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**Ministry of Education and Science of Ukraine**  
**Sumy National Agrarian University**  
Biological and technological faculty  
Department of feed technology and animal feeding

**Work program (syllabus) of the educational component**  
**The latest technologies in mariculture** (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



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Developer:  O.B., Kyselov associate professor of the department of feed technology and animal feeding

Considered, approved and approved at the meeting of the Department of Feed Technology and Animal Feeding	protocol from " <u>06</u> " <u>06</u> 2024 year No. <u>10</u>
	Head department <u></u> <b>Viktor OPARA</b> (signature) (surname, initials)

**Agreed:**

Guarantor of the educational program  Viktoriia VECHORKA

Dean Biology and Technology  Viktoriia VECHORKA

Review of the work program (attached) provided:

V. Popsuy  
(surname)

Igor Rubtsov  
(surname)

Methodist of the Education Quality Department, licensing and accreditation

N. Banonik  
(surname)

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

	The name of the educational component	The latest technologies in mariculture					
	Faculty/department	Biological-technological /Technology of fodder and animal feeding					
	Status of the educational component	Selective					
	Program/Specialty (programs), the component of which is an educational component for						
	An educational component may be offered for	204 Technology of production and processing of animal husbandry products 207 Aquatic biological resources and aquaculture					
	National Qualifications Framework level	seventh					
	Semester and duration of study	the second, 11 weeks					
	Number of ECTS credits	5					
	The total number of hours and their distribution	Contact work (classes)					
		Lectures		Practical/seminar		Independent work	
		full-time	part-time	full-time	part-time	full-time	part-time
		22	-	22	-	-	106
	Language of education	Ukrainian					
	Teacher/Coordinator of the educational component	Oleksandr Kyselov					
11.1	Contact Information	Associate Professor of the Department of Feed Technology and Animal Feeding email address: <a href="mailto:Kyselov_SNAU@ukr.net">Kyselov_SNAU@ukr.net</a> consultations: every Tuesday 14.00-15.00.					
	General description of the educational component	Mastering this discipline contributes to the training of highly qualified specialists capable of solving complex specialized tasks: cultivation of hydrobionts on the basis of natural reservoirs for fish farming; master the necessary knowledge regarding the technological requirements for the use of natural reservoirs for fishery purposes and the peculiarities of the fishery use of fishery reservoirs of complex purpose, regarding the technological methods of the directed formation of industrial ichthyofauna and the cultivation of hydrobionts in controlled conditions on the basis of reservoirs. Knowledge of the discipline is necessary for future aquatic bioresources specialists to develop methods of intensification of aquaculture in natural reservoirs, practice and improvement of hydrobiont cultivation technologies, artificial reproduction of industrially valuable, rare and endangered fish species, creation of optimal conditions for natural and artificial reproduction of fish stocks, preservation of biodiversity.					

	<p>The purpose of the educational component</p>	<p>The purpose of studying the discipline is to prepare highly qualified specialists for the cultivation of hydrobionts on the basis of natural reservoirs for fishery purposes.</p> <p>The task is to provide the necessary knowledge regarding the technological requirements for the use of natural reservoirs for fishery purposes and the peculiarities of the fishery use of fishery reservoirs of complex purpose, regarding the technological methods of directed formation of industrial ichthyofauna and the cultivation of hydrobionts in controlled conditions on the basis of these reservoirs.</p> <p>Knowledge of the discipline is necessary for future specialists in aquatic bioresources for the development of methods of intensification of aquaculture in natural reservoirs, development and improvement of technologies for the cultivation of hydrobionts, artificial reproduction of industrially valuable, rare and endangered fish species, creation of optimal conditions for the natural and artificial reproduction of fish stocks, biodiversity loss.</p> <p>The academic discipline "The latest technologies in mariculture" refers to the cycle of disciplines of professional and practical training of specialists of the Master OS in specialty 204 "Technology of production and processing of livestock products."</p>
	<p>Prerequisites for studying the educational component, connection with other educational components of the educational program</p>	<p>The educational component is based on the educational components "Technology of production of aquaculture products"</p>
	<p>Policy of academic integrity</p>	<p>The policy of academic integrity in SNAU is regulated by the Code of Academic Integrity  <a href="http://docs.snau.edu.ua/documents/education/quality/kodeks_akadem_dobrochesnosti.pdf">http://docs.snau.edu.ua/documents/education/quality/kodeks_akadem_dobrochesnosti.pdf</a></p> <p>In accordance with it, the requirements for the student to observe academic integrity when studying the educational component are as follows:</p> <p>responsibly treat their duties, timely and conscientiously perform the tasks provided by the curriculum; attend all classes; perform independent work; honestly and responsibly prepare for the current, modular and final control; submit for evaluation only self-performed work.</p> <p>It is unacceptable for the student:</p> <p>to show disrespectful and incorrect attitude to the teacher; to be late for classes and skip them without good reason; during the educational process to use tips, the work of others, phones; provide and receive assistance from third parties in passing current, modular and final control; receive or offer a bribe for receiving any advantages in educational activities.</p> <p>For violation of the rules of academic integrity, students may be brought to the following forms of responsibility:</p> <ul style="list-style-type: none"> <li>– repeated passing of the assessment (control work, exam, test, etc.);</li> </ul>

		<ul style="list-style-type: none"> <li>– repeated passing of the training course;</li> <li>– warning;</li> <li>– reprimand;</li> <li>– deductions from the university (Part 5 of Article 48 of the Law of Ukraine "On Education");</li> </ul>
	<p>Link to the course in the Moodle system</p>	<p><a href="https://cdn.snau.edu.ua/moodle/course/view.php?id=5708">https://cdn.snau.edu.ua/moodle/course/view.php?id=5708</a></p>

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

Learning Outcomes	Assessment method
<p>Disciplinary learning outcome 1. Provide the student with knowledge of:</p> <ul style="list-style-type: none"> <li>- features of the functioning of natural aquatic ecosystems of various types;</li> <li>- characteristics of the functional state and peculiarities of the dynamics of aquatic ecosystems under the influence of hydraulic construction, natural and anthropogenic factors;</li> <li>- patterns of biota development in natural reservoirs;</li> <li>- compliance of water quality of reservoirs of various types with criteria of fishery reservoirs, efficiency of use of natural reservoirs in fish breeding;</li> <li>- general characteristics of aquaculture farms of different types;</li> <li>- biological characteristics of aquaculture facilities;</li> <li>- acclimatization and autoacclimatization of hydrobionts in natural reservoirs;</li> <li>- fundamentals of technology of cultivation of fish and non-fish species of hydrobionts in natural reservoirs of various types;</li> </ul>	<p>Abstract, testing</p>
<p>Disciplinary learning outcome 2. Teach the student:</p> <ul style="list-style-type: none"> <li>- characterize the requirements for the fishery use of natural reservoirs of various types and know the duties of their users;</li> <li>- grow turbot, semi-passable and passable species of fish in fish breeding enterprises for the reproduction of fish stocks (spawning and growing farms and fish factories), calculate their planting density and carry out stocking of natural reservoirs;</li> <li>- carry out technical, chemical and biological reclamation of rivers, lakes and reservoirs, estuaries and bays, protecting them from summer and winter suffocation, saving young fish in the spring;</li> <li>- carry out reproduction and further cultivation of non-fish species of hydrobionts, determine promising ways of development of fish farming in natural reservoirs;</li> <li>- grow marine and freshwater mollusks at various technological stages;</li> <li>- grow crustaceans under different conditions and technological cycles;</li> <li>- determine the types of aquaculture farms, methods and objects of growing products, make their choice depending on the conditions of management;</li> </ul>	<p>Essay, testing</p>
<p>Disciplinary learning outcome 3. Teach the student:</p> <ul style="list-style-type: none"> <li>- select and carry out acclimatization measures;</li> <li>- to select aquaculture objects for cultivation in rivers, lakes, reservoirs, coastal areas of the seas and to form the composition of the flora and fauna of these reservoirs by introducing hydrobionts with high bioproductive properties with indicators taking into account environmental safety requirements, preserving natural biodiversity and ensuring the sustainable functioning of aquatic ecosystems;</li> <li>- apply the main technological processes and carry out the cultivation of carp, perch, catfish, salmon, sturgeon, mullet, kamba and other fish in grazing, semi-intensive and intensive forms of fish farming in natural reservoirs.</li> </ul>	<p>Publication of abstracts, testing</p>

**3. CONTENT OF EDUCATIONAL COMPONENT (CURRICULUM DISCIPLINE)**

<b>Topic.</b> <b>List of issues to be considered within the topic</b>	<b>Distribution within the total time</b>			<b>Recommended references</b>
	<b>Auditory work</b>		<b>Individual work</b>	
	<b>Lectures</b>	<b>Practical</b>		
<b>Topic 1. The history of development and the current state of world mariculture</b> 1. History of aquaculture development 2. Current state and development trends of world aquaculture and mariculture 3. Methods and principles of mariculture 4. Requirements for cultivation facilities 5. Basic technologies and types of mariculture enterprises 6. Methods and principles of mariculture 7. Requirements for cultivation facilities 8. Basic technologies and types of mariculture enterprises	6	4	20	1, 2, 3, 4, 5
<b>Topic 2. Mariculture of algae</b> 1. Cultivation of brown algae 2. Cultivation of red algae 3. Cultivation of green algae	2	2	10	1, 2, 3, 4, 5, 6, 7
<b>Topic 3. Mollusk cultivation (Conchiculture)</b> 1. Ecological and biological characteristics and methods of cultivation of mussels 2. Ecological and biological characteristics, methods of oyster cultivation 3. Ecological and biological characteristics and methods of scallop cultivation 4. Terminals 5. Sea pearls 6. Gastropods 7. Cephalopods	4	6	25	1, 2, 3, 4, 5, 7
<b>Topic 4. Cultivation of crustaceans</b> 1. Ecological and biological characteristics, methods of reproduction and commercial cultivation of shrimp 2. Fish-biological characteristics of the main species of shrimp - об'єктив World Mariculture	2	2	15	1, 2, 3, 4, 5, 7
<b>Topic 5. Mariculture of fish</b> 1. Ecological and biological characteristics, methods of reproduction and commercial cultivation of passing salmon fish. 2. Breeding of Pacific salmon 3. Breeding of Atlantic (noble) salmon, and white fish. 4. Steelhead salmon as an object of acclimatization and mariculture. 5. Ecological and biological characteristics, methods of reproduction and commercial cultivation of passing sturgeon fish. 6. Mugilidae 7. Psetta maeotica Pallas 8. Platichthys flesus luscus (Pallas) 9. Gobiidae. 10. Morone sakatilis Mitchill (Serranidae)	8	8	36	1, 2, 3, 4, 5



<b>Topic.</b> <b>List of issues to be considered within the topic</b>	<b>Distribution within the total time</b>			<b>Recommended references</b>
	<b>Auditory work</b>		<b>Individual work</b>	
	<b>Lectures</b>	<b>Practical</b>		
11.Chanos 12.Seriola guingueradiata 13.Anguillidae 14.Reptiles and amphibians 15.Decorative fish farming				
<b>Total</b>	<b>22</b>	<b>22</b>	<b>106</b>	

#### 4. TEACHING AND LEARNING METHODS

	<b>Teaching methods (work to be carried out by the teacher during classroom classes, consultations)</b>	<b>Number of hours</b>	<b>Study methods (what types of educational activities the student should perform independently)</b>	<b>Number of hours</b>
Learning outcomes 1	Educational lecture (narration, explanation, demonstration, illustration) Practical lesson (explanation, demonstration)	14	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	30
Learning outcomes 2	Educational lecture (narration, explanation, demonstration, illustration) Practical lesson (explanation, demonstration)	14	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	40
Learning outcomes 3	Educational lecture (narration, explanation, demonstration, illustration) Practical lesson (explanation, demonstration)	16	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	36

## 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%	5 semecmp, 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 15	25/25%	5th semester, 11 week

### 5.2.2 Evaluation criteria

Component	Unsatisfactorily	Satisfactorily	Fine	Perfectly
Abstract, Topic 1	< 9 points	9-11 points	12-13 points	14-15 points
	Task requirements not met	Most of the requirements are fulfilled, but some parts are missing, there is no analysis of the data obtained	All task requirements fulfilled	All the requirements of the task were fulfilled, the results obtained were clearly interpreted, proposals were made to improve the mariculture to increase the sustainable development of the industry
Written test, Topic 1-2	<5 points	5-6 points	7-8 points	9-10 points
	Fewer than 6 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 1-2	<9 points	9-11 points	12-13 points	14-15 points
	Fewer than 6 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
Essay, Topic 4	<9 points	9-11 points	12-13 points	14-15 points
	Task requirements not met	Most of the requirements are fulfilled, but some parts are missing, there is no analysis of the data obtained	All task requirements fulfilled	All the requirements of the task were fulfilled, the results obtained were clearly interpreted, proposals were made to improve the mariculture to

				increase the sustainable development of the industry
Written Testing, Topic 3-5	<10	11-12	12-14	14-15
	Fewer than 6 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
Publication of abstracts, Topic 5	<13	14	15-19	20-25
	Requirements for the assignment are not met	Content does not align with the topic and requirements	The abstract is superficial, with inconsistent components	The abstract is innovative in nature, substantial, and has thoroughly coordinated components

### 5.1. Formative assessment:

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

<i>N<sup>o</sup></i>	<b>Elements of formative assessment</b>	<b>Date</b>
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>	At the next class after the student has completed the assignment

## 6. EDUCATIONAL RESOURCES (REFERENCES)

### Main sources

#### Textbooks and manuals

1. Shekk P.V. / Mariculture / P.V. Shekk, V.Yu. Shevchenko, A.M. Orlenko. – Kherson, Oldi-Plus, 2014. – 328 p.
2. Hrytsyniak I.I / Fundamentals of Mariculture / Hrytsyniak I.I., Tolokonnikov Yu.O., Izerhin L.V., Krazhan S.A. 2013 / Institute of Fisheries of the National Academy of Agrarian Sciences of Ukraine – Kyiv: DIA, 2013. – 172 p.
3. Shekk P.V. / Mariculture: textbook for training specialists in the field of "Bachelor" training direction 090201 - "Water Bioresources and Aquaculture" for higher education institutions of the III-IV levels of accreditation / Shekk P.V., Shevchenko V.Yu., Orlenko A.M. - Kherson: Oldi-Plus, 2014. - 327 p.: ill., tables. - Bibliography: p. 326-327. - 500 copies. - ISBN 978-966-289-030-3
4. Kononenko R.V. / Intensive Technologies in Aquaculture: textbook / R.V. Kononenko, P.G. Shevchenko, V.M. Kondratiuk, I.S. Kononenko. – Kyiv: "Center for Educational Literature", 2016. – 410 p.
5. Sherman I.M., Yevtushenko M.Yu. Theoretical Foundations of Fisheries: textbook – Kyiv: , 2011. – p.FAO. 2022. The State of World Fisheries and Aquaculture 2022. Towards Blue Transformation. Rome, FAO. 266 p. <https://doi.org/10.4060/cc0461en>
6. FAO. 2016. Planning for aquaculture diversification: the importance of climate change and other drivers. Technical Workshop. 166 p.

- Sharma, A. 2023. Diversification In The Process Of Sustainable Fish Farming: A Guide Book. 608 p.

## Methodical support

### Other sources

- State Standard of Ukraine 4785:2007 Crustaceans. Biological and Commodity Nomenclature [Text]. - Official edition. - Effective from 2009-01-01. - Kyiv: State Consumer Standards of Ukraine, 2009. - III, 15 p. –
- State Standard of Ukraine 4797:2007 Mollusks. Biological and Commodity Nomenclature [Text]. - Official edition. - Effective from 2008-01-01. - Kyiv: State Consumer Standards of Ukraine, 2008. - III, 16 p.
- Hoboken, N.J., 2015. Aquaculture ecosystems : adaptability and sustainability / editors, Saleem Mustafa, Rossita Shapawi.. John Wiley and Sons, Incorporated, 419 p.
- Odd-Ivar Lekang. 2020. Aquaculture Engineering. John Wiley & Sons, Incorporated, 526 p.
- Daniel L. Merrifield , and Einar Ringo, 2014, Aquaculture Nutrition : Gut Health, Probiotics and Prebiotics, John Wiley & Sons, Incorporated, 482 p.
- Claude Boyd , and Aaron McNevin, 2015. Aquaculture, Resource Use, and the Environment. 338 p.

### Additional sources

- Anais, A., Adélaïde, A., Jean- Claude, G., Oihana, L., Philippe, A., & Nabila, G. (2020). Assessment of carrying capacity for bivalve mariculture in subtropical and tropical regions: the need for tailored management tools and guidelines. *Reviews in Aquaculture*. <https://doi.org/10.1111/raq.12406>
- Brown, A. R., Lilley, M., Shutler, J., Lowe, C., Artioli, Y., Torres, R., Berdalet, E., & Tyler, C. R. (2019). Assessing risks and mitigating impacts of harmful algal blooms on mariculture and marine fisheries. *Reviews in Aquaculture*. <https://doi.org/10.1111/raq.12403>
- Dawange, P. S., Mantri, V. A., & Jaiswar, S. (2023). Selection and development of superior strains through functional trait-based approach in agarophytic red alga *Gracilaria dura* (Rhodophyta). *Journal of Environmental Biology*, 44(6), 795–803. <https://doi.org/10.22438/jeb/44/6/5150>
- Gao, F.; Yu, T.; Chen, Z.; Zhang, J.; Xu, H.; Xu, G.; Zhang, C. Study on the Treatment of Simulated Recirculating Mariculture Wastewater by Thiosulfate-Based Autotrophic Denitrification. *Water* 2023, 15, 2076. <https://doi.org/10.3390/w15112076>
- Gökalp, M., Mes, D., Nederlof, M., Zhao, H., Merijn de Goeij, J., & Osinga, R. (2020). The potential roles of sponges in integrated mariculture. *Reviews in Aquaculture*. <https://doi.org/10.1111/raq.12516>
- Ji, J., Sun, Y., & Yin, X. (2022). Study on green output bias of China’s mariculture technological progress. *Environmental Science and Pollution Research*. <https://doi.org/10.1007/s11356-022-20158-5>
- Park, J. W., Kim, J., Ji, S. C., Ryu, Y., & Cho, J. (2023). The reproductive potential of Pacific bluefin tuna (*Thunnus orientalis*) farmed in sea cages in South Korea. *Journal of the World Aquaculture Society*. <https://doi.org/10.1111/jwas.13026>
- Stekoll, M. S., Peeples, T. N., & Raymond, A. E. T. (2021). Mariculture research of *Macrocystis pyrifera* and *Saccharina latissima* in Southeast Alaska. *Journal of the World Aquaculture Society*. <https://doi.org/10.1111/jwas.12765>
- Yu, J., & Yu, J. (2020). Evolution of Mariculture Insurance Policies in China: Review, Challenges, and Recommendations. *Reviews in Fisheries Science & Aquaculture*, 1–16. <https://doi.org/10.1080/23308249.2020.1837067>
- Zhang, S., & Chen, J. (2019). Design of Dynamic Automatic Control System for Mariculture Water Quality under Internet of Things Environment. *Journal of Coastal Research*, 83(sp1), 637. <https://doi.org/10.2112/si83-105.1>

**Software**  
**1 . MS Excel**

**Review of the Syllabus**

<b>Parameter Evaluated in the Educational Component Syllabus</b>	<b>Yes</b>	<b>No</b>	<b>Comment</b>
Learning Outcomes for the Disciplinary Learning Component align with the National Qualifications Framework			
Learning Outcomes for the Disciplinary Learning Component align with the anticipated Common Reference Points (for mandatory disciplinary learning components)			
Learning Outcomes for the Disciplinary Learning Component allow for the measurement and assessment of the level of achievement			

Project Team Member of the Educational Program \_\_\_\_\_  
 (name) (full name) (signature)

<b>Criterion by which the work program (syllabus) of the educational component is evaluated</b>	<b>Yes</b>	<b>No</b>	<b>Comment</b>
The general information about the educational component is sufficient.			
Learning outcomes for the educational component align with the NQF			
Learning outcomes for the educational component align with the anticipated CRC (for mandatory EC)			
Learning outcomes for the educational component allow for the measurement and assessment of the level of achievement			
Learning outcomes relate to students' competencies, not just the content of the discipline (they include knowledge, skills, and abilities, not just the topics of the course curriculum)			
Teaching activities (teaching and learning methods) enable students to achieve the expected learning outcomes			
The educational component involves learning through research			
The assessment strategy within the educational component aligns with the University/faculty policy			
The envisaged assessment methods allow for the evaluation of the degree of achievement of learning outcomes for the educational component			
Student workload is adequate for the scope of the educational component			
Recommended educational resources are sufficient for achieving the learning outcomes			
The literature is up-to-date			

Reviewers (lecturer of the department) \_\_\_\_\_  
 (name) (position, full name) (signature)