

	RIVNE – 2024	

The Syllabus of the Educational Component "Water Quality and Fish Health" for Master's Degree Students of the Degree Program "Protection, Reproduction, and Rational Use of Hydrobioresources", Field of Study 207 "Aquatic Bioresources and Aquaculture". Rivne. NUWEE. 2024. 15 p.

The Degree Program (DP) on the university website:

<https://ep3.nuwm.edu.ua/28749/>

Syllabus developer:

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Syllabus was approved at the meeting of the Department

Protocol No. 18 of June 24, 2024

Head of the Department of Water Bioresources:

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The head of the Degree Program:

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Approved by the Scientific and Methodological Council for the Quality of the Institute of Agroecology and Land Management (IALM)

Protocol No. 23 of August 27, 2024

Head of the Scientific and Methodological Council of IALM:

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The previous version of the syllabus (*specify code*) -----

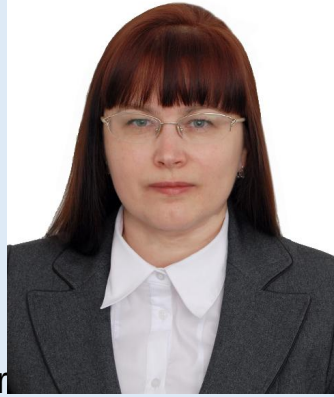
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PROGRAM ‹ Water Quality and Fish Health ›

OVERVIEW

Level of education	<i>Master's (second)</i>
Degree program	<i>Protection, reproduction and rational use of hydrobioresources</i>
Field of Study	<i>207 Aquatic Bioresources and Aquaculture</i>
Study year, semester	<i>2nd year 1st semester</i>
Number of credits	<i>4.5 ECTS credits</i>
Lectures:	24
Practicals /Laboratory classes:	22
Independent work:	89
Coursework:	-
Form of education	<i>full-time/part-time</i>
Type of Summative Assessment	<i>examination</i>
Language of instruction	<i>Ukrainian</i>

INFORMATION ABOUT THE UNIVERSITY TEACHER



Yuliia Romanivna Hrokhovska, Doctor of Agricultural Sciences, Professor of the Department of Water Bioresources

Lecturer

Wikisitet

<https://cutt.ly/GgZrFbm>

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How to communicate

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Actual announcements on the educational component page in the MOODLE svstem

<https://ep3.nuwm.edu.ua/28749/>

INFORMATION ABOUT THE EDUCATIONAL COMPONENT

Goals and tasks

The purpose of studying this educational component is to equip students with theoretical knowledge about the impact of water quality on the health of fish in natural populations and aquaculture, along with practical skills for assessing water quality and fish condition based on relevant indicators. Through studying the educational component, students will gain both theoretical insights and practical skills, enabling them to identify and address fish health issues related to changes in water quality, whether caused by natural factors or human activities, and to implement measures to prevent such issues.

Tasks:*1) to understand the problems associated with changes in water quality and pollution, along with the general reactions of fish to aquatic pollution; 2) to analyze the causes of fish poisoning and/or death; 3) to understand the causes and consequences of fish contamination and the general principles for preventing fish poisoning; 4) to be aware of the impact of pollution on the spread of viral, bacterial, and fungal diseases, as well as fish parasites.*

Link to the course on Moodle

<https://exam.nuwm.edu.ua/course/view.php?id=6502>

Course prerequisite and corequisite information (within the Degree Programme)

Prerequisites are provided by the modules "Prevention and Treatment of Fish Diseases" and "Ecological Physiology and Biochemistry of hydrobionts".

Competencies

The module "Water Quality and Fish Health" develops the following general (GC), professional (PC), and subject-specific competencies:

GC5. Commitment to preserving the natural environment, including ensuring the quality of aquatic habitats for fish.

GC6. The ability to learn and acquire modern knowledge, particularly in the fields of hydrochemistry and aquatic toxicology, in the context of contemporary environmental changes affecting aquatic ecosystems.

GC8. The ability to apply knowledge in practical situations, particularly in the development of measures to prevent fish poisoning and contamination by fish.

PC1. The ability to analyze the ecological parameters of hydroecosystems in natural and artificial environments, and to assess anthropogenic impacts based on a critical understanding of issues in agricultural sciences and food, as well as at the intersection of various fields of knowledge.

PC7. The ability to implement measures for the protection of aquatic biological resources, the maintenance of fish health, and the prevention of mass fish diseases.

PC12. The ability to rationally use natural water resources, including their protection and restoration, in alignment with the principles of sustainable development and in consideration of environmental ecological challenges.

Program learning outcomes (LO)*

LO1. Have specialized conceptual knowledge that includes modern scientific achievements in the field of aquatic bioresources and aquaculture and is the basis for original thinking and conducting research.

LO5. Develop and implement scientific and applied projects on the problems of aquatic bioresources and aquaculture and related interdisciplinary projects taking into account production, legal, economic, and ecological aspects.

LO 15. To analyze the impact of parameters of the aquatic environment on the health of fish and to develop measures to preserve the quality of water in open reservoirs, to apply modern water purification and water treatment technologies in closed aquaculture systems, to reduce the negative impact of aquaculture on the environment.

The structure and content of the educational component

Content module 1. Water environment and water quality

Topic 1. An introduction to the topics of water quality and fish health

LO1; LO15
Number of hours:
lectures - 1.0.
Literature: 1, 2, 3, 9

The educational component "Water quality and fish health" and its role in the preparation of masters in the specialty "Aquatic bioresources and aquaculture". A general introduction to the topics of water quality and fish health.

Topic 2. Aquatic ecosystems and fish biology	
<p>LO1; LO15 Number of hours: lectures - 2.0; practice – 2.0 hour Literature: 1-4, 6, 7, 8, 11, 13, 18</p>	<p>Aquatic ecosystems. Freshwater ecosystems. Marine ecosystems. Connection between aquatic and terrestrial ecosystems. Biology of fish. Adaptation of fish to habitat. The immune system of fish and roundmouths.</p>
Topic 3. Main characteristics of the aquatic environment. Dissolved oxygen and fish health	
<p>LO1; LO5 Number of hours: lectures - 2.0; practice – 2.0 hour Literature: 1, 2, 3, 10, 14</p>	<p>Chemical composition and main characteristics of the water environment. Sources and dynamics of oxygen in the aquatic environment. Causes of hypoxia. Clinical signs of hypoxia. Oversaturation of dissolved oxygen.</p>
Topic 4. Water temperature and fish health	
<p>LO1; LO15 Number of hours: lectures - 2.0; practice – 2.0 hour Literature: 1-3, 8</p>	<p>Dynamics of the temperature of the water environment. Effect of temperature fluctuations on fish. Determination of temperature stress.</p>
Topic 5. Salinity and pH of the aquatic environment and fish health	
<p>LO1; LO5 Number of hours: lectures - 2.0; practice – 2.0 hour Literature: 1, 3, 8, 14</p>	<p>Osmoregulation in fish. Osmotic stress in fish. pH of the water environment and its effect on the health of fish.</p>
Content module 2. Anthropogenic changes in water quality and the impact of pollution on fish health	
Topic 6. Sources of surface water pollution	
<p>LO1; LO5 Number of hours: lectures – 2.0; practice – 4.0 hour Literature: 1- 4, 8, 9</p>	<p>The main causes of water pollution. Point and diffuse sources of water pollution. Classifications of toxic environmental pollutants. Pollution by biogenic substances (eutrophication). Phytoplankton toxins. Organic water pollution.</p>

Topic 7. Water pollution with toxic metals and its consequences for health	
LO1; LO5 Number of hours: lectures - 2.0; practice – 2.0 hour Literature: 1-4, 10	Heavy metals: definitions and sources of pollution. Importance of heavy metals for fish health. Regional hydrochemical features.
Topic 8. Water pollution by toxic organic substances and its consequences	
LO1; LO15 Number of hours: lectures - 2.0; Literature: 1-3, 8, 10	Phenols. Polychlorinated biphenyls (PCB). Surfactants. Pesticides. Oil and oil products.
Topic 9. Biological pollution of water. Bioindication	
LO1; LO15 Number of hours: lectures - 2.0; practice – 2.0. Literature: 1-3, 11	Biological pollutants (pathogens and parasites). Biological pollution in aquaculture. Consequences of water pollution for human health and ecosystems. The use of aquatic organisms as bioindicators to assess ecosystem health. Saprobity of water bodies.
Topic 10. Regulatory framework of aquaculture, monitoring and assessment of water quality	
LO1; LO5 Number of hours: lectures – 2.0; practice – 2.0. Literature: 2, 3, 6, 11, 20, 24, 25	Overview of national and international organizations and regulations on fish health, aquaculture and fisheries. Aquaculture. Types of aquaculture. Principles of sustainable aquaculture. Recommendations for the sustainable development of aquaculture from FAO. Monitoring and assessment of water quality in Ukraine.
Topic 11. Aquaculture and water quality	
LO1; LO5 Number of hours: lectures - 2.0; practice – 2,0 Literature: 2, 5, 12, 15	Impact of aquaculture on water quality. Successful and unsuccessful aquaculture. Ukraine is on the way to successful aquaculture.
Topic 12. Fish diseases and health care	

LO1; LO5

Number of hours:

lectures - 3.0;

practice – 2.0.

Literature: 1-3,13, 19, 25, 26

Fish diseases. Non-infectious fish diseases.

Infectious diseases of fish.

Viral diseases.

Bacterial diseases. Fungal diseases.

Parasitic diseases. Fish health protection.

Biosafety and disease prevention measures.

Teaching methods

Teaching is conducted through lectures (multimedia, interactive), seminars, practical work, and consultations with the instructor.

The forms of theoretical education include lectures and seminars. Lectures are delivered using explanatory and illustrative methods, multimedia presentations, handouts, and tables. Seminar sessions utilize methods such as oral questioning, discussions, debates, and presentations. The discussion of problematic issues is encouraged, for example, "Which factors in the aquatic environment influence the spread of fish diseases?" and "What factors are related to changes in the concentration of dissolved oxygen and other gases? How does this impact fish physiology?" etc. To earn additional points, students have the opportunity to give a public presentation on a chosen topic within the educational component.

Professional training is conducted through practical classes held in the specialized laboratory of the Department of Water Bioresources, equipped with microscopes, devices for electricity and water supply, and containers for keeping aquatic organisms (aquariums, plastic trays, bathtubs).

The methods used include animal behavior monitoring, hydrochemical methods (express techniques for measuring dissolved oxygen concentration, pH levels, etc.), dissection, and microscopy of organisms under laboratory conditions. The research method is applied when students perform individual tasks. Students use methodological materials prepared by the instructor: presentations, lecture notes, and methodological guidelines for practical classes and independent work.

During the course, students are encouraged to participate in the department's scientific research work, prepare scientific articles, and present reports at scientific conferences and round tables.

Student-centered learning, problem-based learning, interactive self-learning, information technologies, the credit-transfer system of learning organization, e-learning in the Moodle system, and research and observation-based learning are all integrated into the teaching process.

Tools, equipment, software

Modern equipment for hydrobiological, hydrochemical, ichthyological, biochemical, ichthyopathological, biotechnological, and other laboratories in accordance with state standards (including the newly established integrated multitrophic aquaculture laboratory created under the AFISHE project), as well as research equipment, instruments, and technical means for carrying out production processes involving aquatic biological resources, aquaculture, and their cultivation technologies.

During lectures and practical classes, a multimedia projector, a laptop, library and internet resources, Google Sheets and Google Forms (corporate subscription), study guides, monographs, and scientific and popular articles are used.

The procedure for evaluating program learning outcomes/learning outcomes

Evaluation is carried out using two grading scales (excellent, good, satisfactory, unsatisfactory) and a 100-point scale.

Types of assessment: *current and final. Students take current (modular) and final assessments at the Educational and Scientific Center for Independent Assessment of NUWEE.*

The assessment of students' knowledge is conducted in accordance with the "System for Evaluating the Learning Outcomes of Higher Education Applicants (Semester Current and Final Control) with Amendments and Additions" (<http://ep3.nuwm.edu.ua/21123>).

Forms of assessment include: oral questioning, defense of practical work, verification of practical work reports, and computer-based testing.

The educational component concludes with an exam, where the points for practical and independent work (a total of 60 points) and the exam (40 points) are combined.

The results of the two module tests (20 + 20 = 40 points) during the semester may be counted as the exam result if they are completed on time and successfully.

To pass successfully, the combined score for current and modular assessments must exceed 60 points, with a maximum of 100 points.

The modular control and exam will be conducted in the form of testing on the university's educational platform MOODLE.

Intermediate (current) assessment is conducted on the NUWEE educational platform in the form of two modules.

The current module control No. 1 consists of 24 random test tasks of three levels of difficulty: Level 1 (choose one correct answer among the proposed options): 20×0.5 points = 10 points; Level 2 (choose one, two, or more correct answers among the proposed options, identify an incorrect statement among the proposed ones): 3×2.0 points = 6 points; Level 3 (identify the name and function of a compound based on an image, solve a problem to calculate the equilibrium concentration of dissolved oxygen; identify the incorrect statement among the proposed ones): 1×4.0 points = 4 points.

The current module control No. 2 consists of 24 random test tasks of three levels of difficulty: Level 1 (choose one correct answer among the proposed options): 20×0.5 points = 10 points; Level 2 (choose one, two, or more correct answers among the proposed options, identify an incorrect statement among the proposed ones, match pairs): 3×2.0 points = 6 points; Level 3 (identify the incorrect statement among the proposed options): 1×4.0 points = 4 points.

The final control (exam) is conducted on the NUWEE educational platform. The exam consists of 40 random test tasks of three levels of difficulty: Level 1 (choose one correct answer among the proposed options): 30×0.9 points = 27 points; Level 2 (choose one, two, or more correct answers among the proposed options, identify an incorrect statement among the proposed ones, match pairs, solve a problem etc): 9×1.0 points = 9 points; Level 3 (identify the incorrect statement among the proposed options): 1×4.0 points = 4 points.

Students can earn **additional points** for the following activities:

- Preparing a presentation or a short report on a course-related topic – 1 point;
- Presenting at a scientific conference on the subject of the course, publishing theses or a scientific article – 3 points;
- Participating in the All-Ukrainian Student Olympiad – 3 points;

Participating in the All-Ukrainian Student Research Competition – 3 points.

Bibliography (primary, secondary)

Basic literature

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Additional literature

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9. *Fish Diseases and Medicine*. Stephen A. Smith (Editor). 2019. CRC Press. ISBN 978-1498727860
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14. *The Physiology of Fishes*. Suzanne Currie, David H. Evans (Editors). 2020. CRC Press. ISBN 978-0367477554

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26. *World Organisation for Animal Health (WOAH)*. – URL: <https://www.woah.org/en/home/>

Methodological support

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2. **05-03-137M**. Hrokhovska Y.R. (2024) *Lecture Notes on the Academic Discipline "Water Quality and Fish Health" for Students of Higher Education of the Second (Master's) Level in the Educational and Professional Program "Protection, Reproduction, and Rational Use of Hydrobioresources", Field of Study 207 "Aquatic Bioresources and Aquaculture" of Full-Time and Part-Time Education (in Ukrainian)* – Access mode: <https://ep3.nuwm.edu.ua/30538/>.
3. **05-03-138M**. Hrokhovska Y.R. (2024) *Test Tasks for the Current Knowledge Control in the Academic Discipline "Water Quality and Fish Health" (Content Module 1) for Students of Higher Education of the Second (Master's) Level in the Educational and Professional Program "Protection, Reproduction, and Rational Use of Hydrobioresources", Field of Study 207 "Aquatic Bioresources and Aquaculture" of Full-Time and Part-Time Education (in Ukrainian)* – Access mode: <https://ep3.nuwm.edu.ua/30537/>.

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Combination of learning and research* (if needed)

During their studies, students have the opportunity to participate in departmental scientific research on fisheries and aquaculture issues, with subsequent presentation of results at All-Ukrainian student scientific work contests, and in scientific publications, particularly in the NUWEE Bulletin, as well as at round tables and conferences at the university, regional, and all-Ukrainian levels.

The requirements for participation and submission of works can be found on the student scientific work sector page <https://nuwm.edu.ua/naukova-dijalnistj/stud-science>, and the announcements page <https://nuwm.edu.ua/university/ads/nov202009041041>.

Students pursuing higher education are involved in research on various fish species to obtain initial data for practical classes. This also applies when selecting a topic for their qualification work or including specific sections in it, in accordance with the course topic – maintaining the fish health and preventing diseases that cause by changes in water quality. In the educational process, the lecturer's individual and collective scientific achievements, relevant to the content of the educational component, are utilized:

- 1. Quality of surface waters in the Pripjat basin: impact of point and diffuse sources of pollution;*
- 2. Water quality of the rivers of the Pripjat basin: ecological and fisheries assessment.*

TEACHING AND LEARNING POLICIES

List of social, "soft" skills (soft skills)

The components of the module contribute to the development of universal skills that enable quick adaptation to new conditions, changing fields of employment, and solving non-standard tasks in production and environmental protection: critical thinking, environmental literacy, curiosity, determination, perseverance, teamwork, responsibility, creativity, and self-directed learning for professional and personal growth.

Deadlines and rescheduling

Announcements regarding deadlines for submitting parts of the educational discipline are published on the course page on the MOODLE platform according to the calendar:

<https://exam.nuwm.edu.ua/calendar/view.php?view=month&course=6502>

The deadlines for submitting intermediate control modules and the final control (exam) are established according to the Regulation on the semester's current and final control of educational achievements of higher education students. Link: <http://ep3.nuwm.edu.ua/15311/>.

Retaking of modules is carried out in accordance with the rules of the Center for Independent Assessment, announcement by the link:

<https://exam.nuwm.edu.ua/mod/forum/view.php?id=1>.

Retaking of modules is allowed with the permission of the dean's office in the presence of valid reasons (e.g., medical leave).

Elimination of academic debt and re-study of the discipline are carried out in accordance with the "Procedure for the elimination of academic debts at NUWEE". Link: <http://ep3.nuwm.edu.ua/4273/>.

If a student disagrees with the assessment results, an appeal can be submitted to the NNIAZ dean's office on the day the test is taken, clearly stating the nature of the issue. A printed copy of all the student's answers during the attempt must be attached to the appeal. The director of the NNI convenes an appeal commission to consider the complaint, to which the student and a representative of the Center for Independent Assessment are invited, in accordance with the Procedure for appeals from students and other individuals studying at the National University of Water and Environmental Engineering <http://ep3.nuwm.edu.ua/15467/>.

Non-formal and informal education (if needed)

Students have the right to have their learning outcomes from non-formal and informal education credited according to the relevant regulations. <http://ep3.nuwm.edu.ua/18660/>. In particular, free courses on the Coursera platform. Link: <https://www.coursera.org>.

Rules of academic integrity

The principles of academic integrity are outlined on the NUWEE "Education Quality Department" website:

<https://nuwm.edu.ua/sp/akademichna-dobrochesnistj>.

It is prohibited to cheat or discuss questions with fellow students during all control measures, including modular and final assessments. If such violations are detected, the student loses the right to continue performing tasks, which may result in a reduction of the overall grade or the failure to pass the entire course, necessitating the re-study of the educational component.

Information on academic integrity, plagiarism, the student honor code, etc., is provided on the website of the National Agency for Quality Assurance of Higher Education <https://naqa.gov.ua/>; and on the NUWEE "Quality of Education" page

<http://nuwm.edu.ua/sp/akademichnadobrochesnistj>.

Attendance requirements

It is mandatory to make up missed classes without valid reasons (e.g., medical leave, mobility, etc.). This can be done during consultations, the schedule of which is published on the Department of Water Bioresources page: <https://nuwm.edu.ua/nni-az/kaf-vb/hrafik-konsultatsij>.

With a medical certificate or a certificate of academic mobility, the student is exempted from making up missed practical classes. Missed lectures must be independently studied by students on the educational platform on the page of the relevant educational component

<https://exam.nuwm.edu.ua/course/view.php?id=839>.

During classes, students may use mobile devices only to search for information related to the module and calculators for solving tasks, except during control measures.

Автор
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Затверджено

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