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Ministry of Education and Science of Ukraine
Sumy National Agrarian University
Faculty of Agrotechnologies and Environmental Management
Department of Ecology and Botany

Work program (syllabus) of the educational component
Introduction to Ecology (selective)

It is implemented within the Aquaculture educational program

in specialty 204 - Technology of production and processing of animal husbandry products
at the second (master's) level of higher education

Sumy – 2024




Co-funded by
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**Developer:
of Ecology and Botany**

Ihor KOVALENKO, Doctor of Biological Sciences, Professor

Considered, approved, and approved at the meeting of the Department of Ecology and Botany	Protocol from «17»06.2024, №17	
	Head department	 (Signature) <u>Victoria SKYLAR</u> (surname, initials)

Agreed:

Guarantor of the educational program



Viktoriia VECHORKA

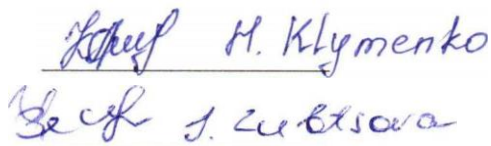
Dean

Biological and technological faculty

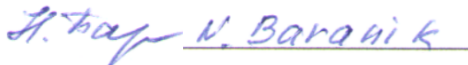


Viktoriia VECHORKA

A review of the work program (attached) is provided:



Methodist of the Education Quality Department,
licensing and accreditation



Registered in the electronic database: date:14.08.2024

Information on viewing the work program (syllabus):

The academic year in which the changes are made	The number of the annex to the work program with a description of the changes	The changes were reviewed and approved		
		Date and number of the protocol of the meeting of the department	Head of Department	Guarantor of the educational program

1. GENERAL INFORMATION ABOUT THE EDUCATIONAL COMPONENT

1.	The name of the educational component	Introduction to Ecology					
2.	Faculty/department	Faculty of Agrotechnologies and Environmental Management Department of Ecology and Botany					
3.	Status of the educational component	Selective					
4.	Program/Specialty (programs), the component of which is an educational component for						
5.	An educational component may be offered for	204 - Technology of production and processing of animal husbandry products					
6.	National Qualifications Framework level	seventh					
7.	Semester and duration of study	the second, 11 weeks					
8.	Number of ECTS credits	5					
9.	The total number of hours and their distribution	Contact work (class)					
		Lectures		Practical/seminar		Independent work	
		full-time education	external form of education	full-time education	external form of education	full-time education	external form of education
		22	-	22	-	106	-
10.	Language of education	Ukrainian					
11.	Teacher/Coordinator of the educational component	Ihor Kovalenko					
11.1	Contact Information	Doctor of Biological Sciences, Professor of the Ecology and Botany email address: kovalenko_977@ukr.net					
12.	General description of the educational component	<p>The purpose of the discipline is to provide a comprehensive study of aquatic ecosystems and obtain essential knowledge about water bodies and water bodies and processes caused by water pollution. The fundamental aspects of the discipline are</p> <ul style="list-style-type: none"> - Assessment of the state of aquatic ecosystems: illumination, temperature, content of elemental gases, etc. - characterization of the central ecological communities of aquatic organisms: plankton, nekton, benthos, Pleistocene, etc., and their interaction in marine ecosystems, which contributes to the conservation of biodiversity; - consideration of the processes of self-purification and restoration of ecosystems and restoration of ecosystems after the impact of pollutants; analysis of methods and ways to regulate the environmental parameters of water bodies. 					

		<p>Regulation of ecological parameters of aquatic ecosystems supports the rational use of water resources.</p> <p>After mastering the discipline, higher education students will acquire fundamental knowledge of ecology for the rational use of water resources and solving environmental problems related to water use, will gain a basic understanding of ecology for the sensible use of water resources, will be able to give an ecological characterization of aquatic ecosystems, make professional decisions on the implementation of measures to optimize the state of marine ecosystems and their components.</p>
13.	The purpose of the educational component	<p>Educational component:</p> <ul style="list-style-type: none"> - Is aimed at mastering a wide range of ecological aspects of aquatic ecosystems; - allows the study of optimal environmental conditions for aquatic bioresources, such as lighting, temperature, gas content, and other indicators; - studies the ecological groups of aquatic organisms, their role in marine ecosystems, as well as the processes of self-purification of water bodies; - introduces methods and ways to regulate the environmental parameters of aquatic ecosystems to ensure their stability and ecological balance. <p>The educational component aims to achieve professional competencies realized through disciplinary learning outcomes, particularly the ability to determine the optimal environmental parameters of aquatic environments and apply knowledge of environmental requirements for the rational use and protection of water resources.</p>
14.	Prerequisites for studying the educational component, connection with other educational components of the academic program	The educational component is based on the academic components of "Aquaculture production technology."
15.	Policy of academic integrity	<p>The policy of academic integrity at SNAU is governed by the Code of Academic Integrity http://docs.snau.edu.ua/documents/education/quality/kodeks_akadem_dobrochesnosti.pdf</p> <p>By it, the requirements for the student to observe academic integrity during the study of the educational component are as follows:</p> <p>To be responsible for one's duties, to fulfill the tasks prescribed by the educational program on time and in good faith; to be present at all classes; perform independent work; honestly and responsibly prepare for current, modular, and final control; submit for assessment only self-made work.</p> <p>It is unacceptable for a student to:</p> <p>Show a disrespectful and incorrect attitude towards the teacher; being late for classes and missing them without valid reasons; during the educational process, use hints, other</p>

		<p>people's work, and telephones; provide and receive assistance from third parties during current, modular and final control; receive or offer a bribe for receiving any benefits in educational activities.</p> <p>For violating the rules of academic integrity, students may be held liable for the following forms of responsibility:</p> <ul style="list-style-type: none">- repeated assessment (test, exam, credit, etc.);- repeated completion of the training course;- warning;- issuing a reprimand;- expulsion from the university (Part 5 of Article 48 of the Law of Ukraine "On Education");
16.	Link to the course in the Moodle system	https://cdn.snau.edu.ua/moodle/course/view.php?id=5918

2. LEARNING OUTCOMES BY THE EDUCATIONAL COMPONENT AND THEIR RELATIONSHIP WITH PROGRAM LEARNING OUTCOMES

Learning outcomes:	Assessment method
Disciplinary learning outcome 1. Justify the importance and impact of environmental requirements for aquatic ecosystems on maintaining biodiversity and ecological balance.	Essay, Testing
Disciplinary learning outcome 2. To know the main ecological groups of aquatic ecosystems, to understand their role in the functioning of water bodies, and to ensure self-purification processes.	Presentation, Testing
Disciplinary learning outcome 3. Assess the environmental parameters of aquatic ecosystems and apply methods of their regulation to create optimal conditions for the existence of marine bioresources.	Testing

3. CONTENT OF THE EDUCATIONAL COMPONENT (CURRICULUM PROGRAM)

Topic. List of issues to be considered within the topic	Distribution within the total time			Recom- mended referen- ces
	Auditory work		Indivi- dual work	
	Lectures	Practical		
Topic 1. Introduction: the concept of ecology and ecosystems. Branches of ecology. Basics of ecology and its importance for aquaculture 1. Definition of ecology 2. Basic concepts of ecosystems 3. Classification and types of ecosystems 4. The main branches of ecology 5. Fundamentals of aquatic ecology as part of ecology 6. The importance of ecology for the development of aquaculture 7. The impact of aquaculture on the environment 8. Environmental monitoring and its role in aquaculture 9. Conclusions and prospects for the development of environmentally friendly aquaculture	2	2	4	1, 2, 3
Topic 2. Aquatic ecosystems: structure and functioning. Ecological factors and ecological valence. Abiotic and biotic factors. 1. Introduction to aquatic ecosystems 2. Structure of aquatic ecosystems 3. Functioning of aquatic ecosystems 4. Environmental factors and their impact on aquatic organisms 5. Abiotic factors 6. Biotic factors 7. Environmental valence 8. Interrelation of abiotic and biotic factors in aquatic ecosystems 9. The importance of knowledge about aquatic ecosystems for aquaculture 10. Summarize essential aspects of the structure and functioning of aquatic ecosystems.	2	2	4	1, 2, 3, 4
Topic 3. Population ecology. Biodiversity and its role in aquaculture. 1. The concept of population and its main characteristics 2. Relevance of population ecology for aquaculture 3. Structure and dynamics of populations 4. The concept of the ecological capacity of the environment 5. Population survival strategies (r- and K-strategies) 6. Human impact on populations and population structure 7. Biodiversity: definition and importance 8. The role of biodiversity in aquaculture	2	2	4	1, 2, 3, 4, 5, 6

Topic. List of issues to be considered within the topic	Distribution within the total time			Recom- mended referen- ces
	Auditory work		Indivi- dual work	
	Lectures	Practical		
9. Methods of conservation and management of biodiversity in aquaculture 10. Current challenges and prospects for the development of aquaculture about biodiversity 11. Basic ecological principles to be considered for effective aquaculture management.				
Topic 4. Organization and functioning of the ecosystem. Environmental protection in aquaculture. Water resources: protection and rational use. 1. Introduction to the organization of ecosystems 2. Ecosystem functioning 3. The role of aquatic ecosystems in global processes 4. Environmental problems and anthropogenic impact on aquatic ecosystems 5. Environmental protection in aquaculture 6. Rational use of water resources 7. Protection of water resources 8. Restoration of aquatic ecosystems 9. prospects for sustainable use of water resources in aquaculture 10. Summarize essential aspects of the organization and functioning of ecosystems.	2	2	4	1, 2, 3, 4, 5, 6, 7
Topic 5. Ecological principles of sustainable aquaculture development. The impact of pollution on aquatic ecosystems and aquatic health. 1. The concept of sustainable development and its importance for aquaculture. 2. Basic ecological principles of sustainable development: conservation of resources, minimization of waste, and maintenance of biodiversity. 3. Renewability of resources: principles and examples of rational water use. 4. The role of recycling systems in reducing water consumption. 5. Environmentally friendly technologies in aquaculture. 6. Biodiversity and its importance for aquaculture sustainability 7. Pollution of aquatic ecosystems and its main types 8. Impact of pollution on aquatic organisms and ecosystems 9. The effect of eutrophication on aquatic ecosystems 10. Risk assessment and monitoring of aquatic ecosystems 11. Measures to minimize the impact of pollution in aquaculture	2	2	4	1, 2, 3, 4, 5, 6, 7, 8

Topic. List of issues to be considered within the topic	Distribution within the total time			Recom- mended referen- ces
	Auditory work		Indivi- dual work	
	Lectures	Practical		
12. Legislative aspects of water resources protection in aquaculture				
Topic 6. Aquatic ecosystems: freshwater and ocean ecosystems. 1. The concept of aquatic ecosystems and their general characteristics. 2. Classify aquatic ecosystems into freshwater and oceanic. 3. Types of freshwater ecosystems: lakes, rivers, ponds, swamps. 4. Hydrological features of freshwater ecosystems. 5. Classification of oceanic ecosystems: shelf zones, open ocean, deep sea. 6. Characteristics of ocean currents and their impact on the distribution of nutrients. 7. Biodiversity in freshwater ecosystems. 8. Biodiversity in oceanic ecosystems 9. Temperature, light, salinity, oxygen level, and their impact on aquatic organisms. 10. Trophic levels and food chains in aquatic ecosystems 11. Functioning of freshwater and ocean ecosystems 12. Anthropogenic impact on freshwater and ocean ecosystems	2	2	4	1, 2, 3, 4, 5, 6, 7, 8
Topic 7. Environmental monitoring in aquaculture. Impact of climate change on aquatic ecosystems and aquaculture 1. Concept and objectives of environmental monitoring. 2. Methods of environmental monitoring in aquaculture 3. Tools for water quality control in aquaculture 4. Biological monitoring in aquatic systems 5. Regularity and importance of monitoring to prevent environmental problems 6. Adaptation strategies in aquaculture to climate change 7. Case studies: examples of successful environmental monitoring and adaptation to climate change	2	2	4	1, 2, 3, 4, 5, 6, 7, 8
Topic 8. Biotechnological methods in the preservation of aquaculture ecology 1. General concept of biotechnology and its application in aquatic ecosystems. 2. Microbiological methods of water purification. 3. The role of phytoplankton and algae in the purification of aquatic ecosystems 4. Genetic methods for improving aquaculture populations 5. Bioenergy resources in aquaculture 6. Biopolymers and biomaterials in aquaculture	2	2	4	1, 2, 3, 4, 5, 6, 7, 8

Topic. List of issues to be considered within the topic	Distribution within the total time			Recom- mended referen- ces
	Auditory work		Indivi- dual work	
	Lectures	Practical		
7. Antibacterial and antiparasitic biotechnologies 8. The role of nanotechnology in the preservation of aquaculture ecology 9. Biosensors for water quality monitoring 10. Application of integrated systems in aquaculture 11. Modern research and innovations in biotechnology for aquaculture				
Topic 9. Invasive species and their impact on aquatic ecosystems 1. The concept of invasive species and their characteristics. 2. Ways of invasive species entry into aquatic ecosystems 3. Characteristics of the main invasive species in aquatic ecosystems 4. Ecological impact of invasive species 5. Economic impacts of invasive species 6. Impact of invasive species on aquaculture 7. Methods of control and management of invasive species 8. Innovative approaches to controlling invasive species	2	2	4	1, 2, 3, 4, 5, 6, 7, 8
Topic 10. Food chains, food webs, and trophic levels. Ecological pyramids. 1. The concept of trophic levels in an ecosystem. 2. The primary trophic levels in aquatic ecosystems 3. Types of food chains in aquatic ecosystems 4. Food webs and their structure 5. Ecological pyramids: types and significance 6. The role of ecological pyramids in understanding aquatic ecosystems 7. Changes in trophic levels due to the impact of aquaculture 8. Development of rational feeding schemes and optimization of resource use.	2	2	4	1, 2, 3, 4, 5, 6, 7, 8
Topic 11. The impact of aquaculture on natural populations of fish and aquatic life 1. The main environmental issues related to aquaculture. 2. Types of impact of aquaculture on natural fish populations 3. The impact of aquaculture on the biodiversity of aquatic ecosystems 4. Spread of diseases and parasites 5. Environmental impact of aquaculture waste 6. Impact on natural food webs 7. Use of feed and destruction of fish populations for feed resources 8. Genetic contamination and hybridization	2	2	8	1, 2, 3, 4, 5, 6, 7, 8

Topic. List of issues to be considered within the topic	Distribution within the total time			Recom- mended referen- ces
	Auditory work		Indivi- dual work	
	Lectures	Practical		
9. Methods to minimize the negative impact of aquaculture on natural populations				
Topic 12. Human impact on the environment. Global (climate) change: global warming, acid rain, ozone depletion, habitat degradation and destruction. 1. The main anthropogenic impact factors are industry, agriculture, and urbanization. 2. Global warming and its consequences. 3. Acid rain: causes and impact on ecosystems 4. Depletion of the ozone layer 5. Degradation and destruction of habitat (biotope) 6. Soil erosion and water pollution 7. Decrease in biodiversity due to anthropogenic impact 8. Climate change and its impact on aquatic life and aquaculture 9. Climate change and its impact on aquatic life and aquaculture 10. International agreements and regulatory measures to protect the environment			8	1, 2, 3, 4, 5, 6, 7, 8, 10, 12, 15
Topic 13. The role of ecosystem services in aquaculture development 1. Define ecosystem services and their role in sustaining life on Earth. 2. Classification of ecosystem services: regulatory, provisioning, cultural, and supporting. 3. Provisioning ecosystem services and their importance for aquaculture 4. Regulating ecosystem services in supporting aquaculture sustainability 5. Supporting ecosystem services as a basis for aquaculture development Cultural ecosystem services: tourism, recreation, and education			8	1, 2, 3, 4, 5, 6, 7, 8, 22, 25, 28
Topic 14. Rational use of feed and resources in aquaculture 1. The main challenges in producing and supplying feed for aquaculture. 2. Types of feed in aquaculture and their characteristics 3. Influence of feed on aquaculture efficiency 4. Strategies of rational feeding 5. Rational use of water resources 6. Problems of excessive use of feed and resources 7. Alternative sources of feed for aquaculture 8. Technologies for monitoring and controlling feed use			8	1, 2, 3, 4, 5, 6, 7, 8, 16, 17, 20

Topic. List of issues to be considered within the topic	Distribution within the total time			Recom- mended referen- ces
	Auditory work		Indivi- dual work	
	Lectures	Practical		
<p>Topic 15. The cycle of substances in nature. Biogeochemical cycles of nitrogen, phosphorus, sulfur, carbon, oxygen, and hydrogen. Human impact on the environment. Global (climate) change: global warming, acid rain, ozone depletion, habitat degradation and destruction.</p> <p>1. Define the cycle of substances and its role in maintaining ecosystems. 2. The cycle of nitrogen, phosphorus, sulfur, carbon, oxygen, hydrogen 3. Global climate change 4. Implications for aquaculture, such as lowering pH levels and biodiversity disruption. 5. Depletion of the ozone layer 6. Degradation and destruction of habitats (biotopes)</p>			8	1, 2, 3, 4, 5, 6, 7, 8, 21, 23, 30
<p>Topic 16. Primary products in ecosystems. Secondary production in ecosystems. Energy flow and distribution of materials in ecosystems. Terrestrial ecosystems</p> <p>1. Basic concepts of primary and secondary products. 2. Primary products in ecosystems. 3. Methods of measuring primary production 4. Secondary production in ecosystems 5. Energy flow in ecosystems 6. Distribution of materials in ecosystems 7. Terrestrial ecosystems and their productivity 8. Interrelation of aquatic and terrestrial ecosystems productivity 9. Impact of aquaculture on energy flows and ecosystem productivity</p>			10	1, 2, 3, 4, 5, 6, 7, 8, 10, 12, 15
Total	22	22	106	

4. TEACHING AND LEARNING METHODS

	Teaching methods (work to be carried out by the teacher during classroom class consultations)	Number of hours	Study methods (what types of educational activities the student should perform independently)	Number of hours
Learning outcomes 1	Educational lecture (narration, explanation, demonstration, illustration) Practical lesson (explanation, demonstration)	4	Working with lecture notes, working with books, working with regulatory and legal acts, generalization, systematization, deepening of the material, calculations, development of a civil defense plan	4
Learning outcomes 2	Educational lecture (narration, explanation, demonstration, illustration) Practical lesson (explanation, demonstration)	36	Working with lecture notes, working with books, working with regulatory and legal acts, generalization, systematization, deepening of the material, calculations, development of a civil defense plan	92
Learning outcomes 3	Educational lecture (narration, explanation, demonstration, illustration) Practical lesson (explanation, demonstration)	4	Working with lecture notes, working with books, working with regulatory and legal acts, generalization, systematization, deepening of the material, calculations, development of a civil defense plan	10

5. EVALUATION BY THE EDUCATIONAL COMPONENT

5.1. Diagnostic assessment (specified as necessary)

5.2. Summative assessment

5.2.1. To assess the expected learning outcomes, it is provided

No	Methods of summative assessment	Points / Weight in the overall assessment	Compilation date
1.	Essay, Topic 1	15/15%	5th semester, 3 week
2.	Written test, Topic 1-5	10/10%	5th semester, 4 week
3.	Intermediate certification, Topic 1-5	15/15%	Five semesters, 4 week
4.	Presentation, Topic 6-8	15/15%	5th semester, 6 week
5.	Written test, Topic 6-15	10/10%	5th semester, 7 week
6.	Research proposal, Topic 16	25/25%	5th semester, 11 week

5.2.2. Evaluation criteria

Component	Unsatisfactorily	Satisfactorily	Fine	Perfectly
Essay, Topic 1	<9 points	9-11 points	12-13 points	14-15 points
	Task requirements not met.	Most requirements are fulfilled, but some parts are missing, and there is no analysis of the received data.	All requirements of the task have been fulfilled.	All the task requirements were fulfilled, and the obtained results were interpreted.
Written test, Topic 1-5	<5 points	5-6 points	7-8 points	9-10 points
	Fewer than six correct answers to a test question	6-9 correct answers to the test questions	10-12 correct answers to the test questions	13-15 correct answers to the test questions
Intermediate certification, Topic 1-5	<9 points	9-11 points	12-13 points	14-15 points
	Fewer than six correct answers to a test question	6-9 correct answers to the test questions	10-12 correct answers to the test questions	13-15 correct answers to the test questions
Presentation, Topic 6-8	<9 points	9-11 points	12-13 points	14-15 points
	Task requirements not met.	The presentation does not correspond to the report's content; the report is not prepared correctly and does not meet the requirements.	The presentation corresponds to the report's content, but the report is not prepared correctly.	The presentation corresponds to the report's content, but the report is prepared correctly.

Written test, Topic 6-15	<10	11-12	12-14	14-15
	Fewer than six correct answers to a test question	6-9 correct answers to the test questions	10-12 correct answers to the test questions	13-15 correct answers to the test questions
Research proposal, Topic 15	<13	14	15-19	20-25
	Task requirements not met.	The form is filled out, but the content does not meet the topic's requirements.	The form is Filled out, but the research proposal is superficial; the components are not agreed upon.	Filled out the form, innovative research proposal, and agreed-upon components in detail.

5.3. Formative assessment:

To assess the current progress in learning and understand the directions for further improvement is provided

No	Elements of Formative Assessment	Date
1.	<i>Survey after studying the topic</i>	At the next practical session, after the presentation of the material on the topic
2.	<i>Verbal feedback from the teacher and students after the presentation of the essay</i>	Immediately after the end of the presentation
3.	<i>Verbal feedback from the teacher while working on individual tasks during classes</i>	In the next class, after the student has completed the assignment

6. EDUCATIONAL RESOURCES (REFERENCES)

Main sources

Textbooks and manuals

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Methodical support

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Modul syllabus review _____

The parameter by which the work program (syllabus) of the educational component is evaluated	Yes	No	Comment
Learning outcomes for the educational component (MLOs) correspond to the EK			
The results of the study by the educational component (MLOs) correspond to the prescribed PLOs (for mandatory EKs)			
Learning outcomes by educational component provide an opportunity to measure and evaluate the level of their achievement			

EK project team member *Ilanna* *Klymenko* *[Signature]*
 (name) (surname) (signature)

The parameter by which the work program (syllabus) of the educational component is evaluated	Yes	No	Comment
General information about the educational component is sufficient			
The results of the educational component correspond to the EC			
The results of the study in the educational component correspond to the prescribed national educational requirements (for mandatory ECs)			
Learning outcomes by educational component provide an opportunity to measure and evaluate the level of their achievement			
Learning outcomes relate to students' competencies, not the content of the discipline (contain knowledge, abilities, skills, and not the topics of the discipline's curriculum)			
Educational activity (teaching and learning methods) enables students to achieve the expected learning outcomes			
The educational component involves learning through research			
The assessment strategy within the educational component is in accordance with University/faculty policy			
The provided assessment methods make it possible to assess the degree of achievement of learning outcomes by educational component			
The workload of students is adequate to the volume of the educational component			
Recommended learning resources are sufficient to achieve learning outcomes			
The literature is relevant			

Reviewer (lecturer of the department) *Inna* *Zubtsava* *[Signature]*
 (name) (surname) (signature)