equilibrium. A firm in a market economy. Economic fundamentals of business
11	Learning outcomes	Students should be able to use the basic concepts of economic theory in practice, knowledge of the main events in the history of the development of economic thought, the ability to analyze individual economic processes, establish relationships between these phenomena, determine the properties of economic entities; acquire skills in working with schemes, test tasks and problem solving;

1	Name of course	English for special purposes
2	Code of course	AYaDSC 2217
3	Cycle of course	BD
4	Amount of credits	6
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	2
8	Prerequisites	Foreign language level B1-B2
9	Postrequisites	Subjects in the specialty in a foreign language
10	Course summary	The course program is designed for the amount of teaching-180 hours, of which: 54 hours-for classroom work and 108 hours-for independent work. The course ends with a comprehensive exam. The course is designed for 1 semester
11	Learning outcomes	According to the results of the development of the program, the student, depending on the level of training, at the time of completion of the course, reaches the level B1-(IELTS 4.0-5.0) or B2 - (IELTS5. 5-6. 0) and the formed skills for solving problems of professional, interpersonal and intercultural interaction

1	Name of course	Professionally-oriented foreign language
2	Code of course	POIYa 2218
3	Cycle of course	BD
4	Amount of credits	6
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	2
8	Prerequisites	Foreign language (English)
9	Postrequisites	English for academic purposes
10	Course summary	Development of fish farming in Kazakhstan. Features of fish farming. Nature reserves of the Republic of Kazakhstan. General biology: classification of fish, nutrition, reproduction, growth and development, physiology, ecology, migration.
11	Learning outcomes	vocabulary; consolidate and deepen knowledge of English grammar; be able to extract the necessary information from special texts; encourage the use of the acquired knowledge of professional English in practice, strive to independently improve foreign language skills

1	Name of course	Hydrochemistry
2	Code of course	Gid 2220
3	Cycle of course	BD
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	2
8	Prerequisites	Biophysics, mathematics with the basics of biometrics
9	Postrequisites	Hydrobiology, hydrology
10	Course summary	Know: the physical, chemical and biological properties of natural waters; the main chemical and biological processes that affect the formation of their chemical composition; the main hydrochemical classifications by mineralization, ionic and gas composition, biogenic and organic substances; natural and anthropogenic factors of spatial and temporal variability of the chemical composition of surface waters of the land and the runoff of dissolved substances; regularities of the hydrological and hydrochemical regime of rivers, lakes and reservoirs; the main regional features of the chemical composition and hydrochemical regime of waters of atmospheric precipitation, local and river runoff, lakes and reservoirs, underground waters; principles of organization of hydrochemical works at a water body; content of hydrochemical section
11	Learning outcomes	Fundamentals of hydrochemistry. Chemical composition of natural waters. Chemistry of atmospheric precipitation. Conditions of formation and chemical composition of underground water. Mineral waters. Chemistry of river waters. Biogenic and organic substances in river waters. Chemistry of lakes and reservoirs. Chemistry of ocean water. Drinking water. Quality requirements. Technical waters. Sources of pollution of natural waters. Methods of wastewater treatment. Analytical chemistry of waters. Metal ions in natural waters. Heavy metals in natural waters. Organic pollutants in water.

1	Name of course	Microbiology and virology
2	Code of course	MV 2219
3	Cycle of course	BD
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	2
8	Prerequisites	Structure and systematics of coastal aquatic plants, fish physiology and biochemistry, fish morphology, genetics
9	Postrequisites	Ichthyopathology
10	Course summary	The section of general and private microbiology studies various groups of saprophytic and pathogenic microbes, their morphology, systematics and physiology, the influence of environmental factors on the vital activity of microorganisms and the role of microorganisms in the transformation of substances in nature, in production processes, in the life of healthy animals and their pathology, as well as agricultural microbiology: the role of microorganisms in animal nutrition (microflora of the gastrointestinal tract) and in the pathological process (pathogens of infectious diseases), the use of microorganisms in the preservation and storage of plant feed (hay, silage, haylage, etc.), the use of microbial synthesis products (protein, amino acids, vitamins, antibiotics, etc.) in animal nutrition, the microbiology of animal products (microbiology of milk and dairy and dairy products, meat, eggs, leather and fur raw materials), the microbiology of manure.
11	Learning outcomes	The student must possess modern methods of microbiological research, knowledge of the function of microorganisms and their role in nature, methods of preparation of preparations and staining, cultivation and isolation of pure cultures of microbes and effective use of the beneficial properties of microbes, as well as diseases, the source of which is water.

1	Name of course	Mathematics with the basics of biometrics
2	Code of course	MOB 1215
3	Cycle of course	BD

4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	1
8	Prerequisites	School course on the subject of mathematics, genetics
9	Postrequisites	Biophysics, fundamentals of scientific research in fisheries
10	Course summary	The course of the discipline studies the issues of mathematical calculations, rules, basic concepts of probability theory and mathematical statistics, principles and methods of correlation, regression and variance analysis, analyze the results of experiments, observations, experiments, identify trends in the laws of the studied objects, apply statistical processing methods in practice, organize experimental and experimental work.
11	Learning outcomes	Development of students ' skills in mathematical calculation, application of mathematical statistics in solving scientific and practical issues in the field of biology, ecology, experimental work.

1	Name of course	Fundamentals of legislation in the fisheries sector
2	Code of course	OZRH 3224
3	Cycle of course	BD
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	3
8	Prerequisites	Aquaculture, a technology for growing hydrobionts

9	Postrequisites	Fishing
10	Course summary	State administration in the field of protection, reproduction and use of the animal world; Protection of the animal world; Use of the animal world; Fishing; Hunting and fishing management; Control in the field of protection, reproduction and use of the animal world; Temporary Model Provision of the Rules of Fishing in the reservoirs of the Republic of Kazakhstan, Protection of water bodies and combating harmful effects of water, protection of water bodies.
11	Learning outcomes	Know the basic principles and requirements of the rules of fish farming; Be competent in matters of legal regulation of fishing and fish farming. Know all the legal acts and bylaws on the regulation of the rules of fisheries management in the Republic of Kazakhstan.

1	Name of course	Operation of closed water supply installations
2	Code of course	EUZV 3225
3	Cycle of course	BD
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	3
8	Prerequisites	Aquaculture, hydrobiont cultivation technology, fish nutrition and feeding
9	Postrequisites	Industrial fish farming in Kazakhstan
10	Course summary	Components of the RAS. Types and forms of fish-breeding pools. Mechanical filtration. Biological filtration. Aeration. Oxygenation. Degassing. UV light sterilization. Operation of a closed water supply system. Selection of the site for the construction of the UZV. The quality of water for use in the RAS. The nitrogen cycle.

11	Learning outcomes	"The principle of operation of ULTRASOUND; Components of ultrasound; Mechanical and biological filtration; Aeration and degassing; Operation of the ULV; work with the methodology of studying sturgeon farming; work with reference literature;"
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1	Name of course	Operation of closed water supply installations
2	Code of course	EUZV 3225
3	Cycle of course	BD
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	3
8	Prerequisites	Aquaculture, hydrobiont cultivation technology, fish nutrition and feeding
9	Postrequisites	Industrial fish farming in Kazakhstan
10	Course summary	Components of the RAS. Types and forms of fish-breeding pools. Mechanical filtration. Biological filtration. Aeration. Oxygenation. Degassing. UV light sterilization. Operation of a closed water supply system. Selection of the site for the construction of the UZV. The quality of water for use in the RAS. The nitrogen cycle.
11	Learning outcomes	"The principle of operation of ULTRASOUND; Components of ultrasound; Mechanical and biological filtration; Aeration and degassing; Operation of the ULV; work with the methodology of studying sturgeon farming; work with reference literature;"

1	Name of course	Fundamentals of scientific research in fisheries
2	Code of course	ONIRH 4226
3	Cycle of course	BD
4	Amount of credits	6
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	4
8	Prerequisites	Ichthyology, fish embryology, hydrobiology, hydrology, mathematics with the basics of biometrics
9	Postrequisites	Theory of fish stock formation
10	Course summary	Fundamentals of fisheries research studies methods of morphological and biological analysis, growth and development of fish, determination of fatness, age, sex, puberty, fecundity of fish. Master the methodology of statistical processing.
11	Learning outcomes	The student must have an understanding of the issues of fisheries research, methods of conducting research in the study of the biological characteristics of fish, the growth and development of fish, the assessment of breeding stock producers. Acquisition of practical skills in fisheries research, the ability to use special and reference literature for the purpose of analyzing the ichthyofauna, the study of the quantitative and qualitative composition of hydrobionts, the nature of their nutrition and the biology of various hydrobionts.

1	Name of course	Decorative fish farming
2	Code of course	DR 3228
3	Cycle of course	BD
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	3
8	Prerequisites	Ichthyology
9	Postrequisites	Aquaculture, a technology for growing hydrobionts
10	Course summary	The discipline studies the prospects of using aquariums as an applied branch of fisheries; Forms certain knowledge about aquariums and pools as managed ecological systems; allows you to gain practical skills in the field of manufacturing and repairing aquariums, maintaining biological balance in aquariums and monitoring the epizootic state of aquariums.
11	Learning outcomes	"The student should know: - the concept of artificial reproduction of fish; - main technological processes; - the concept of incubation;"

1	Name of course	Fish Ethology
2	Code of course	ER 3229
3	Cycle of course	BD
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	3
8	Prerequisites	Ichthyology, aquaculture
9	Postrequisites	Hydrobiont growing technology hydrobiont growing
10	Course summary	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 features of their perception of physical fields; fish reactions to artificial and natural physical fields, as well as their use in fish farming.
11	Learning outcomes	"The student should know: - sexual behavior; - sexual dimorphism in various fish species; - work with the methodology of studying the artificial reproduction of fish; - work with reference literature; - process the received material and make analyses"

1	Name of course	Ichthyogeography
2	Code of course	Iht 3310
3	Cycle of course	BD
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	3
8	Prerequisites	Biological productivity of water bodies, aquaculture
9	Postrequisites	technology
10	Course summary	The current distribution of fish fauna on earth, to show the causes and patterns of settlement and origin of ichthyogeographic complexes, to reveal the reasons for the differences between the ichthyofauna of the World Ocean regions and Conti-tental reservoirs.
11	Learning outcomes	to know the distribution of fish in the world's oceans and surface waters, the theory of faunal complexes. Knowledge and understanding of the basics of the basic scientific direction-ichthyogeography.

1	Name of course	Protection of aquatic bioresources
2	Code of course	OVB 3222
3	Cycle of course	BD
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	3
8	Prerequisites	zoology, hydrobiology, hydrology, ichthyology, fish embryology
9	Postrequisites	Bio-productivity of water bodies
10	Course summary	The history of the development of fisheries in Kazakhstan. Aquatic biological resources. Brief information on biology. Integrated use and protection of aquatic bioresources.
11	Learning outcomes	know of aquatic biological resources, which include various fish species, including juveniles (fish stocks), other aquatic animals (crayfish, crabs, organisms sedentary species, aquatic fur-bearing mammals, etc.) and feed the animal organisms and aquatic vegetation, which together form feed stocks

1	Name of course	Fish processing technology
2	Code of course	TPRP 3221
3	Cycle of course	BD
4	Amount of credits	5

5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	3
8	Prerequisites	Zoology, hydrobiology, hydrology
9	Postrequisites	Bio-productivity of water bodies
10	Course summary	Chemical composition and nutritional value of fish meat, morphometry and mass composition of fish body, organoleptic, postmortem changes in raw materials and principles of its preservation, fish processing
11	Learning outcomes	know the technology content of fish intended for further processing, methods of determining the nutritional status of fish, methods of storage and processing of fish production technology storage canned products.

1	Name of course	Ecology and life safety
2	Code of course	EBZh 2216
3	Cycle of course	BD
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	2
8	Prerequisites	Zoology
9	Postrequisites	Protection of aquatic bioresources

10	Course summary	The general concept of ecology and the basics of life safety, as a theoretical basis for the protection of society and nature. Relationships of organisms with the environment and living conditions. V. I. Vernadsky's Biosphere Concept. Definition of the modern noosphere. Environmental problems of our time. Fundamentals of life safety. The concept of the technosphere. Principles of ensuring the safety of human interaction with the living environment. Potential, real and realized hazards of natural and man-made origin.
11	Learning outcomes	Ecology and the basics of life safety: the general concept of ecology as a theoretical basis for the protection of society and nature; the relationship of organisms with the environment; the biosphere-noosphere concept of V. I. Vernadsky; the definition of the concept of "sustainable development"; global environmental problems of our time, their causes and consequences; socio-ecological problems of our time and sustainable development; the current state and negative factors of the environment.

1	Name of course	Fish nutrition and feeding
2	Code of course	PKR 4227
3	Cycle of course	BD
4	Amount of credits	4
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	4
8	Prerequisites	Biological productivity of water bodies, aquaculture and technology of growing hydrobionts.
9	Postrequisites	Industrial fish farming in Kazakhstan, operation of closed water supply installations.
10	Course summary	"Proteins and their role. The value of fat. Carbohydrates and their role. The value of mineral substances. The role of vitamins. Premixes and their meaning. The role of enzyme preparations. Natural food supply and its characteristics. Improving the natural food supply Cultivation of plankton algae. Obtaining live feed for fish by incubating the eggs of aquatic invertebrates. Cultivation of aquatic invertebrates. Methods of studying fish nutrition. Qualitative characteristics of food. "

11	Learning outcomes	"Natural food supply and its characteristics; Getting live feed; Cultivation of aquatic invertebrates; Feed composition; feed and feeding of various types of fish fish; work with the methodology of studying sturgeon farming; work with reference literature; "
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1	Name of course	Pond fish farming
2	Code of course	PR 4312
3	Cycle of course	SD
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	4
8	Prerequisites	Hydrobiology and hydrology, ichthyology with the basics of embryology
9	Postrequisites	Fishing
10	Course summary	Objects of cultivation in pond farms. General issues of fish farming. Production base of fish farming. Organization of fish farms. Biological justification of carp pond farming. Growing commercial fish. Transportation of live fish and caviar. Land reclamation measures in pond farms. Fertilizing and feeding in ponds. Methods for increasing the natural fish productivity of ponds.
11	Learning outcomes	"know about artificial fish breeding, modern forms of intensive fish farming, types and design of pond farms; study the types of pond farms; know about artificial fish reproduction; know the multiplicity of fish feeding in ponds; to study land reclamation measures used in fish farms; "

1	Name of course	Ichthyopathology
2	Code of course	Ilt 3311
3	Cycle of course	SD
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Hunting and Fisheries Management
7	Year	3
8	Prerequisites	Hydrochemistry, Ichthyology
9	Postrequisites	Fishing
10	Course summary	The nomenclature of fish diseases is based on the principles of nosology, which defines a disease isolated on the basis of established etiology, pathogenesis and characteristic clinical and morphological picture. According to the etiological factors, infectious diseases of fish are distinguished by viral, bacterial, fungal (mycoses). Invasive diseases are numerous, caused by zooparasites from various systematic groups. Among them, the main mass of protozoan diseases, helminthiasis and crustaceosis. Non-infectious diseases caused by violation of zoohygienic conditions and toxicosis with pollution of water bodies
11	Learning outcomes	Gain in-depth theoretical knowledge and practical skills in the study of fish in continental waters. Have an understanding of the science of ichthyopathology, its principles and objectives, as well as correctly diagnose fish diseases. Know the rules of fisheries management in the Republic of Kazakhstan.

